The validation of the Royal Stoke Pharmacy Workforce Calculator – a mixed methods study

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Abstract

Background

The Royal Stoke Pharmacy Workforce Calculator (RSPWC) was developed to meet a local need of identifying clinical pharmacy staffing levels, not described nationally. This study demonstrates the validity and transferability of the RSPWC and its application to other settings.

Methods

A two-round Delphi consensus study was conducted to confirm the activity standard (tasks, times and frequencies) for clinical pharmacy services. An operator evaluation was undertaken to demonstrate the reliability of the tool by multiple operators and a series of qualitative interviews explored the utility of the tool in different settings. These research strands ran concurrently from April 2016 to December 2016.

Results

Participants from 21 sites across the UK were recruited, including district general hospitals (nine), teaching hospitals (eleven) and one mental health trust. A wide range of staffing levels, across all staff groups, was reported. Consensus was achieved for 68% of components of the algorithm that drives the RSPWC. For a further 21% of components, 'nationally-representative' figures were identified from the data. Eleven percent of the components, those relating to elements dependent on individual patient responses to medicines, failed to achieve agreement. A pragmatic approach was taken in the derivation, from study data, of

these activity frequencies for typical patient groups. Content validity of the tool was demonstrated. The 'operator evaluation' demonstrated reliability in its use by different operators. The application of this tool to a variety of settings was identified through the qualitative data.

Discussion

The results of the study demonstrate the validity, transferability and utility of the RSPWC. They capture, for the first time, a consensus on the required service components for the delivery of pharmaceutical care, across multiple hospital sites nationally in the UK. Through this study a clinical pharmacy workforce calculator for acute hospital settings has been developed and validated.

Dedication & Acknowledgements

Dedication

This Doctoral thesis submission is dedicated to my favourite doctor, Dr David Jenkins, MStJ MB BCH DDAM. The man, who throughout my life has shown me what it is to be a 'doctor' and inspired me to strive to deliver the best possible care for my patients. The man whose Saturday morning coffee stops at 'Uncle Bernard's' pharmacy (who let me count Smarties® in his electronic tablet counter) set me on this path and he has supported and encouraged me every step of the way. This is for you, Dad.

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Preface

This thesis charts the course of the development of a pharmacy workforce calculator, from its inception at the Royal Stoke University Hospital to its national validation as part of this Doctoral study. As a tool conceived from a practical, local need, the Royal Stoke Pharmacy Workforce Calculator, as it is now known, facilitated the growth of a pharmacy workforce at the Royal Stoke University Hospital. Its validation for application by pharmacy managers in acute hospital sites across the UK comes at a time when the attention of hospital Chief Executives across the country has been drawn to their pharmacy departments, with a previously unprecedented level of scrutiny. Through the NHS Benchmarking project and the Lord Carter report, the issue of pharmacy staffing levels and productivity has become a key work-stream for NHS managers. Having clarity on the capacity of their workforce will be paramount for pharmacy managers over the coming years and the Royal Stoke Pharmacy Workforce Calculator is a novel tool to support them in this task.

Chapter 1 of this thesis introduces the subject in the context of the historical development of clinical pharmacy services, the identification of a local need to calculate accurately workforce need and details the current political context. This is followed in Chapter 2 by an in depth review of the literature pertaining to workforce planning in general terms and more specifically in healthcare. Published evidence from the pharmacy profession is considered from the perspectives of workforce planning, productivity, outcomes and time and motion data. From this review the research questions, aims and objectives of the research project are crystallised in Chapter 3.

The methodological approach of the World Health Organisation for identifying healthcare staffing resource, it's 'Workload Indicators of Staffing Need' (WISN), was adopted for the delivery of this project. Chapter 4 explores the methodological considerations for the

establishment of calculating workforce, developing consensus, confirming validity and conducting of research using questionnaires and interview processes, all of which are required to implement a WISN approach. The concept of reflexivity is explored and its influence on practice research is described.

Moving into Chapter 5, the feasibility study, which informed the main Doctoral research, is reported. This element of the research identified practical and methodological challenges which were addressed to improve the delivery of the main study, and also confirmed that the proposed data collection methods were realistic. The methods used for the main study to recruit participants, collect and analyse data are described in detail in Chapter 6. The main study had three distinct parts. Part 1 was a two-round Delphi consensus study, which determined the 'activity standard' for clinical pharmacy i.e. it confirmed a national view on the scope of the job of the clinical pharmacy team. Part 2 was an Operator Evaluation to assess the transferability and reliability of the Royal Stoke Pharmacy Workforce Calculator in the hands of other operators. The final part of the study consisted of qualitative interviews with pharmacy managers to explore the utility of the tool in different settings and to understand the reasons behind outlying data sets from Parts 1 and 2. The methods used for each of these parts are detailed and justified.

Results of the study are reported in Chapter 7 and describe the consensus achieved and the activity standard defined by the data returned. The applicability of the Royal Stoke Pharmacy Workload Calculator to other settings is described, with the limitations identified. The final part of this chapter is the analysis of the qualitative data which enriches the quantitative results of the first two parts. The development of a nationally validated tool for calculating pharmacy staffing requirements is discussed in detail in Chapter 8. The criteria, by which the Royal Stoke Pharmacy Workforce Calculator can be considered to demonstrate

the various elements required for validity to be proved, are identified from the results. A validated version of the calculator, suitable for distribution through pharmacy networks nationally, is published.

A wider discussion of the findings of this research, the degree to which the aims and objectives were met, their place in the published literature and implications for practice is presented in Chapter 9.

Chapter 10 concludes the study, highlighting the key findings and giving recommendations for further work and actions for practice.

The final Chapters of this thesis (11 and 12) are for the reader's reference. These include a full list of references used in its construction, a glossary of terms used, copies of all relevant study documentation for their examination and a list of participant sites, so the reader has an understanding of the population from which the consensus was drawn and can identify the presence of key stakeholders.

In summary, this thesis presents the evidence for the validation of the Royal Stoke Pharmacy Workforce Calculator and its applicability to pharmacy departments across the UK.

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1. Introduction

1.1 Background

For many years the disciplines of industry and commerce have recognised the need to identify appropriate staffing resource. In order to be competitive and generate a profit, staff resource needs to be carefully managed. In this time of financial austerity and with a growing elderly population with increasing reliance on health services, healthcare delivery is increasingly driven by cost containment and tight budgetary management and there is much that can be learnt from established approaches in industry in terms of staff resource calculation and productivity. This challenge falls to all professions within healthcare and pharmacy is no exception. This study explores the validity of a staffing calculator tool developed to identify clinical pharmacy staffing resource requirements within an NHS hospital trust.

1.2 The evolution of 'clinical pharmacy'

The role of the hospital pharmacist has changed significantly over the past 40 years. The initial focus of the role was on dispensing and manufacturing of medicines within the confines of the pharmacy department. The first steps were taken to working on the wards in the late 1970s by supporting nursing teams with stock management and safety checks of prescribed medicines. Subsequently, through the 1980s, the focus moved towards one of direct patient-specific care. This was initially delivered in the ward environment and now often in out-patient or domiciliary settings. This 'new' (late 1970s) form of pharmacy practice was initially described as 'ward pharmacy' to distinguish it from that of dispensary based activities, but is now referred to as 'clinical pharmacy' which has been defined as

'that area of pharmacy concerned with the science and practice of rational medication use'(1). More specifically the delivery of 'clinical pharmacy' has been described as the provision of *pharmaceutical care*. This expression was first coined by Hepler and Strand in their seminal 1990 paper 'Opportunities and responsibilities in Pharmaceutical Care'(2). They defined pharmaceutical care as 'the responsible provision of drug therapy for the purpose of achieving definite outcomes which improve the patient's quality of life'. They challenge the pharmacists to manage or prevent 'drug related problems' ('drug' referring to medicines use rather than illicit substances). These 'drug related problems' were previously defined in an earlier paper by Linda Strand *et al.*(3) and these are summarized in Figure 1.1. *How* this should be delivered was not described, but pharmacists would need to access patient specific information to be able to identify and address the problems listed.

Figure 1.1 'Drug related problems' adapted from Strand *et al.* 1990(3)

Drug related problems
Untreated medical indication requiring drug therapy
Too little of correct drug prescribed
Patient not receiving the prescribed drug
Too much of the correct drug is prescribed
Adverse Drug reaction
Drug interaction
Drug treatment with no valid indication
Wrong choice of drug
Compliance with prescribed regimen

Lack of early clarity or direction from either Government or professional bodies regarding how pharmaceutical care should be delivered has resulted in a diverse and varied array of

services across the UK and other countries. Service development has often depended on the success of various managers in resourcing and delivering specific services and then building on a successful service model(4).

Through the first decade of this century a substantial body of literature became available to demonstrate the benefits of a 'clinical pharmacy service', in terms of both financial (cost-effectiveness)(5-7) and patient care (morbidity and mortality)(8-10) outcomes. As the benefits of clinical pharmacy services became clear, the need to deliver these services became more pressing and identifying, securing and maintaining the workforce to deliver 'pharmaceutical care' has become a challenge faced by Chief Pharmacists and other hospital managers. There is, however, fairly limited published work in this field and little national guidance. An exception is in the specialty of intensive/critical care. Critical care pharmacist groups, as part of the Faculty of Intensive Care Medicine have identified through consensus of experts from the United Kingdom Clinical Pharmacy Association (UKCPA) and the Royal Pharmaceutical Society (RPS), both standards of practice within this patient cohort and a pharmacist/patient ratio required to deliver these(11). This group recommends 0.1 WTE pharmacist should be employed for every level three bed (providing care to patients requiring respiratory support or have two failing organs) and 0.1 WTE pharmacist for every two level two beds (providing care for patients requiring detailed monitoring, stepping down from critical care or require increased levels of monitoring). Aside from this much of the published literature focuses on the targeting of limited pharmacy resource in the most efficient way. This includes identifying ways of prioritising patients to receive pharmaceutical care to a level appropriate to their needs, along with the need to demonstrate productivity and value for money.

However, as other hospital services expand, it is essential that pharmacy resource grows alongside, otherwise increasingly a smaller proportion of patients will be able to receive pharmaceutical care as the staff will not have the capacity to see all patients and the need to prioritise services becomes more important. When hospital business cases are submitted for funding of new or expanded clinical services, hospital pharmacy departments are often asked to submit their required resource needs to service this expansion. With no nationally accepted service model or staffing guidance, the figures submitted are often 'best guess' and due to the relatively expensive employment costs of the pharmacy workforce, substantial. As a result, local experience demonstrates these often get rejected or arbitrarily reduced in the final submission and pharmacy resource effectively shrinks on each occasion, as existing staff have to deliver pharmaceutical care to a greater number of patients. This suggests that a robust and objective means of identifying adequate staffing levels, that is evidence based and nationally validated is required.

1.3 Reflections of a pharmacy manager

This section describes the challenge of identifying and securing adequate workforce resources in a changing clinical environment.

Over the course of the past 14 years the delivery of healthcare in the area has undergone substantial transformation. The acute Trust originally operated from three sites in a half mile radius of each other, which fragmented the delivery of care and resulted in many operational challenges and inefficiencies. An ambitious building project was commenced to centralise services in a modern, state of the art premises on the largest of the three sites. The premise for its design was a focus on acute general and specialist care, with a clear plan to move routine services into expanded community based locations, both for rehabilitation

in-patient purposes and for out-patient clinics. As a result there was a substantial reduction (circa 300) in bed capacity in the design of the new premises. During the course of this project the global economic downturn occurred and the resultant financial challenges for local government services and private businesses resulted in the planned community services not being developed. This had a number of consequences. There was not sufficient capacity for 'step-down' or rehabilitation patients in the community resulting in 'bed-blocking' and negative impact on patient flow through the Trust. As a consequence wards which should have closed when their service transferred into the new building remained open or shortly after closure, re-opened, to provide additional capacity. The healthcare managers in these situations considered the need to employ additional nurses and doctors but made no provision for pharmacy resource. Repeatedly requests for service delivery were received by phone, typically at the end of the day or working week for imminent implementation. Initially, the expectation was for the pharmacy team to simply stretch resources, with no additional funds being requested. Eventually the message that the resource could not simply be stretched indefinitely was understood by the business teams and pharmacy resource requirements began to be requested. Our main challenge was that the staff numbers we were requesting were instinctively based on experience and because of the short timescales allowed for response, limited evidence to support the figures could be accrued and so the justification for the figures was limited and difficult to defend. As a consequence these values were challenged or arbitrarily reduced. For a pharmacy manager this was increasingly frustrating and there was a very real risk that the staff resource would begin to fall short of that needed to deliver a safe service. These challenges led to the development of the pharmacy workforce calculator (see Appendix 2). This calculator now referred to as the Royal Stoke Pharmacy Workforce Calculator (RSPWC) is an Microsoft Excel® spreadsheet (the development of which is described in more detail in the following

section) which calculates the pharmacy staffing requirement for a whole ward *per annum*. The development of this tool resolved issues for us initially – the objective spreadsheet-based nature of the tool, appealed to the sensibilities of the business managers and led to much more successful requests for increased resource.

The capacity challenges described were largely due to supporting the emergency admissions to the Trust. Elective services had to develop different approaches to managing bed shortages, by introducing new procedures which substantially reduced length of stay. In addition, to support the finances of this new premises additional income had to be sought and cases were developed to bring new business from neighbouring geographical areas e.g. the establishment of a major trauma centre covering parts of north and mid Wales in addition to Staffordshire and bariatric surgical patients from Shropshire. This increased activity within the Trust, more patients to review, with no impact on bed numbers. Pharmacists provide care to patients not beds and this insidious creep in activity needed to be addressed so the workforce calculator was developed from its original prototype to allow its application in these circumstances. The business managers required a little more convincing by the pharmacy team on this concept, but eventually it was accepted and application of the calculator over a period of time allowed the pharmacy resource to grow in line with the rest of the Trust.

As a pharmacy team in Stoke-on-Trent we were keen to share our success with colleagues nationally and this work was presented at a national conference. This generated much discussion and interest. Many colleagues recounted similar experiences and challenges and we were being asked to share the calculator widely. This however, generated a level of concern for the developing team and those of us who used it. The service delivery model that existed in Stoke was resourced on the basis of the calculator. We had no idea if this

would translate to other sites and whilst this could be a caveat in its use, if proved to not be transferrable and therefore discredited, we may lose the benefits we had gained locally. This was a risk we were not prepared to take. So 'to share or not share' was the question. The answer was to validate and then to share, but the process of validation required time and led to the identified need for a focused project.

1.4 Staff resources for clinical pharmacy services in Stoke-on-Trent

The need for a robust and objective method of calculating staff resource was identified by pharmacy managers at the Royal Stoke University Hospital (RSUH) and the absence of national guidance as described earlier, led to their development of the 'Royal Stoke Pharmacy Workforce Calculator' (RSPWC). This was based on time and motion data collected on a range of staff of differing grades and specialty i.e. junior and senior pharmacists (Agenda for Change Bands 6-8a) on a range of wards (excluding paediatrics, critical care and renal medicine) completing tasks that are required to deliver pharmaceutical care(12,13). The calculator uses these task times, and the frequency with which the standard operating procedures of the department specify they should be completed, to calculate the pharmacy time required to deliver pharmaceutical care to one patient. Using the average length of stay data, bed numbers and average patient throughput, the resource required to support the whole service is identified in a more consistent and transparent way, than the 'best guess' approach.

This tool has been used successfully within RSUH and is now accepted as part of its pharmacy business planning process. It was internally validated by comparing the resource it calculated for a specific ward area, to that identified by more traditional and time

consuming methods of benchmarking with other organisations i.e. comparison between service specification and staff available to deliver this (see Table 1.1).

This benchmarking exercise took several months, requiring multiple visits to several other hospitals to establish the pharmacy staffing resource needed for the unit, based on how similar services were delivered at these other hospitals. Apart from being a time consuming process, the output remained entirely subjective and open to challenge. In contrast, the use of the calculator resulted in a more objective assessment of the staff resource required as it was based on specific measurable activity necessary for patient care. This comparison resulted in local acceptance that the data that the tool had generated was reasonable and realistic.

Table 1.1 Comparing existing staffing levels for Acute Medicine with Benchmark and RSPWC

Ward Area	Benchmark*	Resource tool calculation	Current staffing	Shortfall
Clinical Decision Unit	1 x Band 8a 1 x Band 6/7 1 x Band 5	1 x Band 8a 1 x Band 6 1.5 x Band 5	1 x Band 8a	1 x Band 6 1.5 x Band 5
Acute Medical Unit	1 x Band 8a 1 x Band 7 2 x Band 6 2 x Band 5	1 x Band 8a 2 x Band 7 0.55 x Band 6 2.96 x Band 5	1 x Band 8a 1 x Band 7 0.5 x Band 6 2.0 x Band 5	1 x Band 7 1.46 x Band 5

*Benchmark – UHNM service compared with other equivalent Trusts – regional and national

The RSPWC can be applied to a range of scenarios; the opening of new beds, for specific additional patient case numbers, for simple increases in throughput due to reduced length of stay and appraisal of existing resource for current activity. It only calculates the staff resource required for the direct delivery of pharmaceutical care activities to patients, and excludes activities such as medicines information, staff development, and clinical audit. This

is because it is assumed that these activities will be funded as part of the core pharmacy service. It is also not applied to areas such as critical care where nationally accepted pharmacist/patient ratios exist and already form the basis of staffing resource requirements(11). Finally the RSPWC identifies resource required across a 7-day service. This is not universally delivered across the Trust and as such for wards with lengths of stay less than 72 hours, a reduction to 5/7 of the value is used. There will be a proportion of patients for whom the service cannot be delivered if the pharmacy service is Monday-Friday only and the value adjusted accordingly.

Examples of the use of the RSPWC in identifying required staff resource at UHNM include the conversions of a small 'winter pressures' ward with ad hoc pharmacy cover into a permanent medical ward with a greater number of beds. At around the same time a medical ward with a pharmacy service was converted to a short stay unit (SSU) with a much higher turnover of patients. Application of the RSPWC to the business data calculated the required resource and allowed successful negotiation of 1.0 whole time equivalent (WTE) Band 7 pharmacist and 1.0 WTE Band 5 technician for these reconfigured services Monday to Friday (see Table 1.2).

Table 1.2 Staffing requirements (WTE) identified by RSPWC for reconfigured wards.

Ward Area	RSPWC Calculation (for a 5 day service)	Current Staffing	Shortfall
SSU	1.26 x Band 7 1.06 x Band 5	0.5xBand 7 0.5 x Band 5	0.76 x Band 7 0.55 x Band 5
New Medical Ward	0.28 x Band 7 0.24 x Band 5	Ad hoc cover	0.28 Band 7 0.24 Band 5

The RSPWC has also been used to determine the pharmacy staff requirements for several surgical business cases that involved increases in patient throughput. In these cases the additional patient numbers were small and so the calculator generated small extra staff

requirements, such as 0.2 WTE for example. However, to date, through consistent and persistent application of the calculator to successive business cases, 2.0 WTE pharmacists have been funded in this piecemeal way at RSUH, whereas without the workforce calculator, this service would have had to been delivered with no additional funding.

1.5 Current approaches to identifying workforce needs in the NHS

The RSPWC is based on local services and a local approach to staffing resource calculation. It needs to be considered in the context of a more general approach to workforce planning and more specifically in the context of NHS guidance.

A Google® search of 'workforce planning' generated over 11 million results and amongst them are many management consultancy firms advertising their services to solve this problem for their clients. One such company, the Hay Group, in their brochure 'Strategic Workforce Planning'(14) identify the 'five rights of workforce planning'. The first of these is the 'right size', knowing that you have the right number of people in the right roles with the right time to deliver the job. The other four are 'right shape' relating to organizational structure and skill mix, 'right place' ensuring staff are available where and when they are needed, 'right skill' covering the need to have appropriately trained staff and the overarching 'right cost'. These are fundamental principles and apply to clients in all sectors.

With the NHS workforce estimated at 1.4 million(15), placing it in the top five of worldwide employers, the number of Google® results directly linked to NHS workforce planning is unsurprising. The King's Fund recently published 'Workforce Planning in the NHS'(16). This explores workforce planning experiences and aligns these with the NHS strategic policy in three key areas – mental health, general practice and community services. In each of these the shortfall of staffing is identified and the future pressures that will arise. It concentrates

largely on training and recruitment and retention issues generally rather than specifying methods of calculating the workforce required.

Monitor, the regulator for independent Foundation Trusts, produced their 'Strategic Workforce Planning Tool'(17). This suggests that 'strategic' planning is 'long term' (defined as three years ahead). It identifies a four stage process. Firstly to identify each staff 'cluster', then to model the workforce demand i.e. workload to be completed by which groups, then to model workforce supply (including sickness absence). Managers should then identify the gap between the last two stages and finally in stage 4 plan how to build the model of future workforce delivery. It follows the same principals of the 'five rights' of the Hay group(14) at a very high level, leaving a significant amount of detail to be agreed and identified by individual managers in individual services.

If the NHS Employers website is explored, workforce planning tools(18) are identified that were commissioned by the Department for Health with the aim of supporting managers to identify health science workforce requirements. Three professional groups were considered pathology, physiological sciences and physical science and engineering. That most closely aligned to pharmacy is pathology and closer examination of this explains the process and application of this tool. Managers are asked to gather data about their available staff including grade, contracted hours and overtime. They need to include services drivers e.g. numbers of tests, numbers of samples. Then they must describe time allocated to processes, activities or tasks, the list of which have been agreed through consultation with people delivering the service and is fixed in the calculator. This is referred to as the 'PAT list' and time data collected for each activity on the list. These data are then entered in to a spreadsheet which can be manipulated to model different scenarios. This tool reflects that developed by Monitor above. It gives greater clarity and indeed fixes the tasks to be

completed by different staff groups, but still requires a significant amount of localised time and motion data for individual managers if they are to use this tool in practice.

The largest staff group in the NHS is that of nurses(15) and the Royal College of Nurses website has a link to a 'Skills for health'- nurse workforce planning tool(19) to guide decision makers as to the most effective level and mix of staffing. This is a comprehensive spreadsheet document with a separate workbook for different wards. The user can enter the numbers of patients of different categories expected in an average hour and their opening times and the calculator works out the staff required from a list of timed activities, generated from work by Hurst *et al.*(20) (this is described in more detail within the literature review, see section 2.4.1). This is a simple to use tool, applies the principles described above but requires little data collection by the user other than service metrics which are likely to be already known. It has caveats in the text though that some sheets are driven by small data sets and that it is undergoing further development and cautions the user that the results should be 'indicative only'.

When considered in this context, the approach taken in the development of the RSPWC would appear to follow the principles outlined in documents produced for other allied health professions and the nursing workforce. However, a similar document for Pharmacy has not yet been developed.

1.6 The Lord Carter Report and the current political context

In February 2016 Lord Carter of Coles(21) published the report of his investigation in to the 'unwarranted variation' in service delivery within the NHS, with a resultant variation in the cost to the tax payer in delivering an apparently similar service. There were a number of work streams within this project including clinical staffing, estates and procurement,

medicines expenditure and the pharmacy workforce. It is explicit in the report that these latter two are seen to be interlinked.

> *"The delivery of hospital pharmacy services and the optimisation of medicines are intrinsically interwoven and, from a value perspective, can't be separated"* [Lord Carter page 30](21).

With this in mind the report states that more pharmacists need to be deployed in patient facing clinical roles, rather than in doing tasks considered to be 'infrastructure' e.g. supply of medicines, education and training, medicines information and manufacturing of medicines. The percentage of pharmacists who are prescribers must be increased and that where possible the 'infrastructure' elements of the service should be delivered either collaboratively or through outsourcing to non-NHS partner providers.

It recommends that each Trust developed and approved a 'Hospital Pharmacy Transformation Plan' by April 2017, to outline the process by which the pharmacy department would move to address the required changes in pharmacy services by 2020.

It proposes a method of making more direct comparisons by the introduction of the terms 'weighted activity unit' (WAU) – one WAU is equivalent to one inpatient admission – and the adjusted treatment cost (ATC) which defines the cost envelope expected for each WAU. This cost envelope includes staff resource to deliver the service, but it stops short of specifying numbers for each cohort of staff.

The report is based on a series of benchmarking exercises run across the NHS with participant sites reporting on various elements of their service(22). The metrics considered were developed from focus groups run nationally to identify priorities and "what good looks like" [Lord Carter of Coles, page 69](21). The detail of the specific Pharmacy NHS

Benchmarking project is critically reviewed within the literature review (see section 2.5), where limitations and challenges are identified. However, the reality is that regardless of perceived shortcomings in its methodology or findings Lord Carter's report is gathering political momentum. As a consequence, the attention of NHS Chief Executives across the country has been focused on the pharmacy workforce in their hospitals and there seems to be both a greater level of scrutiny and expectation of delivery from this profession than ever before. Pharmacy departments are challenged to identify their productivity in delivering the existing clinical pharmacy services, whilst at the same time there is an explicit remit for expansion of the roles of pharmacists in supporting other professional groups. With the required base-line staffing levels having not been established, this expansion may require additional staff. Alternatively existing services may be delivered by a skill-mixed team, thereby releasing pharmacists into these new roles. The development of a validated pharmacy staffing calculator would facilitate a more objective review of staffing needs and deployment.

1.7 Summary

Hospital pharmacy has evolved over the past 40 years and in its latest incarnation of 'clinical pharmacy' is seen to have many beneficial outcomes, in both patient safety and financial savings. There is a political drive to develop and extend the role of the pharmacy workforce, but no nationally accepted tool exists with which to calculate the size of the required resource to deliver existing services as a baseline to these proposed developments.

The RSPWC was developed by pharmacy managers at the RSUH for local staffing calculations. Its wider application nationally requires validation of the elements of its use.

This study seeks to explore this validity or otherwise and its place in the context of current service delivery priorities.

The next chapter considers the literature on workforce planning generally and specifically for healthcare and pharmacy and seeks to identify what evidence exists to support the components (tasks, times and frequencies) which drive the RSPWC.

2. Literature Review

2.1 Overview

The purpose of this literature search is two-fold. Firstly, it reviews the literature to identify if other researchers have explored the issue of pharmacy staffing and to review the RSPWC in the context of this information. Secondly to identify if evidence already exists to support the components (tasks, times and frequencies) that are included in the RSPWC.

The first section of this chapter describes the search strategy in detail. This is followed by a review of the literature pertaining to workforce identification in general, learning from other disciplines and reflecting on the relevance of this to hospital pharmacy practice. The next section reviews the pharmacy literature to explore whether the challenge of identifying the necessary pharmacy resource has been addressed by other studies and to identify the evidence that already exists to support the underlying elements of the RSPWC. Finally the implications of this review on the proposed study are considered

2.2 Literature Search Strategy

A search of the literature was performed in November 2015, and repeated at regular intervals (most recently June 2017) to identify literature relating to the methods used and proven for the identification of workforce requirements generally, as they apply to the healthcare industry and specifically in the pharmacy profession. There were three strands to this literature review

Firstly, a search of the 'grey' literature using Google® as a search engine with general search terms of 'workforce planning', 'staffing levels', 'time and motion', 'hospital' and 'pharmacy'.

The broad search on 'workforce planning' generated results in the millions, with many of the top results relating to NHS healthcare. The top ten hits relating to healthcare and published in the last fifteen years were reviewed. These formed the starting point for the contextualisation of the study and the key findings from this review have been outlined in the introduction.

Secondly the academic literature was searched for papers on identification of workforce requirements. Health care databases were searched including Medline, Embase, CINAHL and Web of Science to identify work on this subject in allied health professions (AHP). This ensured that learning from other disciplines was included in the development of this specific pharmacy tool. The search strategy used accepted Boolean operators and equivalent Mesh browsers or thesaurus terms were used wherever possible. Searches were limited to English language and published since 2000 (post Hepler and Strand(2)). Combinations of the following words were used in searches across all identified databases.

'workload', 'time and motion', 'staffing resource', 'workforce', 'resource allocation'

The criteria for selection of papers was that they should discuss approaches to identifying required staffing levels for clinical care and description of the methods used to do so.

Thirdly a search focused on the pharmacy specific academic literature was also conducted. This used the same database selection described above, with the same limitations applied. The keywords once more were combined using Boolean operators and Mesh browsers or thesaurus terms appropriate to the database were used. Combinations of the following key words were used.

'pharmacy', 'hospital', 'clinical', 'ward', 'benefits', 'workload', 'time and motion', 'staffing resource', 'workforce', 'resource allocation', 'services'.

Inclusion criteria were research papers or journal articles reporting the deployment of pharmacy staff, the benefits of this deployment in financial and patient safety terms, those where time and motion figures were reported and those where staff deployment and productivity were described.

Searches were repeated in different databases and combinations until no new relevant papers emerged. Further literature was identified from the references of relevant papers, through routine scanning of contents pages of key journals as they were published and from personal communication with other parties working in this field. The papers identified through this series of literature searches are discussed over the following pages and the implications of these findings for the development of the RSPWC are identified.

2.3 Identification of healthcare workforce requirements

The need for adequate human resources to deliver healthcare has been recognised by the World Health Organisation (WHO) and it recently updated its Workload Indicators of Staffing Need (WISN) tool(23) which provides a framework for the provisions of healthcare utilising principles long used in industry. It can be applied to specific services or whole health care systems and there is published literature supporting its use for example in Namibia, India and Uganda(24-26). This can be considered to be the 'gold standard' approach to healthcare workforce resource calculation, but there is no published report on its application to a pharmacy workforce.

The application of the WISN tool requires the gathering of experts in the field to define 'workload components', the standard to which these should be delivered and the workload it is reasonable to expect one health care worker to achieve. It includes recognition of 'unavailable' time during the working year (e.g. annual, sick and study leave). When all this

information is available it provides a calculation to identify required resource and where shortfalls or overstaffing exist in current provision. It is a robust and established method of calculating resource but requires a significant time and operational commitment from a wide range of senior professional staff to deliver. This approach is reflected in that of the Hay group(14) and also the Kings Fund(16), Monitor(17) and Skills for Health(19), with only the latter completing the full cycle for a specific staff group and none of them for pharmacy.

The existence of the WISN tool and the reflection of its approach across a range of NHS and non-NHS workforce guidance would appear to suggest that this 'methodology' of identifying staffing resource is well established and accepted. The literature was further explored to find reports of applications of this type of approach, rather than specific application of WISN, in healthcare settings. The largest staff group in healthcare, the nursing profession, generated most literature, though one paper applying these principals to AHP was found.

2.4 Identifying staffing requirements in the nurse and AHP workforce

2.4.1. The nursing workforce literature

The papers presented here are a selection of the literature post 2000 in which nursing approaches to the issue of workload calculation are describe. The purpose of this section is to establish a context for the review of pharmacy literature and the development of the RSPWC. It is not intended as a comprehensive review of the nursing literature as the nuances of acuity and workload of the nursing profession do not translate to that of pharmacy and would therefore not add relevant detail.

Ghosh and Cruz(27) presented a pragmatic paper on this subject. They recognised the benefits to patient care of adequate nurse staffing levels and that, in developed countries, standard nurse-to-patient ratios have been established. However, the affordability and

achievability of these ratios is questioned for services in developing nations, such as Oman, where this team are based. Whilst acknowledging that the debate on the 'right' nurse-to-patient ratio is ongoing and further research is required, they identified a problem for the here and now, namely that hospitals need some sort of tool to determine the nursing resource required to deliver care in their setting. They highlighted a review that considers five different methods for workforce planning and conclude that a combination of methods may generate improved accuracy in the prediction of staffing requirements. They argued that the complexity of available staffing models puts the task of resource identification into the 'too hard' category and as a result either genuine requests are ignored or resource allocated on an ad hoc basis. The paper then described the development of a computer programme designed to model nursing staff requirements for hospitals in the Sultanate of Oman Ministry of Health hospitals. This programme identified nursing numbers for a variety of care settings. It was based on bed numbers, bed occupancy, available nursing working hours (taking factors such as annual leave and sickness into consideration) combined with an assumed nurse-to-patient ratio depending on acuity. It should be noted that this ratio is not referenced. Finally a 'workload factor' was applied which recognised that there is lower workload during afternoon and evening shifts, but how this was calculated was not explained. Individual ward areas could then be applied to the calculator and a total organisation requirement identified by combining results. The computer programme developed to calculate the resource based on this model requires substantial local data collection and entry and the authors did not describe any validation process for this model, nor the experiences of its implementation. It is suggested that this tool is only applicable for medium-term planning rather than day-to-day rostering, but that it allows managers to model different scenarios. It also recognised that numbers alone do not ensure the quality

of the service and asserts the need to continue with adequate training and development of staff.

In 2008 a UK team lead by Keith Hurst, described the development of a similar calculator tool for NHS hospitals(20). They recognised that though tools were available to calculate staffing requirements they were complex to use and therefore often ignored and instead managers employed their own 'professional judgment'. The project was intended to develop the existing Association of UK University Hospitals (AUKUH) ward staffing multipliers, which were workload and nurse to patient ratio based. These original multipliers were devised through professional judgment alone and it was unknown what standard of care they generated. It was therefore determined by the research team, made up of senior nurses from across the UK, that a more evidenced based approach was required. Their method for validating and developing their calculator was to take the AUKUH multipliers, adjust them with evidence from the literature, alongside new patient dependency (i.e. patient acuity with respect to nursing care) workload data collected and validate their calculator by comparison with the more established, but time-consuming to use, Leeds University Acuity-Quality Staffing System. Their literature review identified a range of tools, recognising that none was perfect – but that if used, they needed to be valid and reliable for the specific setting for the output to be acceptable to the nursing team. Data collection was led by experienced local practitioners at 3 AUKUH sites and reviewed the care of around 2,800 patients, well in excess of that needed for statistical significance to be proved. Data included rating of patient dependency using the two scales, time taken in delivering care and 135 quality standards which included timely assessment post-admission, speaking to patients and carers, inspecting the ward environment. The ability of different nurses to use the tool reliably was proved in a smaller validity study. Following detailed data correlation,

an algorithm for calculating direct care hours per day was constructed. This was based on bed numbers and patient dependency ratings. These were derived from observing around 3000 hours of nursing care, documenting activities completed and time taken and finally an adjustment for non-available time (which they identified as 0.22 WTE, from the study attendance on nurses from 83 wards). For statistical significance of the comparison between the two calculators to be demonstrated the care of 200 patients needed to be reviewed. The data set achieved exceeded this and equivalence to the established but time-consuming method was proved. Use by individual managers in real-life settings requires only the entry of either bed occupancy or acuity data to generate a staffing resource requirement for the ward on a daily basis. They conclude that this is an evidence based easy to use tool which has been made freely available for use by other sites via their website and subsequently through adoption by the NHS Skills for Health website(19) (see section 1.5).

A different approach to workforce planning was taken by Twigg and Duffield(28). They identified that nurse staffing levels in Australia at the time were at crisis point, with many nurses leaving the profession due to the pressures of under-staffed work environments. They proposed a new staffing model to address this issue. Like Hurst *et al.*(20) they completed a literature review and identified 5 approaches to nursing workforce

- Professional judgment
- Top down – nurses/occupied bed or hours of care/patient approaches
- Acuity-quality models such as the AUKUH model(20)
- Timed task activity models
- Regression analysis

The failings of each were discussed. For Hurst *et al*.(20) the challenge was that the model is based on nurses' assessment of dependency which might be over estimated to achieve the level of care that the nurse thought appropriate, rather than actual need. They then established a working party to develop a new model called the 'nursing hours per patient day' model (NHPPD). This group undertook two further tasks, in addition to the literature review, to develop the model. They benchmarked current staffing nationally and they exercised professional judgment through consensus amongst senior nurses, though they note that this was "prone to significant variation" (Twigg *et al.*, 2009 pg 136). They then established a set of seven categories of ward e.g. a category 'A' ward has a stated NHPPD of 7.5. This is assumed to be the number of hours of nurse time per occupied bed per day but this is not stated explicitly in the paper, nor is there any detail as to how this has been calculated. From the methods it would suggest that it is based on professional judgment, benchmarking and literature. A category 'A' ward would typically have one or more of the following characteristics:

- high complexity patients,
- have a high dependency beds within a ward,
- be a step down ICU,
- be a high intervention level specialist unit/ward,
- have tertiary paediatric patients,
- have mental health patients with a high risk of self harm and aggression,
- have patients frequently on 15 minute observations.

By contrast for a category 'D' ward with an NHPPD of five, characteristics would typically be:

- moderate complexity patients,
- acute rehabilitation ward

- emergency patient admissions >40%
- moderate patient turnover >35%
- mental health patients with medium to low risk of self harm and aggression.

A senior nurse then appraised the hospital wards against the seven categories and identified the nursing requirements. There is no validation of the tool reported and its application is subjective on the part of the senior nurse conducting the review. Application of this tool to hospitals in Western Australia resulted in an increase of 313 nurses across the state's public hospitals. The author's identify in their own appraisal of the tool that it removes subjectivity of assessment but this is not apparent in their description of the tool's application. They also identify two limitations of the tool. Firstly that it does not fully deal with the issue of acuity as it relies on the judgment of the senior nurse and would benefit from an acuity appraisal as per Hurst *et al.*(20), i.e. the same element of that paper which was earlier described as its shortfall and that there was no evidence for the effectiveness of this tool in improving patient care.

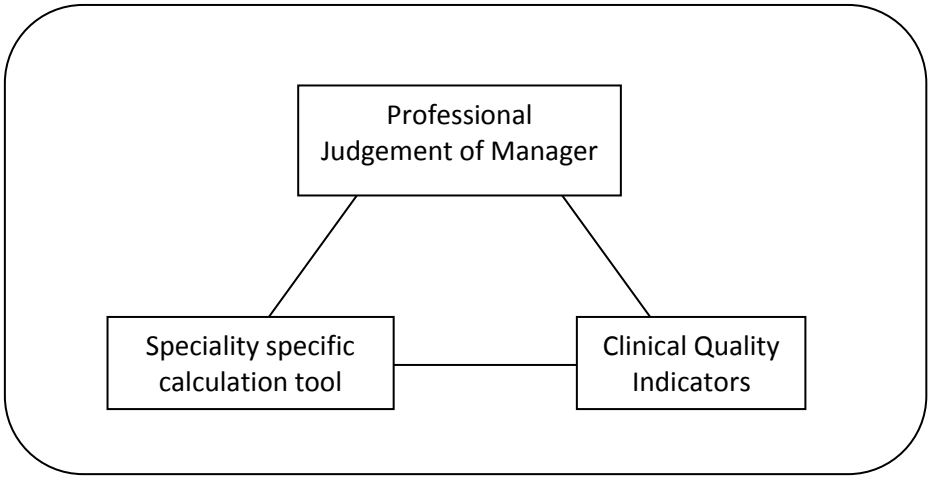
The team addressed this second element in later work(29). They explored the patient outcomes that resulted from changes in staffing levels generated from the use of the NHPPD. Application of this tool generated increased requirements for staff numbers across all wards and the increased cost associated with this approach had been approved in budgetary terms. The output of this investment was intended to be improved patient care which needed to be demonstrated. They reported on a study conducted over a 4 year period in the state capital Perth. Data collected from 3 hospitals with 1449 beds in total included staffing data on nursing time available for shifts and patient data extracted from the hospital coding systems. This allowed analysis of nursing related outcome measures e.g. wound infection, urinary tract infections, pressure ulcers, pneumonias, and deep vein

thrombosis (DVT). The results demonstrated that after the implementation of the NHPPD staffing levels (requiring over 300 more nurses) mortality rates reduced by 25% and other patient safety measures also improved e.g. lower rates of pneumonia, pressure ulcers and DVT. The authors suggested that mandatory staffing levels should be implemented nationally as an evidence based approach to improving patient care.

An American perspective was presented by Hughes *et al.*(30). In their recent paper they described 'traditional' methods of calculating nurse staffing based on midnight census i.e. number of occupied beds at midnight (the details of this calculation are not presented). They proposed that this was an underestimate of staffing requirements as it did not take into account 'patient churn' i.e. admissions, discharges and transfers all of which are more labour intensive than looking after a single patient for a shift. The aim of their study was to compare workload estimates of patient churn using three different measures and the different nurse staffing levels to deliver this care. Workload data (details not specified) was collected from 183 wards over 32 hospitals for a two week period, along with staffing levels. The adult care wards were grouped into three categories, general medicine/surgery, intermediate care and critical care to allow different rates of patient churn to be established. Using the data collected the different methods of calculating staff requirements were applied to calculate and compare the staffing numbers generated. The full calculation is not provided, only the element related to patient churn and its impact on final staffing numbers, so full appraisal of this approach is not possible. In both cases the methods that included patient churn generated statistically higher staffing levels than midnight census. The authors concluded that to accurately forecast staffing needs it is essential to include patient churn to identify workload.

Finally work on this topic by the Nursing and Midwifery Workload and Workforce Planning Programme for Scotland was described by Flynn, Kellagher and Simpson(31). In a guidance paper published in 2010 they suggested an approach to nursing workforce identification that does not depend on a single tool but instead triangulates requirements using a number of approaches (see Figure 2.1)

Figure 2.1 Triangulation in nursing and midwifery workload and workforce planning



(adapted from Flynn, Kellagher & Simpson.(31))

The speciality specific calculation tool refers to the use of a calculator that has been proven to be applicable to the speciality in question. The Hurst *et al.* model(20) is established for acute care settings but may not be applicable to community or mental health units for which other methods may be more valid. Flynn, Kellagher and Simpson go on to identify four tools which can be used. All these tools specify a 22.5% predicted staff absence rate and include varying degrees of acuity assessment. The staffing levels calculated should be triangulated with clinical outcomes as defined by care quality indicators e.g. falls and pressure ulcer prevention and finally reviewed with the professional judgment of the relevant manager. They also identify the need for education of practitioners in the use of

the tools so that they are applied consistently. This paper does not provide details on the calculations. It is more a guide to their practical use and implementation.

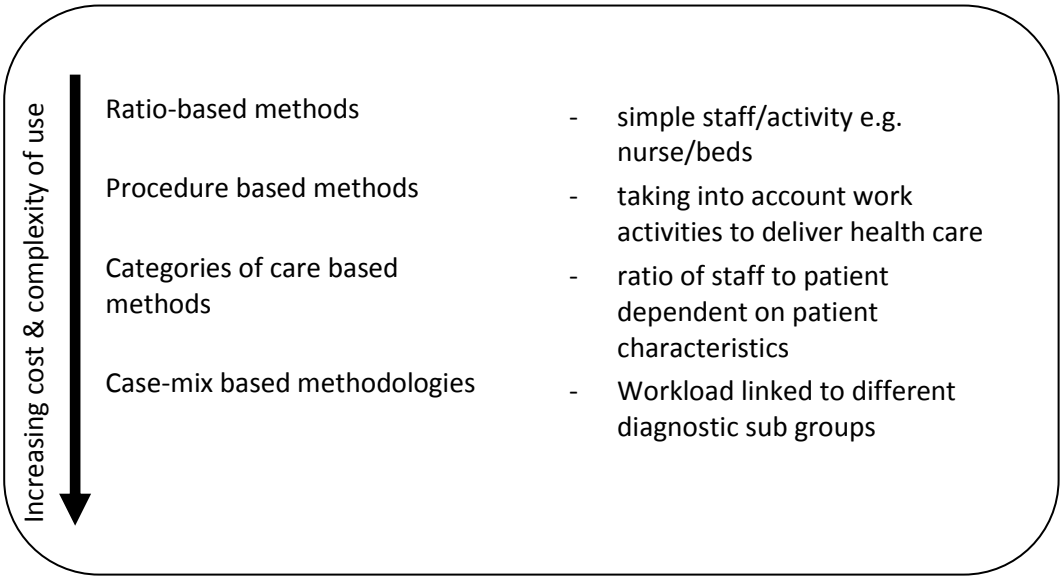
In summary this selection of the nursing literature illustrates a number of points. Firstly, it identifies the benefit of a simple, easy to use calculator tool, based on objective measurement of workload. Secondly, there is a need to consider acuity and 'patient churn' if workload is to be accurately assessed. Thirdly, any staffing model should be used alongside quality outcome markers to demonstrate effectiveness of the staff in delivering patient care. Finally, we are reminded by Flynn, Kellagher and Simpson of the need for managers to triangulate staffing calculations and quality indicators with the pragmatism of professional judgement(31).

2.4.2. The AHP workforce literature

Only one paper was identified through the literature search to complement the information already discussed in the NHS employers workforce planning tool(18)(see section 1.5). Adrian Schoo and colleagues presented results from an Australian study conducted in the state of Victoria(32). This study had three objectives, namely to identify from the literature current methods of quantifying workforce requirements amongst the AHP, to identify the potential use of these with their state and to identify the potential barriers to use of these tools. Pharmacy is not included in the list of AHP specified in the objectives but the profession is represented in one of the focus groups conducted and in the literature (two papers from 1980 and 1995, predating the limit for the literature review). Their literature review analysed 78 papers which met their inclusion criteria and the initial comment was that there was a lack of consistency in use of descriptors within the literature which made identification of suitable papers and direct comparison between them difficult. They conceptualised the topic through a simple relationship of service activity or demand to

workload and the labour required to deliver it. From the literature on deriving workforce they identify four main types of methods for calculating workload capacity (see Figure 2.2) and a fifth approach of mixed methods was also identified. Which of these is most 'accurate' was not established from the literature. They also reported that the application of these tools had been demonstrated in local settings, for specific professions, rather than as a strategic, regional or national approach for AHPs. The lack of progress with development of robust workload calculation was summarized from the literature in three categories.

Figure 2.2 Methods for calculating workload capacity (adapted from Shoo *et al.*(32))



These included that activity could not be accurately captured within single professions, let alone across the range of AHP, due to the lack of specified performance measures; the difficulties associated with difference in approaches to service delivery in different settings e.g. hospital v community and finally the suspicion that a rigorous tool would not allow space for professional judgment.

Following their literature review a series of focus groups were held to discuss the issues identified. The findings relating to small, site-specific application of tools were upheld, with a variety of measures being reported. The impact of patient acuity was not discussed. This might have been included in the reference for the need to triage patients for service provision, though at face value this appeared to relate to managing workload by seeing patients appropriately, rather than a variation in workload because of acuity. The need for a tool to be practical for use was identified in both the literature and focus group discussions. Four main considerations when choosing a calculator tool were identified

- That it should be simple to operate, requiring minimal time by user i.e. using available data
- That it had technical acceptability i.e. it is seen as valid by the healthcare practitioners
- That it's output is comprehensible i.e. results accepted and understood by non-clinicians
- That it is flexible, in that it can adapt to changing models of service delivery

The authors acknowledged the complexity and challenges of developing a fully functional resource calculator. However, this is countered within their discussion where they identified a trend within state government to standardize workforce planning approaches and cautioned that unless there is investment in this process there is a risk that a sub-optimal solution may be forced upon professions.

In summary this paper adds little detail to the process of workforce calculation but concisely summarises the challenges faced when trying to develop and implement such tools, key features to include the success of implementation and a warning of the urgency of investing in this for the AHP.

2.5 Review of the pharmacy staffing workforce literature

Within the pharmacy profession the 'dilemma of establishing effective pharmacy staffing levels' is recognised and debated(33,34). There are a small number of papers that describe in detail the development of methods of identifying the pharmacy workforce resource to deliver the service, but the focus of much of the literature is on prioritisation of resources, rather than the establishment of the required levels of staffing to deliver that service and the productivity of the pharmacy team. In recent years the global economic crisis has resulted in reductions in healthcare funding and pharmacy departments are often faced with using staff reductions as their only way of meeting the required saving targets(35), so there is need to prioritise resources to deliver greatest effect and demonstrating the benefits or outcomes of the service is necessary. This review of the pharmacy literature will consider the relating to the identification of staffing resource requirements, prioritisation, productivity and service benefits.

It has already been identified that there is no specific guidance as to the delivery of pharmaceutical care and service models have developed in localities based on historical funding(4). The challenge of quantifying the staff to deliver the service in multiple different settings was recognised by Schoo *et al.*(32,35) and it may not be possible to produce a universal calculator because services are too different. A description of the delivery of pharmaceutical services has been produced by a London-based team(36). Onatade, Miller and Sanghera report on a quantitative comparison of ward-based pharmacy services across seven acute NHS hospitals in the UK. They recognised that whilst some guiding principles exist it is not clear if clinical pharmacy services are provided in the same way at different hospitals, so the aim of their study was to quantitatively compare key clinical pharmacist activities across a number of Trusts. The study was based across three NHS trusts in Greater

London and included seven different hospital sites (four teaching hospitals and three district generals) with bed bases ranging from 180-1000. Only one site had full electronic prescribing. At each hospital, pharmacy teams (pharmacists, technicians and support workers) visited the wards on a daily basis and the activities they completed included the review of patients' clinical status and assessment of prescriptions to ensure safe and effective use of medicines. In addition they ensured a supply of medicines was available, provided information and guidance on the use of medicines, discussed treatment with patients and completed medicines reconciliation (MR). The latter is the process of ensuring an accurate and up to date record of current medicines is recorded on transfer between settings and particularly on admission to hospital. The variety of activities was consistent across the seven sites, however the detail and scale of their delivery varied across the settings. The Monday-Friday (9am-5pm) service comparisons identified that some sites have high percentages of wards with pharmacists present for the full day i.e. 9-5pm and others have many wards which have a time-limited service of around 2-3 hours per day. Clinical verification of prescribed medicines is routinely undertaken by the ward based pharmacist, but, in their absence, this duty falls either to a 'discharge team' or the dispensary. Data collection for this study was done using data collection forms developed following a 'brain-storming' session to ensure that the main duties were captured. The duties listed in this paper reflect those tasks included in the RSPWC. Following a pilot on each site, data collection was undertaken for five consecutive weekdays. Data was collected on over 13,000 patient encounters (review of drug chart) and 40,000 activities took place. There were a number of activities for which there was no statistically significant difference in their delivery across the seven sites. These included MR, transcription checks, confirmation of allergy status, supply and checking of discharge medication and consultations with patients. Those activities with statistically significant differences in

frequencies across the sites included, checking notes and blood results and making interventions. Another statistically significant difference between sites was the time spent per patient. Pharmacists at two hospitals spent more than eleven minutes per patient (in one of these hospitals 99% of wards have full time pharmacist cover and also registered the most interventions). At the remainder, pharmacists spent less than ten minutes/patient. Explanations for some of the differences in service provision were suggested. These included use of technology and specialities provided e.g. high numbers of 'calculations' in a hospital with high numbers of neonatal and paediatric beds and low numbers of 'check of blood results' in a site with the least acute patients, suggesting treatment was more stable. No patient outcome measures were described. The authors believed that the multi-site, multi-organisation, large scale data collection makes this work generalisable. They did recognise the absence of data collection by technical and support staff, the self reported nature of the data collection and the London focus of the study which might have influenced the results. The bed/pharmacist ratio was not reported in this study, though it is possible to extrapolate this from the data presented. It suggests that there is a narrow range, with six of the seven sites having between 16.6-18.5 beds/pharmacist and the seventh, less acute site, having 22.5 beds/pharmacist. However, the pharmacist time/beds ratio will be substantially different due to the range of pharmacist hours per day per ward that is described. From the available data, it is not possible to extrapolate this, but the extremes of the data set serve to highlight the 'unwarranted variation' in service delivery. In two neighbouring hospitals the pharmacists might have twice the amount of time available to deliver care to broadly the same number of patients. The difference in the service provided by those sites relates to those activities which were done at statistically different rates. It is not known which is right or whether there are patient outcome differences. This is the first published, quantitative comparison of the delivery of

pharmaceutical care and serves to describe the phenomenon being explored in this validation study. What this illustrates is a difference in available resource and from the literature review published methods of calculating this requirement are few.

If we turn our attention to the literature relating to the identification of pharmacy staffing levels, a small number of papers exist. Within the UK such projects have been undertaken in the past and much of it has focused on dispensary(37,38) or oncology services(39). In 2004 Acres(37) described an approach to reviewing required staffing levels in his pharmacy dispensary, but this is not directly relevant to clinical pharmacy services and so is reviewed for context purposes. He used a simple process to calculate capacity and demand and from this identified the shortfall in his service. The capacity of his team was calculated as the total number of hours available to the service each week (this included consideration of annual leave, sickness absence and study leave). The demand was the number of items dispensed (using retrospective data from previous financial year) divided by dispensing rate items/hour to identify how long the workload should take. The shortfall in his service was calculated by subtracting capacity from demand. It was reported as a 35% shortfall in capacity against demand. This process followed the principles of WISN(23) but it was small scale, one Trust, and only for dispensing activities. No data was collected for clinical checking of prescriptions or accuracy checking of final items. He recognised that it did not solve his staffing problems or directly improve morale but allowed an objective review of his service and provided answers to challenges relating to delays and he suggested that it would illustrate the impact of any investment.

Low *et al.*(39) reported a year earlier on a similar project undertaking to support capacity planning for cancer services. They established a working party in Scotland, chaired by a chief pharmacist, to consider the subject. They recognised the absence of workload data for

clinical practice and they established a focus group to discuss and identify the required resource. This two person focus group identified the resource required for clinical pharmacy services for a cancer unit as 1.0 WTE as lead for unit (0.4 WTE if not a specialist centre), 1.0 WTE per 30 inpatients and 1.0 WTE per 20 outpatients. They used Purkiss(38) figures for dispensing and aseptic services as these were felt to be reasonable and subsequently produced a list of WTE staff requirements for a range of pharmacy services required for the delivery of Cancer treatments. This paper has a number of limitations, some identified by the authors, namely that the grade of staff is not identified nor the acuity of the patient illness and their need for pharmaceutical care. In addition the methods used to calculate the WTE for clinical pharmacy are not explained and the focus group was very small, which leaves the output open to challenge as simple opinion not consensus.

The paper by Purkiss(38) is worth review, despite it being outside the criteria for inclusion by means of its date (1997). The model proposed by him at that time is still referred to twenty years on whenever pharmacy staffing levels are discussed by pharmacy managers in networking settings. Therefore understanding its concept and output is an important basis for current work. He starts by quoting a previous commentator

> *"It has been the dream of many hospital pharmacy managers that a formula would be derived which could be used to predict staffing levels and that health authority members and managers would see the logic behind the statistics and provide appropriate funds"* [Riley in Purkiss, 1997 pg 393](38)

He identified that computer models developed at that time for the purpose of calculating staff resource required comprehensive data sets to be gathered which was time consuming. Furthermore, whilst benchmarking was becoming fashionable, the process had inherent limitations and risks. He identified the limitations due to data quality issues in self reported

data sets, and the potential of bias in data submitted by managers with different incentives. Risks associated with benchmarking were outlined and included that all would be driven to the average, rather than the weakest aspiring to the best and that there was a presumption that managers had their current staffing levels correct. He therefore proposed a simple model which would allow calculation of staff resource for all elements of a pharmacy service. The dispensing WTE were calculated using JAC® data. The aseptic services data provided the evidence for that WTE requirement, similarly with medicines information. In none of these categories are the calculations provided. For the clinical service he identifies the need for 1 WTE pharmacist (AfC 8a equivalent) per speciality e.g. respiratory medicine. There is no indication how many wards, beds, patients this might cover. Other staff groups were allocated based on reasonable 'judgement'. Within the paper examples of application of his model were given and these included the expansion of existing services and the use of 'fractions' of WTE e.g. 0.2 WTE being used to grow a service incrementally. He concludes that the 'dream' had become a reality. This paper demonstrates that the need for simple methods of calculating workforce requirements has been relevant to pharmacy management historically and, whilst the 'solution' may have been identified by the team in Sheffield at that time, there is a need for an update on this model to reflect current working practices.

In the more recent published literature, work by an Australian team comes closest to describing a method of identifying the resource required to deliver pharmacy services(40). This work is based on a PhD study of around 4000 patient admissions and detailed time and motion work on the 20,500 pharmacist activities completed for these patients, analysed by patient group(41). Their calculation method had three components

- The data from Stutchberry *et al*.(41).

- The frequency with which tasks should be completed as specified in the national Standards for Clinical Pharmacy Services(42)
- The knowledge of the 'unavailable pharmacist time', which related to the mean non-clinical time spent at work, rather than the out-of-work unavailable time identified by WISN(23)

Using this approach the team calculated the number of patients for which an individual pharmacist can care, by patient group. This work reflects and supports that done already on the RSPWC since several of the clinical activity timings identified cross-reference with those suggested in the RSPWC (see later Table 2.1 page 55). The national standards though require daily patient review, so frequencies of many activities are greater in this model than in the RSPWC. Another difference is that in this Australian model, only pharmacist time is considered, as there was less routine use of technician staff in current practice(42). Pharmacist time per patient is, therefore, greater than that identified in the RSPWC, as pharmacists delivered all elements of the service provided. The RSPWC includes calculations of various grades of support staff resource required to deliver the supply and distribution of medicines for use by this patient cohort, as well as the clinical element, of direct patient care. This is omitted from the Australian model. Whilst its application in the identification of pharmacy resource for a specific cohort is demonstrated, it is not apparent if this model could be applied to the business case process, particularly, for example, the incremental growth of commissioned services in surgery.

With little guidance available on the required number of staff to deliver a clinical pharmacy service, managers have recognised that they have to use the staff resource they do have to deliver care to those patients who need it most. They have to prioritise their service and it

is this prioritisation of services that is the focus of much of the published literature. Much of this is American as the privately financed nature of the service drives closer and more detailed scrutiny of what services are being provided and therefore charged.

Granko *et al.*(34) describe a tool developed to allocate clinical pharmacist resources(34). This development involved a process of consensus amongst a number of groups of clinical pharmacy leaders. They scored scores service areas based on patient throughput, severity of illness or clinical condition by historic patient group characteristics, teaching activities, drug costs and high risk medicines for example anti-coagulants, anti-epileptics and anti-biotics. The composite score achieved for each service area is then ranked and allows prioritisation of resource to the most high risk service. They do not describe what pharmacy service is delivered to those areas whose priority falls below their identified top 20 high risk services. Similar work to prioritise service delivery according to risk was presented by Bednall *et al.*(43). This is similar in its methods (with the exception of teaching commitments) and conclusions as that described by Granko *et al.*(34). No patient outcome is demonstrated in either paper and the validity of these ranking models is unconfirmed.

The East and South East England Specialist Pharmacy Services team have produced a resource for managers to support the prioritisation of pharmaceutical care(44). This is a comprehensive guide on methods of delivery of care, to support managers in the planning and delivery of service. On the subject of prioritisation they recognised that it is not possible to review every patient every day (cf SHPA standards(42). They then identified three areas to consider when prioritising patients. These are the drugs the patient is prescribed, the underlying health of the patient and the operational priorities of the organisation. They go on to suggest the activities necessary to identify such patients which include MR, screening ward lists for new patients, reviewing notes, charts and blood results and in liaison with

ward staff. In addition they considered skill mix in detail and outline anticipated competencies of differing grades of staff, suggesting clinical areas where they maybe most acceptably deployed. Once more this paper focuses on doing the best you can within the resources available rather than identifying the resources needed to deliver the service.

The accuracy of prioritisation of services by the allocation of a 'risk score' has been investigated by a team at University Hospital Birmingham(45). Their work, at a single hospital with full electronic prescribing, involved the review of almost 59,000 patient admissions over a two year period to establish if it was possible to allocate a 'risk score' to patients based on demographics, types of drugs prescribed and blood results, which would then allow direction of staff resource to the most needy patients. This work demonstrated that a 'risk score' could be calculated, but when this was compared to actual pharmacy intervention data it was found not to be either specific nor sensitive enough to accurately predict need for pharmacy intervention. There was a positive correlation with increased age i.e. patients over 80 years old were most likely to require pharmacy intervention and a paradoxical decrease in interventions for those patients with renal or liver dysfunction. They suggest that prediction of the level of pharmaceutical care need in a patient cannot be predicted by metrics alone but requires an element of professional judgment which is not well defined.

Within Scotland's pharmaceutical services a 'pharmacy triage' process has been established – again to prioritise limited resource by using the professional judgment of a pharmacist following initial clinical review. They use a red-amber-green (RAG) approach to identifying patients requiring further pharmacy input(46). This is once more based on various patient characteristics e.g. patients requiring MR, drugs requiring therapeutic drug monitoring and patients with liver or renal impairment. The frequency of subsequent review is dependent

on this initial triage process, which is repeated on subsequent reviews and the RAG scored amended. The method of compiling these characteristics is not reported and the evidence from Suggett and Marriott(45) would suggest that the presence of renal or liver impairment is not necessarily a good marker of need for pharmaceutical intervention. The Scottish team report a reduction in pharmacist time spent on 'low risk' patients as a result of using this tool but again no patient outcome data is presented

In another recent British paper, published in the European Journal of Hospital Pharmacy(47) the evaluation of the implementation of a pharmaceutical assessment screening tool used to identify pharmaceutical acuity of patients on admission is reported. This was a small study (35 patients), using a similar RAG approach to the Scottish model. All pharmacy staff were trained on the use of the prioritisation tool and six months post implementation was evaluated by a team who independently verified the priority assigned to the study patients. The results failed to demonstrate acceptable validation, in that pharmacists using the tool in practice did not assess patients' acuity to the same level as the assessment panel. A number of reasons for this were discussed including training and compliance of staff using the tool, but also whether it accurately identified the patients most in need of pharmaceutical in-put. The authors suggests that clinical experience and judgement of individual pharmacists on individual patients plays as significant part.

This literature suggests that much time and effort is being expended in the search to identify methods to prioritise pharmaceutical services, with little robust evidence of success. There is a need to identify what resource would be needed to see every patient according to their actual pharmaceutical need and, as suggested by Acres(37), even if the funding or staff are unavailable to meet this need, at least the gap would then be known and allow appropriate acknowledgment and mitigation of risk.

As well as trying to prioritise patients for pharmaceutical intervention another focus of the literature is the productivity of clinical pharmacy services, to justify the investment of staff time in delivering pharmaceutical care.

Krogh, Ernster and Knoer describe a method of delivering staffing-to-demand as a way of providing a cost-managed service(35). Their model is based on a ratio of actual activity:staffing against budgeted activity:staffing, aiming for 100% productivity at all times. Their work identified a strong correlation between unit of service (UOS) and daily patient census and by monitoring daily patient census early in the working day it is possible to calculate the staff required to deliver care over the 24 hour period. Where census is down, staffing is reduced either by voluntary or compulsory reduction in working hours and calling in additional staff if census is higher than normal, or staff sickness occurs. This model is dependent on the budgeted staff-to-work ratio being correct but Krogh, Ernster and Knoer give no suggestion as to how this is calculated. In addition there is also the need for a flexible workforce, available at short notice for additional shifts and prepared to work fewer hours than planned. This model proved effective in reducing staffing costs, but there is no evaluation of service quality or patient outcomes. Human resource issues such as job satisfaction, pay and benefits also had to be managed. In addition the UOS monitored do not include clinical activities; this maybe because of the lack of availability of robust workload data for clinical pharmacy services. The authors suggest that this might not be transferrable to other sites due to different patient cohorts and services delivered, but there is a need to ensure that staff levels match activity. In addition they point out that it is only a mathematical model and not a substitute for sound judgement, echoing the guidance from Flynn , Kellagher and Simpson(31).

Naseman and colleagues(48) describe another approach in the US to developing a pharmacy productivity model. This was based on units of activity rather than basic metrics such as doses dispensed, which are often used in external benchmarking. They capture activity from all staff groups i.e. pharmacists and technicians. Their method was to use an 'expert panel' representing all elements of the workforce to identify the key activities for each staff group and the associated time standards. For pharmacists the key activity was clinical verification of prescribing and the process was weighted by drug i.e. chemotherapy would take longer than a laxative to verify. For the technician group time standards were created by analysis of historical workload by drug category and then observation of process to determine timings for each category. These time values were then applied to data reports from the electronic system relating to verification and dispensing on a monthly basis. To these figures were added fixed routine commitments and then the final figure was compared with actual work hours to establish productivity. This model was compared with others used in external benchmarking and found to be comparable. The main advantage cited in the discussion being the timeliness of data availability. Their approach used in-hospital data rather than being based on financial charges post-discharge which often result in time lag. This allows a more responsive adjustment of staffing to activity. The transferability of this model is not proved. This paper identifies a methodology for identifying time standards for pharmacy activities. It is however limited to single activities for both pharmacists and technicians, rather than the breadth of professional practice and patient outcome data which is not recorded.

Another common measure of relating staffing costs to out-put is that of benchmarking, i.e. comparing individual departments with the group results of their peers. In an attempt to describe a more general staffing picture, Fitzpatrick and Sanders(49) reported on a

benchmarking exercise undertaken to compare staffing establishments across the UK relative to hospital admissions. This was an update of a previous paper(50). The mean percentage whole time equivalent (WTE) pharmacist per admission to acute hospital was identified as 0.114%. A wide variability in this figure was noted both nationally and regionally, ranging from 0.095 WTE/admission in the South West and 0.135%/admission in London. It would be reasonable, therefore, to assume that there is an accompanying variability in the service delivered, which would suggest that this is being done based on utilisation of available resource rather than identification of need. This variation had remained unchanged since the previous paper although staffing levels had grown along with activity over the intervening years.

Much interest has been generated in the size and deployment of the NHS pharmacy workforce by the NHS Benchmarking project which recently reported on its review of hospital pharmacy services(22) and is the evidence base for much of the Lord Carter Report(21). Trusts were invited to participate by entering their own data against an array of categories, from number of staff in individual staff groups, to whether the directorate is independent or part of a large section of the organisation; from existence of service level agreements to antimicrobial policies. This was a wide ranging study across all aspects of hospital pharmacy with clinical pharmacy included as one of the sections. Categories of data included numbers of pharmacists per 100 beds, time spent on wards per 100 beds, numbers of ward rounds attended per week, numbers of clinics attended per week. Results, available to participants only via password protection on the website, reported as bar charts against an identified 'benchmark' which is the mean or median depending on the data set. Much has been made about the position of a Trust against a benchmark. The data is anonymous except for the users own data and relative position above or below the line

can be subjectively judged as 'good' or 'bad'. The reality is that it can be 'spun' either way. This is a powerful tool and used by decision makers to form judgements as to whether a department is delivering relative to its national peers. The data does not clarify activity delivered at each site and as demonstrated in the paper by Onatade, Miller and Sanghera(36) the pharmacists/bed metric does not necessarily represent pharmacist-time/bed. Another comparison between these papers is of note. They both identify the same figure for the mean percentage of pharmacist time spent on a ward each day as 66% (equivalent to approximately 5 hours/day) and yet Onatade, Miller and Sanghera's paper identified a substantial number of wards within their study that had pharmacists allocated for only 2-3 hours/day. There appears to be a mis-match between workload and resource. This benchmarking data gives numbers but little in the way of outcomes; however this review has started to define the priorities for the service and shape key performance indicators for clinical pharmacy. Do you attend ward rounds? How many active prescribers do you have? Do you MR your patients within 24 hours? What percentage of patients do you see each day? It describes what different Trusts are saying they deliver with the resource they currently have. It does not describe what pharmacists should be doing when they see those patients, what tasks need to be done and how long they take and how many staff might be needed to deliver this service.

The pitfalls of external benchmarking identified by Purkiss(38) were further expanded in a series of papers by Rough, McDaniel and Rinehart(51,52), along with suggestions as to how to avoid them. In the first paper they identified that benchmarking is only effective if services are compared like for like and that for clinical pharmacy there is no accepted standard for measuring productivity(51). A series of limitations of pharmacy benchmarking processes were identified. These included:

- Definitions not being aligned between participants and so answers are not comparable
- Questions often do not reflect best practice
- Drug expenses not categorised e.g. sites with Cancer services will have much higher spend
- Acuity measures not sensitive enough
- Clinical activity not accurately captured
- Contractual differences are not recognised
- 'Gaming' in the reporting (i.e. shaping the results by the responder to suit purpose)

In the second paper the team suggested strategies for the effective use of benchmarking tools(52). They advocated the value of 'internal' benchmarking i.e. developing performance metrics for individual services that are more representative of the service. Their approach to developing this benchmark is to first identify the core activities that should be measured and methods for capturing that data. To establish the time-standard for these activities they suggested, either 'borrowing' from another department or running a 'Delphi' approach amongst pharmacist practitioners internally to identify how long the tasks should take. The mean time from this response should be fed back and participants given the chance to amend their response. They suggest this should then be followed by a small sample confirmation by direct observation. Once these measures are agreed and accepted data should be collected on a routine cyclical basis. The authors recognised that this is a time consuming activity for individual sites but that its value is in demonstrating the quality and outcome measures of a service which are rarely addressed by external benchmarking.

The issue of the need to effectively capture clinical activity is one that is identified and addressed by Pawlowski, Cusick and Amborn(53). In their 2102 paper, they identify that,

over a three year period, patient numbers in their organisation grew, but pharmacy staffing remained static. External benchmarking was not effectively capturing the clinical elements of their service. They recognised that they were unable to describe the clinical pharmacy workload in a manner that reflected its importance to the delivery of safe, effective and cost effective care and that without this justification existing and future services would be at risk. Their first step was to commence manual tracking of pharmacist activities such as clarification or confirmation of orders, antibiotic regimen change, formulary conversion, monitoring of renal doses. The workload associated with this manual tracking they believed to result in under-reporting of activity and so they collaborated with their IT department to establish an electronic reporting system incorporated into the electronic medical record. Through a consensus process they established a weighted metric for each variable to identify the relative time each took. Consensus was defined as full agreement between manager and staff. Data was collected electronically in real time, the activities were counted and weighted accordingly and a sum total and average was reported monthly and quarterly to the hospital authorities. In addition to a productivity report a variance report was also created to support deployment of staff to high work-volume areas and targeting those team members who might require additional support or training. Throughout their discussion the authors identified the known benefits of clinical pharmacy(5,8,10) and therefore the importance of being able to capture activity to support them.

This is another example of a 'single-site' solution for describing clinical pharmacy activity. The argument that this has to be done site by site because of operational differences is repeatedly offered(32,35) and should be challenged. Why should there be such differences if the benefits of specific activities are known and if there are differences in services can the known benefits be presumed?

For clarity and context a number of papers outlining the benefits of clinical pharmacy services are reviewed. Bond and Raehl have published a series of papers on the subject of the benefits of clinical pharmacy services. Their early work(5,8) demonstrated that increased levels of clinical pharmacist staffing and the presence of four clinical pharmacy services (clinical research, medicines information, admission drug histories and participation in cardiopulmonary resuscitation) were associated with reduced morbidity and mortality. This was reprised in 2006/7(9,10) and demonstrated that benefits identified in the first papers had been sustained over a period of years. They reported results of a US national survey of pharmacy services and staffing were correlated with mortality data from Medicare hospitals. Results were reported for 885 hospitals (93% response rate) and over two million Medicare admissions. Statistical analysis demonstrated that provision of all of these services reduced mortality. For eleven of the eighteen service and staffing variables that were considered, these analyses are statistically significant. The top five services associated with reduced mortality ($p \leq 0.007$) were adverse drug reaction (ADR) monitoring, drug protocol management (advising or changing therapy in response to blood results), drug use evaluation, CPR participation and admission drug histories. For each of the clinical pharmacy services clear definitions are provided enabling pharmacy managers to identify the value added activities of their staff. In terms of pharmacy staff groups, the numbers of clinical pharmacists (at least 50% of employed time spent on ward based duties) was most highly associated with reduced mortality ($p=0.003$). This is compelling evidence, both for which services should be delivered and for the need for the staff to do so. A limitation of this paper (and of those in the series) is that they are based on historic data (1995 and 1998) i.e. with seven to eight years between data collection and report. The authors cite that this is due to the time lag in the national mortality data becoming available. In reality services may have changed in the interim period.

Bond and Raehl's paper the year earlier(10) considered the impact of clinical pharmacy services on the frequency of ADR using the same data set described above. Again this confirmed that the presence of clinical pharmacy services was statistically associated with reductions in the frequency of ADR which also translated into reductions in patient LOS, 'Medicare' charges and drugs costs. These financial aspects have more recently been confirmed by a number of teams in smaller site specific studies. Gallagher *et al.*(6) reported on a study of a full year's worth of pharmacist intervention data in an 850 bedded, Irish university teaching hospital. They define a pharmacist intervention as:

> *"an action taken by a pharmacist that aims to change patient management or therapy"* [Gallagher *et al.*, 2014].

They conducted a retrospective review of all interventions recorded by the 13.8 pharmacists employed to provide a clinical service, using a paper based data collection system that was transcribed on to a database. Their analysis of the cost of the service was done by calculating the time taken to complete the interventions (not the full time employment) and the hourly rate of employing a pharmacist. The cost avoidance achieved was done by the recorded interventions being allocated a 'score' based on the chances that a patient would have suffered harm had the treatment continued unchanged. A sample of the score allocation was reviewed by two independent academic pharmacists with hospital pharmacy experience and found to correlate. This figure was then multiplied by an ADR avoidance value, identified from recent European literature. Their results included review of 4,257 interventions conducted on 2,147 patients (NB 32,000 admissions were recorded for the hospital that year i.e.only 6% of admissions) and showed a net cost avoidance of over 600,000 euros. This was analysed using a variety of 'worst and best case scenarios' e.g. lower values associated with cost avoidance, lower acceptance rates of interventions, more

expensive pharmacist salaries and the converse. All variations still generated substantial net values (0.6 to 3.7 million euros). There were some short-comings in this analysis. Key issues include the subjective nature of the appraisal of the interventions, the cost being that of time delivering the interventions rather than employment costs and the measure being cost avoidance rather than cost saving. Cost avoidance is not a tangible financial metric and one, which local experience suggests, is not fully acceptable to healthcare managers. The authors argue that ongoing cost-avoidance will lead to cost-savings but this is a long term view which does not always help short term financial management. Another reflection on this study is the number of pharmacists employed to deliver the service that was being examined. With 850 beds having 13.2 WTE clinical pharmacists, corresponds to 64 beds per pharmacist. This should be compared to the study by Onatade, Miller and Sanghera(36) who reported a range of 16-22 beds per pharmacist. It could therefore be argued that intervention rates would be much higher if staffing levels were higher and it should be noted that pharmacy interventions were made for only 6% of the hospitals patient population that year. No comment was made as to the acceptability of this situation nor the actions taken to mitigate the risks for patients not reviewed, the number of which is not identified.

Whilst the evidence continues to exist relating to the benefits of clinical pharmacy, not all studies are as positive. Work by a Swedish team(54) investigated the cost-effectiveness of introducing a new clinical pharmacy service on two wards at a university hospital, through a prospective randomised (method not described), controlled study. This clinical pharmacy service had three elements, a medication review including feedback to the physicians, a discussion of medicines use with the patient and a medication report sent to the GP. The 'normal' service was not described. Once more costs were associated with the pharmacist

time required to complete the intervention and in addition this study included cost of other healthcare contact during a six-month follow-up period. Effectiveness data related to improvements in quality of life metrics. Patient characteristics in the control and intervention groups were equivalent. Data relates to 164 intervention and 181 control patients and the results of this study found that the intervention was not cost-effective. The authors discuss this in detail and postulate a number of reasons for their findings which contradict other studies e.g. its implementation by relatively inexperienced pharmacists in a pharmacy naive service – it was too big a step change, data collection too early in the implementation of the service, the delivery of the service, estimation of cost and length of follow up. They also note a high rate (66%) of exclusion of patients deemed unable to participate in the medicines use discussion. Fundamentally, the results of this study are not comparable to the previous studies, as neither the service delivered, nor the costing methods are equivalent. Their interventions were not in the top five services identified by Bond and Raehl.(9). Their outcome measures were based on patient subjective quality of life reporting, not population data and their costs elements (e.g. out-patient appointments, GP contacts, drug costs and hospital admissions costs for six months post intervention) which inflate the value, and will be influenced by factors in addition to the pharmacist intervention.

This issue of non-comparable data was discussed by Gammie, Vogler and Babar(7) in their systematic review of the recent (2010-15) literature pertaining to the economic evaluation of pharmacy services. They recognised that differences in methodologies prevented a meta-analysis approach. This review included both community (ten papers) and hospital (four papers) services. The hospital services reported represented discrete specific intervention e.g. HIV pharmacy services, pharmacy led self management programs for

patients with obstructive pulmonary disease, improved diabetes medicines education of doctors and nurses and therapeutic drug monitoring, rather than delivery of clinical pharmacy services to in-patients. They noted in summary that the majority of studies

> *"indicate minor to significant clinical benefits and are cost-effective"* [Gammie*, Vogler and Babar*, 2017 pg 64].

This review of the literature has demonstrated paucity in the availability of practical methods of calculating clinical pharmacy staffing resources. It identifies a focus on prioritising limited resource for those patients who need it most, though the success of this approach is not proved and there is a need to be able to demonstrate productivity or value for money of the investment in a pharmacy service. There is evidence that certain clinical pharmacy activities are both cost and clinically effective, but demonstrating this at local level remains challenging.

The next section will consider the literature that contributes to the validation of the RSPWC in terms of the timings of the activities included in its algorithm.

2.6 Evidence to support timings of activities in the RSPWC

There are three key elements which drive the algorithms in the RSPWC – the tasks completed by pharmacy staff, how long they take and how often they are completed. The tasks are not well defined in the literature, though there is evidence that some core elements are common to a number of sites(36). Many of these core elements are based on the findings of Bond and Raehl(9,10) and the principles of pharmaceutical care identified by Helper and Strand(2,3). How often these tasks should be completed is also not well defined, though a number of approaches have been explored to address this with limited success(45-47) However, amongst the literature there are reports of timings of patient care activities

conducted by pharmacists and these begin to provide support for the validity of the timings that underpin the RSPWC. Papers reviewed in this section were selected because they reported specific timings for the identified activities. A summary of the key data identified is presented in Table 2.1 (Page 55) but the papers are discussed individually here.

Direct comparison of tasks and times in the RSPWC is most comprehensively done using timings identified by Stuchberry *et al*(41). This was discussed in detail in the previous section. In their paper they included many of the elements of the RSPWC in their results, but all supply elements of the process are excluded. Reported timings, relating to the delivery of a clinical service, are largely similar in their paper to those in the RSPWC. Other papers deal with more specific elements of pharmacy service.

Medicines reconciliation (MR) is the first task in the RSPWC. The NPSA/NICE alert from 2009(55) identified the need for hospitals to implement a medicines reconciliation service. Based on the evidence from the work of Bond and Raehl(9,10). As with other NICE guidance, a costing template for service delivery was included this identified a time for completion of MR of 15 minutes per patient, longer than that identified by Stuchberry *et al.*(41).

This time is increased further when data from Murphy *et al.*(56) is reviewed. This American team reports on the implementation of a comprehensive MR system, introduced at their 450 bed teaching hospital. The process evaluated is equivalent to that described in the NICE guidance(55) i.e. ideal timeframe within 24 hours, use of more than one source of information, documentation of home used medicines (drug history) in the medical notes, consideration of appropriateness in the current clinical context and comparison with the prescribed in-patient chart and identification and resolution of discrepancies. The outcomes focus on the benefit to patients and improved prescribing as a result of this initiative. Included in the data presented is the time they considered it took to complete

MR (including documentation of a drug history) for each patient (31.7 minutes) and this was used to calculate the staff resource needed to deliver this service.

Urban *et al.*(57) report on a study exploring whether MR best practice (as per NICE(55) and WHO(58) guidance) is being adhered to in actual practice. They reviewed MR in four UK hospitals with the aims of identifying how long it took to complete, the number and types of sources used to confirm a drug history and the number, type and significance of identified discrepancies. Their results showed that none of the four sites studied fully complied with national best practice standards with an over-reliance on GP information and little use of patient sources. The mean time to complete MR for a patient was recorded as 35.4 minutes from start to finish but this is reduced to 14.8 minutes if time waiting for other professionals was removed.

A recent American study considered the effectiveness of pharmacist involvement in MR in an inpatient behavioural health unit(59). All patients admitted for a one-month period were included in the study. The existing practice of nurse MR continued, followed by a pharmacy technician completing an information gathering exercise (equivalent to the drug history component of NICE guidance described previously) which was then passed to a pharmacist for review (full MR as per NICE(55). Data was reported on 57 of 68% of eligible patients admitted during the study period (11 patients were not reviewed due to a lack of staff to carry out the task). 91% patients were seen within 18 hours of admission. The mean number of medicines identified by the nurses was 4.0 +/- 3.2 compared to 5.3 +/- 3.7 by the pharmacist. A mean of 2.9 discrepancies per patient were identified between nurse and pharmacist MR and almost half (48%) related to omitted medicines and a third to incorrect doses. This required a mean of 13.9 minutes of pharmacy time to complete.

Nester and Hale(60) found similar outcomes in their earlier study both in terms of improved accuracy in MR when completed by pharmacists instead of nurses and also in the time it took to complete the task. They assigned 100 patients alternately to standard nurse-led MR (control) or pharmacist-led MR (intervention) and the quality and efficiency of this was assessed by the time is subsequently took the dispensing pharmacist to issue the medicines, which included solving identified discrepancies. The intervention group were reported to have had MR completed earlier in admission, in less time and with greater accuracy than those in the control group. Time to complete MR was reported as a mean of 13.4 minutes. The MR process described was equivalent to those in other studies.

A European perspective is given by Leguelinel-Balche *et al.* who report on the impact of pharmacist MR on medication safety in a French teaching hospital(61). Their study was divided into two phases the observation phase where pharmacist MR was completed after the initial writing of the drug chart (as reflects common practice) and the intervention phase when pharmacist MR was completed prior to the initial writing of the prescription. MR took a median time of 35 minutes in the observation phase – with the standard for completion of MR as reference to three sources of information which is more than the two reported in most cases, and 30 minutes in the intervention phase. The authors conclude that MR completed in a prospective (intervention) manner is associated with increased safety, but the deployment of these staff is resource heavy and a mixed method approach (proactive and reactive) should be employed.

A Canadian team reported their time and motion study on medicines reconciliation at admission and discharge(62). They studied two discreet populations - general medicine and elderly care - in two academic centres. On the surface their findings are significantly longer for MR on admission than any other study – a mean of 92.2 minutes for elderly care and

46.2 minutes for general medicine. However, when the details of their data are reviewed, this time includes activities that are not considered part of the MR process in other studies or the RSPWC e.g. reviewing lab results, calculating creatinine clearance. They include the waiting time for receiving a fax, though acknowledge other duties would be undertaken during this time and the breakdown of time for this is not included in the data. Finally the time taken for elements that are part of process in other studies and the RSPWC took substantially longer. In the elderly patient these include 29 minutes for reading the medical notes, 32.3 minutes for documenting the medication list and 12.3 for documenting recommendations for a prescriber. In their conclusions they suggested that multiple health professionals are involved in the process and like Urban *et al.*(57) suggested that process differs between different hospitals and that there are inefficiencies in the process that might be resolved by better use of informatics. Their data has not been shown in the comparative Table 2.1 as the timings are confounded by having different components and because not all activities were done for all patients it was not possible to lift out the individual elements with any certainty. For this reason this study was excluded from the comparison as it would skew the data.

When considering the time for clinical interventions, in the few papers that report this data the results are quite homogenous. Oh *et al.*(63) described a time and motion study entitled 'Pharmacist time requirements for counselling in an out-patient pharmacy', the results from which were used to form a payment framework for community pharmacists to undertake extended duties. However on closer analysis the data actually captured what would be defined in a UK hospital setting as 'clinical interventions' and that is how it has been recorded for the purposes of this review. They reported a range of times dependent on the

nature of the intervention. This range sits across those times identified by Stuchberry *et al.* (41) and the RSPWC (see Table 2.1).

If the dispensary elements of the RSPWC are considered, a number of relevant papers can be found in the US literature. Jenkins and Eckel(64) focus on improving workflow by changing the skill mix of pharmacy staff, utilising pharmacist time only for activities requiring a registered pharmacist completion i.e. they report times for clinical checking, counselling and dispensing of out-patient medicines. Times for the first two categories are similar to the RSPWC. Dispensing is reported as being significantly quicker, but it is not clear as to the units of measure. Their paper refers to 'prescriptions' and if this was to be a single item rather than complete list of medicines. Extrapolation of this data to UK hospital in-patients (median six items per patient(65)) would yield similar values to those in the RSPWC. This is likely as out-patient prescriptions are rarely for a patient's full list of medicines, unlike discharge prescriptions, although the process of preparation usually will be identical.

The difficulties relating to comparability of data applies with the work by Calabrese and Williams(66). They reported the implementation of a web-based medicines tracking system which allowed more accurate prediction and measurement of work flow. Their data included times for clinical checking, dispensing and accuracy checking of final products (see Table 2.1)

The UK perspective is brought by two papers from Welsh research teams who report on task times for dispensing of medicines in Welsh hospital dispensaries. James *et al.*(67) compared two techniques for capturing this data to demonstrate that both produced similar data and so the less complex method could be used with confidence as a data collection technique in practice. They measured times in two Welsh hospitals, hospital A has an automated

dispensary and hospital B is manual. They report on items/person/hour and so their data has been extrapolated for the purposes of this review using six items per patient(65).

In the second paper, Hiom *et al.*(68) bench-marked dispensing rates across a number of Welsh hospitals and identified an average dispensing rate of 9.9 items/person/hour – once more extrapolated for purposes of comparison.

Finally, a team from London reported dispensary timings in their report of using 'discrete event simulation' to design efficient hospital out-patient pharmacies(69). This involved the description of the dispensing process in detail and the generation of a process map. They then conducted a number of time and motion studies in two hospital sites, Charing Cross Hospital (CX) and Hammersmith Hospital (HH) which recorded the times taken for a number of the tasks. These times were then used to build a simulation model and then a number of scenarios run through the simulation varying either workload or skill mix. The out-put from this study resulted in changes to staffing levels to match peaks and troughs of work both in terms of numbers and skill mix. Their times, reported for a six item prescription, are shown in Table 2.1. (It should be noted that *data has been extrapolated for a six item prescription).

Table 2.1 Comparison of reported times (minutes) for activities from the pharmacy literature

(NB First-named authors only cited for tabulation purposes)

RSPWC Task	Prototype RSPWC	Stuchberry(42)	NICE/NPSA(56)	Murphy(57)	Urban(58)	Lizer(60)	Nester(61)	Leguelinel-Blache(62)	Oh(64)	Jenkins(65)	Calabrese(67)	James(68)(67) (Hospital A)	James(68,) (Hospital B)	Hiom(69)	Reynolds(70) CX	Reynolds (70) HH
Medicines reconciliation	**10**	**10.2**	**15**	**32**	**15**	**14**	**13**	**39**								
Clinical review of notes	**5**	**6**														
Interventions	**5**	**6**							**4.3-6.3**							
Ordering of non-stocks	**2**	**3.6**														
Clinical check of TTO	**5**									**5.1**	**6**					
Counselling	**5**	**3.8**								**2.4**					**3.5**	**2.6**
Booking in	**2.5**														**0.8**	**0.87**
Dispensing	**20**									**7**	**9**	**60**	**30**	**36**	**16**	**13.3**
Accuracy check	**8**										**3**				**2.6**	**2.75**

2.7 Implications of the literature review for the RSPWC validation

This review of the literature identified implications for the proposed validation project in a number of different areas.

Throughout the literature a consistent approach to workforce resource identification is demonstrated, regardless of the discipline involved(14,16,17,19,20,23,27,30,40). Namely the identification of a staff group, the tasks they have to complete and the time they take. For some professions this has been completed i.e. a calculation tool exists, that can be applied simply by other managers applying available local metrics to a developed tool(19,20,40). It is noted however that in these cases there has been limited external validation(19,40). In other cases(14,16-18), all that is described is the process, leaving individual sites having to complete substantial local research to populate. No calculator for clinical pharmacy has previously been published.

An inherent trait of the pharmacy profession is accuracy and this may have inhibited the development of any such tool. The processes of ward-based clinical pharmacy are not formally established in any national guidelines and the permutations are complex and the search for the 'perfect' solution, accurately capturing the requirements for staffing may be put into the 'too hard' category. The profession has therefore focused on how to deliver services within existing resources(34,43-45,47) and comparing their efforts through benchmarking processes(22,49,50). Outliers in the data sets are almost always explained by staffing levels, with the performance of a department being judged against this benchmark. A better position to judge the performance of individual sites would be in understanding how many staff should be needed to deliver a service and then being able to recognise the

efficiencies made and productivity improved, by demonstrating clinical and economic outcomes.

This review has demonstrated that the approach taken in the construction of the RSPWC is supported by the literature from various disciplines and follows the principles of WISN(23) which is an internationally recognised method of identifying healthcare workforce resource. At this stage the 'experts' involved in the identification of the tasks have been local to Stoke-on-Trent and the timings used to drive the calculator are also sourced from one site. Validation requires confirmation of the former through development of consensus and the latter by collection of timing data from a variety of settings, addressing the weaknesses identified by Skills for Health(19), Stuchberry *et al.*(41) and Hurst *et al.*(20) in their work.

The review also identified shortfalls in the initial version of the calculator. A key step missing is the omission from the calculation of the 'unavailable time', inherent in employing a staff member e.g. study, sick and annual leave, mandatory training, travel time. This needs to be addressed to ensure that the staffing levels calculated can deliver sustainable service delivery that should be resilient to predictable absences. Another issue with the initial version of the RSPWC is that it currently does not address the issue of patient acuity; it is a one-size fits all approach. This is recognised by the developers, as the frequencies of the tasks are based on agreed minimum standards of care and may therefore be an underestimate. Following this review modifications have been made to improve the sensitivity of the tool to different patient groups by calculations being driven by numbers of prescribed items rather than just by simply admission numbers. It is accepted that this still falls short of perfection but as per Ghosh and Cruz(27) – it is a starting point.

Finally the value of a 'ready-to-use' tool has also been identified(20,27). Local managers need to be able to simply apply population data to generate a resource calculation and this is a solution that is offered by the RSPWC for the pharmacy workforce.

Support and guidance for the project methods can also be found in the literature. WISN(23) requires the 'gathering of experts' to determine tasks to be completed. This requires a method of developing consensus. This is also reflected in the pathology tool(18) where the 'PAT' categories were established from 'people working in the service', though the participants in this process are not identified. The Hurst *et al.* paper(20) identifies that a weakness of previous models for staffing were because they were based only on 'professional judgment' and so their validity was questioned. With no agreed standard operating procedures on the delivery of the clinical pharmacy service, 'professional judgment' has to be used to shape what it should look like. It was important therefore to ensure that consensus on the tasks is achieved from a 'broad church' and includes key stakeholders as well as being from a large enough representation of the pharmacy manager population. The approach of collecting data relating to task timings using senior pharmacists from differing sites is supported used by Hurst *et al.*(20) for their nursing calculator. This approach may improve acceptance of the tool if local data from wide ranging participants is seen to be utilized in its development.

The literature review has demonstrated that apart from the issue of MR there is very little published time and motion data for pharmacy practice activities. On the subject of how long it takes to complete MR there are differences in definition, although those with outlying opinions can be easily identified(62). When the data is reviewed overall a mean time for MR calculated from those reported in the literature is 19.74 minutes. This value is greater than that in the current version of the RSPWC.

What little data is available around interventions and clinical checking of prescriptions is reasonably homogenous and reflects that in the RSPWC, though the small data set is acknowledged. This too requires confirmation from current working environments.

Finally when dispensing time and motion is considered a problem of standardisation is encountered. All papers that report timings for the different elements of dispensing use different denominators and it is not possible to accurately extrapolate the data to a common value for comparison purposes. This difficulty informed the study methods and 'time per item' was used as the unit for comparison dispensing/checking activities.

Finally, the use of evidence from literature, combined with data collection to validate a workforce tool was described by Hurst *et al.*(20) and supports the approach to the validation of the RSPWC.

2.8 Literature review summary

In summary, completion of this review has confirmed that there is no published, validated calculation tool for identifying staff resource for the delivery of pharmaceutical care. As such the RSPWC is novel, but requires validation for acceptance into practice. The approach taken in the early development of the RSPWC is supported by evidence from a number of disciplines and the proposed study methodology can be justified by the literature. Some evidence for the timings that drive the RSPWC can be found in the literature, though robustness of this is limited by inconsistencies in data presentation. The omission of 'unavailable time' in the initial version of the RSPWC was identified through the literature review and steps were taken to address this in the study version of the tool, which included this adjustment in its calculation.

3. Aims and Objectives

The aim of this research was to explore whether a tool, developed to calculate the staff resource required for delivery of pharmaceutical care to hospital in-patients at a RSUH, could be applied to equivalent services delivered at other hospital sites. Research questions considered in the scope of this project included:

i. Does the delivery of pharmaceutical care at other sites require the completion of the same task list as at RSUH?
ii. Do pharmaceutical care activities take the same time at other sites and does automation have an impact on these processes?
iii. Do other sites use the same staff groups as RSUH for delivery of various tasks?
iv. How often are the activities completed for individual patients?
v. If there are differences in the tasks, times, staff groups or frequencies of different activities between, can a consensus be reached to allow the development of a more widely applicable staff resource calculator for clinical pharmacy staffing?

From the literature review it was identified that the WISN(23) approach to identifying staffing levels for healthcare delivery would be an appropriate overarching methodology for this study. This required the completion of a series of objectives

- Objective 1: To develop an 'activity standard'(23) for clinical pharmacy i.e. establish consensus on the form and nature of the job, how long it takes, how often it should be done and the staff group required for its delivery.

- Objective 2: To identify 'unavailable time' inherent in the employment of pharmacy workforce to ensure the sustainability of the service across the full year irrespective of annual leave, sick leave etc.

These first two objectives were required to compare the prototype RSPWC with practice in other settings and identify consensus where differences were identified.

The validity of the RSPWC in different settings and its reliability in the hands of different operators was explored by the completion of further objectives, namely:

- Objective 3: To explore the current staffing resource requirements as perceived by hospital pharmacy managers and the comparison of these to the resource generated by the RSPWC
- Objective 4: To demonstrate the transferability of the tool to different operators, by comparison of out-put values from its application in a number of scenarios by different pharmacy managers
- Objective 5: To explore the applicability of the tool in different settings through qualitative interviews
- Objective 6: To explore the reasons for any outlying data through qualitative interviews

The final objective of the study (Objective 7) was to produce a consensus-based workforce calculator for clinical pharmacy services that could be utilised by pharmacy managers in different settings to identify required staff resource for delivery of pharmaceutical care.

To meet the identified aims and objectives of this study, methodological consideration was required on the approach to development of consensus, the establishment of validity, the design and delivery of questionnaires and approaches to qualitative research in the form of

semi-structured interviews. The iterative nature of practice-based research also requires consideration of reflexivity (i.e. how process are continuously remodelled on the basis of new knowledge and social context) and its influence on the methods employed and the results achieved.

4. Methodology

The RSPWC has been developed to identify the resource required to deliver pharmaceutical care to in-patients at the Royal Stoke University Hospital. For other centres to use this tool, confirmation is required that it accurately reflects 'pharmaceutical care' in those settings i.e. that it is valid and reliable in the data it produces when applied to different services.

From the literature review it was identified that the methodology which underpins the WISN(23) approach to calculation of staffing levels is appropriate for application in this research and the theories behind the algorithms which drive WISN will be explored in this chapter.

Using the WISN model first requires the agreement of experts about the details of the work to be completed by the staff – consensus will have to be identified. In this chapter consensus methodologies are discussed alongside those of questionnaire and interview design as tools to capture consensus data. Also within this chapter the concepts of validity and reliability are explored and applied to the context of this study. Finally, the place of 'mixed-methods research', using quantitative and qualitative approaches to explore this subject are considered

4.1 Research question

Pharmaceutical care has been clearly defined as

> *"the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life"* (2).

However, this clarity of definition on the *delivery* of this care has not been established. There is evidence that providing this care is of benefit to both patients (reduced morbidity and mortality)(5,8,9,9) and organisations (financial and governance)(5,6) but what tasks have to be completed in order to ensure that all the medicines related problems described by Strand *et al.*(3) are identified and addressed has not been established. The provision of pharmaceutical care has developed centre by centre. Key statements on purpose(2) and national drivers(70),(55) have resulted in commonalities developing but there is no standard procedure for the delivery. Views on how to deliver pharmaceutical care differs between settings and therefore calculation of how many staff are required will be dependent on the individual understanding of what that service should consist. If one considers the ontology (the nature of existence of this phenomenon) there is not a single, objective reality, to be identified, measured and described. However, in the current political and financial context, there is a desire to strive for consistency in healthcare; that regardless of location a patient should experience the same quality and content of a service. The removal of 'unwarranted variation' is desired(21). This requires an epistemological approach to explore and refine these multiple realities on the delivery of pharmaceutical care, which acknowledges the socially contingent nature of the data, whilst gathering and 'converting' them into a single agreed reality.

For a single calculator tool to be applicable to a variety of settings, agreement on this 'converted' reality needs first to be established; some sort of consensus needs to be achieved. The tool then needs to be demonstrated to be valid for different settings and reliably generate data on required resource.

4.2 Workforce calculation using WISN

The theory of workforce modelling techniques lies in the domain of mathematics and business management. This section gives an overview of this field to place the use of the WISN approach in context of workforce planning theory and to understand its relevance to the RSPWC

WISN(23,71) as described previously, is the WHO model for calculation of staffing requirements for the provision of healthcare. It is published as a practical manual, outlining a step by step process for calculating staffing need, giving instructions in simple to follow language. However, the theoretical basis underpinning these calculations needs to be understood.

In his paper 'A study of Factors Affecting Effective Production and Workforce Planning'(72) Dr Hallim Kazan identifies that whilst many of the issues related to workforce planning have already been investigated through various studies an additional feature of the field of workforce modelling research is the need to manage the 'stochastic' demand for staff. Stochastic demand, being defined as 'a randomly determined probability distribution or pattern that may be analysed statistically but not predicted precisely'(73). This is of direct relevance to healthcare workforce planning, as at healthcare facilities patient attendance is difficult to predict (other than seasonal variation) and therefore there is a significant challenge to match staff resource to the patient need. Prestwich, Tarim and Hnich(74) suggest that stochastic techniques such as 'evolutionary search' are not guaranteed to generate optimal solutions but do offer a quick, pragmatic solution. A review of the literature in this area reveals that there are many complex mathematical algorithms developed to calculate manpower requirements. The application of these to real-life settings is limited by the ability of non-mathematicians to these algorithms to generate valid

calculations specific to their situation. However, these algorithms can be demonstrated to directly relate to the basis of WISN see Table 4.1.

Table 4.1 Comparison of the mathematical algorithms of Kazan(72) **to WISN (1998)**(71)

Establishment of Need of Real Personnel. Kazan(72)	WISN(71)
RPR = $\frac{TT}{AWT}$	Staff resource = $\frac{\text{Time to perform role for full patient population}}{\text{Available working time}}$
TT = $\sum_{i=1}^{n} R_i * T_i$	Time to perform role= Activity standard x number of patients
Where	
TT: Total time needed to finish whole job	Time to perform full role for all patients
R_i: the number of repeats	Frequency with which task done
T_i: The required time to perform a job at least once	How long it takes to do a task
i: the individual task	Each task identified
n: total operation	Total number of tasks required to perform role
	Activity standard
RPR: real personnel requirement	Staff resource
AWT: average workforce time	Available working time = Time available for patient care

Therefore, as this comparative table shows, WISN can be demonstrated as equivalent to an accepted mathematical algorithm for workforce planning so, therefore, using its approach to resource calculation can be considered theoretically sound for the development of staffing models.

Once a staff resource is identified it is followed by the need to improve the productivity of a service. Developing service standards (i.e. for one patient what tasks should be completed, how long they should take and how often they should be done) for different staff groups should allow the establishment of productivity measures for different professions. It should

therefore follow that improved efficiency of this group results in delivering either the same service standard with fewer staff or caring for more patients with no additional resource. However, the challenge of measuring productivity in healthcare as described by Scott(75) recognises that this is confounded by the issue that patients seen by the same doctor for the same condition may respond differently to the same treatment and that patients with the same condition may be treated differently by different doctors due to the difference in their knowledge and experience. Therefore outcomes and resource requirements are not always predictable. In addition the usual market forces do not apply, as the recipient of the service rarely pays the full cost of the service they receive which results in market forces being skewed. However, with productivity becoming increasingly important in a modern healthcare system it is essential that baseline resource is first identified and standardised, in order that productivity can be demonstrated.

The calculations that drive the RSPWC are based on the same mathematical principles suggested in WISN and therefore as such can be considered an appropriate approach to workforce calculation. For WISN to be applied, the activity standards must be established for individual staff cadre in a particular setting. The RSPWC has achieved this for pharmacy staff in Stoke-on-Trent(13). This validation study explored whether this activity standard was valid for other pharmacy settings i.e. the staff cadre was the same but the setting is different. Within NHS Trusts the available working time of staff is largely fixed by the 'Agenda for Change' terms and conditions with respect to annual leave and sickness absence(76). However, unavailable time' for other reasons (such as travel between locations and training etc.) required confirmation. The WISN approach relied on the development of 'activity standards' by the establishment of consensus on the tasks required and the confirmation of how long these tasks should take and how often they should be

completed should focus on the use of existing local data, rather that the collection of new time and motion data. This is also supported by the work of Hurst *et al.*(20). How to identify this consensus will be considered in the following section.

4.3 Consensus

The considerations above suggest that validity of the RSPWC is dependent on the establishment of 'consensus' – both to demonstrate elements of validity (see later section 4.4) and that appropriate approaches to workforce planning have been applied(20,71).

Consensus is defined as a 'general or widespread agreement'(77) that is achieved from listening to the views and opinions of a population. It differs from 'voting' in that there are no 'winners' or 'losers' but the solution or plan agreed on is one which has the support of the whole group(78); it is deemed acceptable to all(79). Moreover a decision can be developed through consensus, rather than being a simple choice between conflicting option(80,81). When consensus is sought in an ideal process, it requires active participation of all parties who should be considered as 'equals'(78). There should be no weight given to those in hierarchical positions(78). The process will be more successful if certain prerequisites are achieved. These include a commitment to reach a consensus - everyone involved should be seeking a common goal, no one should approach this process with a fixed view or a hidden agenda. There needs to be trust and openness – one needs to be able to voice opinion without fear of retribution and the process should be clear and all play their part(78).

Consensus is used in different groups and communities as a way of decision making(78) and is increasingly used in healthcare, particularly in the area of policy decision making where the need to move away from the authority of a single practitioner has resulted from a

number of legal and technological developments, which have challenged the appropriateness of such practice(79). As a consequence consensus has become a necessary philosophical consideration particularly with respect to epistemology i.e. the nature of how this process is achieved(79). When approaching the subject of developing consensus one must consider both the approach used to gather opinions that will form the consensus and the level of agreement that is required for consensus to be considered to have been reached.

A number of techniques of gaining or identifying consensus exist and a number of studies have reviewed the relative merits of each(81-85). For example the 'Nominal Group' technique has been employed in healthcare where individuals initially write down their own thoughts without discussion and then in turn share ideas with the group, which then ranks and votes on the collected list(81,82); the Quaker technique, whereby each individual is only allowed to speak once, until all have spoken, ensuring the consideration of all views and opinions(78). Brainstorming and focus group activities(82) could also be applied although these are known better for idea generation than problem resolution. The 'World Cafe' is another approach, where smaller groups of individuals gather to discuss specific issues around tables(80). Key points of agreement are captured and added to as conversations progress. Members of the 'cafe' switch tables periodically, to ensure that they contribute to all discussions and that the final out-put includes everyone's opinions and is enriched by the diversity of the discussions held. These face to face techniques risk the discussions being dominated by strong individual opinions which may skew the outcome and reduce the strength of the consensus, as less vocal individuals may consider the validity of the consensus tainted by a domineering view. In addition the physical presence of the stakeholders in the same venue is imperative and attracting the presence of the relevant

experts requires an acknowledgement of the credibility and importance of the task in hand. For the validation of the RSPWC, these techniques would prove challenging on both areas described above. Any 'expert group' gathered to develop consensus would require the presence of representatives from the Shelford Group of Trusts, as significant service influencers(86). For greater richness in the consensus, the presence of smaller regional units is needed. In face-to-face techniques discussions may be dominated by the experience and 'expertise' of the large teaching hospitals, with quieter voices failing to be heard. In addition the gathering of such a group would be challenging in terms of logistics and cost. As a consequence these techniques were discounted for the generation of consensus on the tasks and times that drive the RSPWC as a more pragmatic approach was required.

An alternative approach is the application of the Delphi technique(80,81,87), where the general principles are that a group of stakeholders or experts are asked to anonymously state their views on a number of issues. These views are then summarised and fed back to the group who are then asked to identify their level of agreement or disagreement with the list of issues and articulate their reasons for this opinion. This data is then gathered and summarised by an independent facilitator and fed back to the group who are asked to review their original response in the light of the knowledge of the responses of their peers. The process is iterative until an acceptable level of agreement or, consensus, is reached. However, consensus is not the only end point that should be sought in Delphi research. Von der Gracht(88) also argued that stability of data needs to be achieved, i.e. that opinions have settled and stopped changing over the course of repeated rounds.

Delphi can be administered in a questionnaire format which has the advantage of being able to be delivered electronically and therefore wide-spread geographical distribution of participants is not a barrier to its success. Its use is particularly appropriate if the research

subject cannot be investigated by analytical techniques, but would benefit from "subjective judgements on a collective basis"(89). This method is increasingly gaining credibility in the field of healthcare research generally and in pharmacy specifically. It has been used to establish the European Standards for Hospital pharmacy(80) and policy solutions for medicines adherence(87) . However, it is not without its criticisms. For example it has been suggested that the data summary stage risks feeding back the 'right' answer as perceived by the researcher and therefore the consensus process has the potential to be manipulated(79). Modifications of the original technique have evolved e.g. 'reactive Delphi' where respondents are asked to give their opinions on a previously established set of information. Whilst it is recognised that such evolution is an expected phenomenon when considering human activity there is a risk that in modifying the process the fundamental validity of the approach may be lost(89,90). The scientific credibility of the approach has also been questioned(90). These challenges include reliability (would the same result be achieved by giving the same information to more than one group), the potential bias in the selection of 'experts' and validity of the out-put (consensus does not necessarily equate to absolute fact). These are, however, criticisms raised against other qualitative methods and the Delphi technique is recognised as having application in subjects which require broad consensus or direction of group decision making(90). Powell(91) suggests that researchers using this technique identify the 'goodness criteria' of their results, by triangulation with literature and other data sources, using follow up research to explore outlying data sets and establishing credibility in the transparency of the decision process used in their study design and implementation. These triangulation methods are built into the approach taken in this validation study.

The strengths identified above are particularly relevant to this study, because the ability to deliver the questionnaire electronically allows for a wide geographical distribution of participants, preventing a regional bias and the anonymity of the process removes any hierarchical effect. However, acknowledgement of participant lists will enable individuals to respect the outcome on the basis of knowing that key stakeholders have been involved. Caws(79) identifies that having respect for the participants in a consensus process is critical to the acceptability of that consensus in practice. This leads to consideration, when using the Delphi technique, of the definition of 'experts'. The use of this title might preclude the contribution of knowledgeable individuals not classed as experts e.g. a clinical pharmacist in a district general hospital many not be considered (by themselves, the researcher or their peers) an 'expert' compared to a clinical lead pharmacist at a London teaching Trust. However, their views and opinions are valid for the delivery of service in their setting. Powell(91) suggested that knowledge of a topic and willingness to participate in the discussion is of more value than a remote non-participant 'expert'.

Finally when considering the establishment of consensus it is essential to recognise when this has been reached. There is little agreement in the literature as to what level of agreement is required to demonstrate that consensus has been achieved(88). Various approaches to the identification of the establishment of 'consensus' have been reported(88). These range from subjective analysis(92), stipulated numbers of rounds(93), specified levels of agreement – which in turn range from as little as 51% agreement(94) though other authors suggest figures as high as 95% are needed(95) – to the calculation of a variety of inferential statistics(88). However, what is recommended for the robustness of the outcome is that the level of agreement required to prove consensus is specified prior to data collection and not simply interpreted during the analysis phase(88,96) Where

inferential statistics are used to demonstrate consensus it is important to select appropriate measures as 'violations in basic assumptions' (von der Gracht 2012 p 1533) have been identified in published studies. For the purposes of this study consensus was predefined using specified levels of agreement between participants (see section 6.3.3) as participant numbers were unlikely to be sufficient to allow meaningful inferential statistical analysis to be applied.

There is also a need to ensure that the sample size is credible. Hsu and Sandford(96) recommend that a Delphi study should utilise the smallest acceptable sample size. Delphi studies with participants from homogenous backgrounds tend to have 10-15 members. However, even with greater heterogenicity of participants and more complex issues, Delphi studies have rarely included more than 50 participants(97). The participants in this study were all pharmacists, practising in different settings. The subject is complex and so it would therefore seem reasonable to aim for a minimum of ten participants from each setting e.g. teaching hospitals, district generals, community hospitals. Therefore the total study sample size was anticipated to be in the region of 30-50 participants depending on the range of participants that accepted the invitation (see section 6.2.2)

The establishment of consensus, as discussed in this chapter, is required in this study both as part of the WISN methodology for calculating staffing resource and in contributing to the establishment of the validity of the tool. This is discussed in detail in the next section.

4.4 Validation of the RSPWC – validity & reliability

For a tool to be valid it needs to be shown to accurately represent what it claims to represent, within acceptable limits. Its reliability is demonstrated in the reproducibility and consistency of its output. Both are considered and applied to the RSPWC.

Determination of validity first requires an independent knowledge of the nature of the phenomenon. As discussed in the literature review there is no agreed standard for delivery of pharmaceutical care and therefore validity of any tool measuring this phenomenon has to be demonstrated from a number of different perspectives. Validity and reliability of 'tools' often relates to educational assessment e.g. written exams, Objective Structured Clinical Examinations (OSCEs) or to those capturing data for studies e.g. questionnaires, assays, observations. The RSPWC falls into neither category but the principles applied can be transferred to this work.

In educational arenas, issues around validity theory are widely debated - which form of validity is most valid?(98) It appears that even the experts do not agree. Some clarity is brought by Gorin's article(98) responding to a new framework proposed by Lissitz and Samuelson(99) where she concludes that

> *"Validity is a judgement, and like all judgements is relative and ever evolving. It can be, and should be evaluated in the light of new evidence and desired interpretations, making validity and validation an ongoing process"* [Gorin 2007, pg 461)](98).

This suggests that finality and precision will not be achieved in any validation and ongoing re-validation will always be required, it will never be 'job done'. There is a large body of literature on the subject of validity of research tools, which is summarised in Chapter 9 of Sim and Wright's 'Research in Healthcare' (2002)(100). They identify several different forms of validity and each will be discussed in turn.

Face validity is the extent to which the tool 'appears' to be valid when assessed by impartial 'experts'. This is important for the credibility of the data generated – if it does not 'look

right' then its output will not be believed. Face validity for the RSPWC has already been achieved through presentation at conference. This peer review suggested that at 'face value' the tool was worth developing. This will continue to be developed throughout the course of the study.

Content validity measures the extent to which any tool addresses the full scope of the phenomenon being measured. The RSPWC is calculating resource for the delivery of ward based pharmaceutical care and to demonstrate content validity it therefore needs to measure all, or certain, clearly defined elements, of ward based pharmacy services. There is no standard for such services and as a consequence the tool in its current version measures the elements that the developers believe to be necessary. What needs to be established is whether this is considered to be the full extent of the service or whether there are other aspects that need to be added to or removed from the tool to improve its validity.

Criterion validity consists of three associated types of validity; 'concurrent', 'predictive' and diagnostic' validity. The first, **'*concurrent*** validity', is concerned with comparison of a tool to a 'gold standard'. For the delivery of pharmaceutical care there is not a 'gold standard' yet established, though the 'Hospital Medicines Optimisation' group (HopMop)(21) are working to identify a 'model hospital' based on what 'good looks like', though this model stops short of specifying staffing levels. The WISN(23) tool for workforce calculation, howev, is considered a 'gold standard' method for determining healthcare staffing. Whilst this has not previously been applied to pharmacy, the development of the RSPWC follows the key steps in their recommended process and therefore its output can be justified by its approach. The 'gold standard' does not exist but the method used to calculate the value is structured on a 'gold standard' method of staffing calculation.

Predictive validity relates to how the prediction is borne out in reality. For the RSPWC the resource calculated needs to work in practice. With the resource calculated can the service actually be delivered in a consistent manner – does it still under-estimate the requirement leaving services stretched or does it overestimate the resource required and so lose credibility in the eyes of the financiers and management? From a local perspective it has already been recognised that the resource falls short, as the initial version of the tool does not include the WISN requirement for the identification of 'unavailable' time. This needed to be identified and incorporated into a 'validated' version of the calculator.

Diagnostic validity considers whether a tool identifies true or false positives/negatives. This is not applicable to the RSPWC as that is not the nature of its out-put.

Finally, ***construct*** validity requires correlation of out-puts of some elements of the tool with values calculated by a different method. This is particularly important if the tool being validated is theoretically novel. This is directly relevant to the validation of the RSPWC. Some construct validity can be demonstrated by reference to the literature – certain elements of the tool e.g. medicines reconciliation (MR) are well reported and published data reflects that in the RSPWC(41,55-57,59-61) Moreover, confirmation of tasks, times and frequencies which drive the tool can be collected from other hospital sites to identify the consensus of the profession on the subject.

The validity of health care models was considered by a US task force(101). They identified five optimal elements of validity that model developers need to strive to achieve if they are to demonstrate best practice. Of these five forms, three (face, cross or construct and predictive) are covered in the descriptions above. In addition they identify ***internal*** and ***external.*** Internal validity requires the computational elements of the model to be proven i.e. are the calculations correct. The methods for this depend on the complexity of the tool

in question. In the case of the RSPWC this would need to be done manually by a second programmer and the calculations made available to users for their own verification. The former has been done, but needs to be described, and the latter is achieved by the issue of the tool as the calculations are accessible through the spreadsheet, though protected by password to prevent inadvertent modification. External validity requires the forecasts of a model to be proved in reality so that its output can be seen to generate realistic figures. This is difficult to achieve in the case of the RSPWC as the pharmacy workforce has not been thoroughly described and agreed upon. With no agreed formula to quantify staffing need, the tool cannot be checked against reality. It may not generate the same level of staffing that currently exists in hospital pharmacies, but that will not necessarily make it invalid. This is accepted by Eddy *et al*(101) as they acknowledge that not all models will achieve all measures of validity, but this should be the aim of the researcher.

Eddy *et al.*(101) also require a further element of 'transparency' which requires the developer to provide users with technical details of how to utilise the tool so they understand the way in which the calculation works, and provide sufficient detail so that the computational basis can be checked or developed. This needs to be done in the context of confidentiality and intellectual property rights. When the RSPWC is issued to users it will be accompanied by a 'user guide' to aid its application and the calculations will be visible though password protected as described above. In their conclusion, having extolled the virtues of robust validation Eddy *et al*.(101) remind the reader that a model is only ever a model and not reality and that, effectively, validity is in the eye of the user, who needs to determine whether it is 'fit for purpose'.

Reliability of a tool i.e. the consistency and reproducibility of the data it produces also needs to be established. Sim and Wright(100) consider there to be three types of

reliability: ***equivalence, stability*** and ***internal***. This latter is not relevant as it considers how a tool cross references answers and is generally applied to questionnaires. ***Equivalence*** requires the tool to produce consistent measurements in the hands of two or more investigators – can other pharmacy managers generate the same data with the RSPWC using the same criterion? This inter-rater reliability is vulnerable to the active participation of the user. Equivalence reliability is increased when the variables that are under the control of the operator are limited to a minimum. The validated tool will require protected cells to limit the editing ability of third parties, to assure the reliability of output. This may prove challenging as the desire to 'bespoke' the tool to different settings may result in increased numbers of variables made available for individual operators to manipulate, which in turn may diminish the validity of the tool. Consideration of this will have to be made at the time the tool is issued. This study will need to demonstrate equivalence reliability by assessing the use of the tool in the hands of other operators. The matter of ***stability*** (that a tool consistently produces the same data in the hands of a single operator) has already been established(13). Importantly reliability relies on the assumption that the phenomenon being measured remains the same between measurements. For the RSPWC this has the implication that as technology progresses and pharmacy practice changes the tool will need to be recalibrated – it will not be a one-time process. This reflects the opinion expressed by Gorin(98) on the need for ongoing re-validation.

In summary the validation of the RSPWC needed to be multifaceted. Some elements have already been partly achieved i.e. face and concurrent validity, others needed to be confirmed during the progress of the study. Predictive validity was enhanced by identifying the 'unavailable' time inherent in the employment of staff. Content and construct validity was confirmed through the generation of consensus on the tasks, times and frequency that

drive the tool. Internal reliability was documented and reliability was achieved by assessing the utilisation of the tool by study participants. External reliability requires longer term evaluation and was not addressed in this study.

4.5 Questionnaires and interviews

It has already been identified that, to achieve validation of the RSPWC, consensus will need to be developed on the form of the phenomenon of delivering pharmaceutical care. We have established that this phenomenon does not exist as one finite reality, but is dependent on the opinions, experience and setting of individual practitioners. The epistemology of this suggests that data on this subject can only be collected from these individual practitioners i.e. you have to ask them. The Delphi technique has been identified as an appropriate approach for establishing consensus in this field of research and its use requires the construction and delivery of an effective questionnaire. Consideration must be given to the various theoretical elements which lead to the development of a robust data collection tool. Finally, it is recognised(21,22) that there is substantial variation in practice and therefore opinion on this subject and a qualitative approach to capturing this breadth of data needs to be included in the study plan. This section explores the methodology behind the development of quantitative questionnaires and the exploratory approach of qualitative interviews.

4.5.1. Questionnaire design

For the Delphi approach a self-completed questionnaire is required, as opposed to a researcher-administered tool. The construction of an effective questionnaire is crucial to the successful delivery of research using this technique. It is acknowledged that three types of problems may be experienced in the completion of questionnaires(102):

- That respondents do not understand the question being asked of them
- That respondents interpret and therefore answer the question from their own perspective
- That the respondents experience difficulty in remembering the answers to questions if drawing on factual knowledge

It is therefore the researcher's responsibility and challenge to manage these problems and this can be achieved if a number of fundamental rules are obeyed(103)

- The language used should be non-technical
- Individual questions should be unambiguous
- Answers need to be unambiguous and so the researcher needs to consider the possible responses that will be made
- Answers to questions should not be mixed – factual response and opinions need to be separated for data analysis purposes
- It should be clear what requires answers from a participant and how they should respond
- A participant should be able to respond to all elements of the questionnaire

When conducting data collection using questionnaires the researcher needs to be aware of various forms of bias which might limit the quality or reliability of the data. Individual responses are personal and as such will be affected by the social context in which they are being given. Respondents may answer in a certain way to achieve their own personal outcome. Examples include the desire to be socially accepted, to appear to conform, to avoid being seen as extreme and take the middle ground(104).

Researchers may generate bias by asking leading or presumptive questions. Finally the process of research might generate its own bias. Respondents may rate items according to

their general rather than specific perceptions, they may fall into a pattern of answers e.g. always tick 'C' or demonstrate 'yea-saying' or always agreeing with a statement. Steps must be taken to limit bias in questionnaire design or identify and acknowledge its impact when it does occur(105).

When conducting a study using a questionnaire effort must be made to maximize the response rate and a number of considerations should be made. The method of initial approach, receipt of the form, length and layout of the questionnaire, use of open and closed questions and clear instruction for completion should all be considered. The questionnaire should flow and similar questions, both in style and content, should be grouped together, with transitions statements between sections(106). The length of questionnaire is dependent on the nature of the subject being explored and the intended recipients. Commentators within Sim and Wright(107) suggested that if the topic is of direct relevance to well informed participants 12-16 pages is not unreasonable, but more general topics to a general population should be limited to 4-6 pages. Consideration should be given to font size and type and pagination. All of these elements will improve the aesthetics of the document and the impression that it generates, and increase the likelihood of completion. However, there is also the need to plan for the follow up of non-responders. It has been suggested(107) that reminders should be accompanied by another copy of the questionnaire to aid response. There is an acknowledgement that response rates are unlikely to be 100% and a response of 60% or more is considered acceptable(107).

The issue of anonymity brings further challenges. Fully anonymous data might result in more honest and complete responses, though this does not allow for contextual analysis of the data and follow up is more difficult as it is not known who has not responded(107). Identifiable data might preclude participation in some settings or generate preconceptions

in the analysis. A balance needs to be struck, dependent on the nature of the study and in topic under investigation. When anonymity from the researcher cannot be assured then confidentiality of any data collected must be.

Consideration should also be given to the analysis of the data that the tool will generate. In some cases questionnaires are pre-coded so that data entry is clear, but this can add to the complexity of the appearance of the tool which might be off-putting to respondents(108). Finally piloting the questionnaire in a small group is essential to identify potential ambiguities or data retrieval challenges that might present in a larger scale delivery(109).

4.5.2. Mixed methods research

Up to this point the approaches to identifying and collecting data on the phenomenon of delivering pharmaceutical care has focused on quantitative measures i.e. counting and measuring. Quantitative research is perhaps still the most common approach in health care research, often driven by the need to prove outcomes i.e. blood pressure reduced by 20% by the use of drug A. However, it is increasingly recognised that qualitative research, which explores social context, motivations and opinions(110) has a valuable place in healthcare research. For example, patients' use of medicines and understanding how their social context might alter the use of the medicine is essential to understanding how that medicine will work in reality rather than laboratory. Moreover it is being increasingly recognised that using 'mixed methods' where both quantitative and qualitative approaches are used within one study is of value. This is a useful technique as it benefits from the strengths of both approaches and can achieve a number of outcomes, including triangulation of data, added depth of knowledge and exploration of deviant or outlying data sets(111,112).

Understanding the utility of the RSPWC in different settings will require qualitative exploration, this is not something that can be measured and, given the 'unwarranted

variation'(21) that is known to exist within health care delivery, there is likely to be outlying data to explore in the course of this study. To that end there is a need to consider the methodological approaches to qualitative research in the context of this work.

4.5.3. Qualitative data collection and analysis

As described above qualitative research explores the 'uncountable' – beliefs, opinions, influences and motivations(110). This can be *explorative*, reviewing previously uncharted knowledge and this type of research cannot follow a predetermined structure and its design is described as *emergent.* The alternate type of qualitative research is *descriptive*, where a framework of knowledge exists and the investigation is adding further detail. Descriptive research in this field is largely structured, sequential and predetermined. It can be conducted quantitatively but benefits from a mixed methods approach because of the ability to triangulated data from different sources, gain depth of knowledge and explore outlying data more fully. Data collection in this particular type of qualitative work is often in the form of 'semi-structured' interviews. An interview 'guide' is prepared in advance and outlines key topics for discussion, but allows the conversation to develop between interviewer and interviewee. This process is, as Sim and Wright quote(113):

> *"not a transfer of information from one person to another but a creation of knowledge and understanding through interaction of researcher and informant"* [Holstein and Gubrum in Sim and Wright 2002, pg 55]

The effective conduct of these interviews, which are perhaps better thought of as conversations with a purpose, requires a skilful researcher. There is a need to balance the active participation of the interviewer with leading the interviewee or dominating the conversation. However, neutrality or indifference are not helpful demeanours, as the key skill is developing a rapport, so participants are comfortable talking. What should be aimed

for is “conscious partiality”(114) i.e. partial identification with the study participants. Specific skills or techniques that need to be employed include(115):

- Active listening
- The use of open-ended questions
- Use of examples to give the participant something tangible to discuss
- Probes to further explore initial answers
- Paraphrasing responses, sometimes incorrectly, to elicit a more robust and detailed confirmation
- Managing of the silences – not necessarily filling them

If the research activity for qualitative studies is usually conversation (though observation is a technique sometime employed), the data which is produced is textual. This can be in the form of verbatim transcripts of recordings of the conversation, hand written field notes or post activity reflections. These however require management and analysis if they are to be distilled into new understanding, knowledge or theories – they require *content analysis.*

This content analysis can be ‘inductive’ – the categories and themes that are generated come from the data – ‘constant comparison’(116) or ‘thematic content analysis’ are techniques employed to achieve this. Alternatively the analysis can be ‘deductive’, whereby some categories are pre-determined before data collection and then applied to the data set. The latter is more readily applied to descriptive studies and one technique which is growing in its popularity, particularly in the field of applied healthcare and policy research is that of ‘framework analysis’(117). It is useful when objectives have been set in advance and are being shaped by the information requirements. It has applications when timescales are short and can be used to link to quantitative data. Gale *et al.*(117) identify its value in mixed

method studies and it's accessibility as a technique for non-specialist qualitative researchers.

Pope, Ziebland and Mays(118) describe five stages of analysis using the framework approach.

- *Familiarisation* – this requires the researcher to immerse themselves in the data, by reading and re-reading transcripts and listening to recordings, adding reflections and comments to the data in the process
- *Identification of the thematic framework* – this is based on the aims and objectives which are pre-determined and added to by the familiarization with the data which may generate additional, unconsidered issues
- *Indexing* – the data is coded against the identified framework
- *Charting* – the data is rearranged into a structured grid or 'framework' so that it can be seen in one place and in relative context
- *Mapping and interpretation* – the data in the framework is analysed to define concepts and map the range of the issues that have emerged.

This analysis often runs concurrently with data collection (unlike quantitative research when analysis is more often held until all data has been collected). This results in findings in the early part of the study informing future data collection, directing enquiry to develop themes and ideas that have begun to emerge that might not have been predicted. It is therefore a reflexive process, which is discussed in more detail in the next section.

How much data to collect is a question that is more difficult to answer in the field of qualitative research than in quantitative work, as in the latter sample sizes are often determined by the need to adequately 'power' the research for effective use of inferential statistics and probabilities. It is usual to continue data collection until 'data saturation' is

reached i.e. that no new themes or ideas are being generated in the conversations. Sometimes the availability of the population being studied will define the sample size. The analysis then has to convey the population context of the findings – the 'generalisabilty' of qualitative data is not a key consideration of the technique, of greater value is the deeper understanding of specific perspectives.

Qualitative research has a number of limitations that need to be acknowledged. Even more so than with questionnaires, the data produced is socially contingent. What the participant says will be influenced by environment, prior experience, opinions of the researcher, perspectives or understanding on what it will be used for as well as culture and background. It is possible that different data would be collected from the same individual, on the same subject, on different days. This lack of consistent reproducibility is cited as limitation of this type of research, along with the potential for bias to be added by the researcher's own social contingencies, as the output is their 'interpretation' of what someone has said. Mixed methods can help to address this if data can be triangulated by another source or type of data. Studies of this nature are best supervised by an experienced researcher(117,119). The influence of the researcher and their experience and perspective is an important consideration in qualitative research and is discussed further in the next section.

4.6 Reflexivity in service development research

It could be argued that the personal, social, educational background and experience of a researcher are factors that may influence the manner in which they approach a research question and their chosen methodologies may impact on the outcomes they measure, even if the subject matter and methods employed are purely science-based, objective measurements of a phenomenon. All researchers should be aware of this social

contingency in their work and either embrace it for the richness that it will bring to the data, or mitigate against it confounding their objective results. This is reflexivity i.e

> *"..taking account of itself or of the effect of the personality or presence of the researcher on what is being investigated.."* [Oxford Dictionaries 2017](120)

The recognition of the need for researchers to become reflexive in their practice is a relatively recent development. Rather than ignoring or denying the social contingency of research, the reflexive researcher embraces it and explores its impact to gain greater breadth and insight in to the phenomena they are considering. As Sim and Wright quote Tindall in their explanation of reflexivity(121), that it:

> *'centralises, rather than marginalise or denies, the influence of the researcher's life on the research and construction of knowledge'* [Tindall in Sim and Wright; 2002 pg147]

Reflexivity recognises the value of applying knowledge and experience gained in one element of the research in shaping its future progress and that in doing so greater richness of knowledge is achieved. Actively employing reflexivity within a study requires a number of considerations which are outlined below.

Greenaway suggests that reflexivity allows different 'voices' within a study to be heard(122). The researcher needs to consider what 'voices' are participating in a study and the implications of ensuring they are all 'heard'. For example these 'voices' will include the participants, the practitioners, the organisations which are being studied or who are funding the work in addition to that of the researcher. Capturing this 'speech' within the text of a report is important, though Wilkie(123) cautions that in writing reflexively about their place within the study a researcher risks only their 'voice' being heard.

Reflexivity is particularly relevant to research related to service development. In contrast to pure scientific research, where external influences have to be excluded or controlled, service development is often an iterative process which aligns strongly with the concept of reflexivity. The development of the RSPWC has itself been an iterative process, grown through trial, evaluation and modification. Its validation requires the generation of consensus amongst peers and the use of Delphi as a technique for achieving this is again iterative and so reflexive in nature. The inclusion of a qualitative element at the end of this study was therefore the natural part of this approach and which allowed examination of the social and political context of healthcare delivery and workforce requirements. The reflexive approach taken in this study is discussed in Chapter 9.

4.7 Summary of methodology

There are accepted approaches to workforce calculations. One of these is the WISN approach and the construction of the RSPWC follows these principles. The tasks, times and frequencies (service standard) need to be agreed and consensus amongst experts is required to achieve this.

A reactive Delphi approach has been demonstrated as appropriate to develop the consensus in this field and the tool will be adapted in the light of that consensus.

The applicability of the RSPWC to other settings needs to be confirmed. The tool needs to be validated. The study has to demonstrate as many forms of validity as possible and these will be identified using the approaches identified in Table 4.2.

Table 4.2 Validation activities for the RSPWC

Type of validity	How this will be demonstrated
Face	Already achieved through peer review at conference
Content	Consensus from profession on what constitutes delivery of pharmaceutical care
Criterion (concurrent)	Comparison with NHS Benchmarking
Construct	Comparison with evidence in literature. Consensus on tasks, times and frequencies
Internal	Detailed explanation of the construction of the tool and confirmation of the accuracy of its mathematical calculations

5. Feasibility Study

Through the previous chapters it has been identified that an appropriate approach to the validation of the RSPWC requires the establishment of consensus amongst pharmacy managers on the tasks required to deliver pharmaceutical care, how long these take and the frequency with which they are done. The data on these issues, which initially drove the RSPWC were collected as part of a local time and motion study at the Royal Stoke University Hospital in 2009(12). What was unknown was whether pharmacy managers at other hospitals would be able to provide either local data or experienced 'best guess' estimates on this subject to facilitate the generation of a consensus on the subject. In addition, it was necessary to explore the 'unavailable time' inherent in the employment of different grades of staff and to understand what resources managers would request for different scenarios. Collecting data for these different elements required the administration of a detailed questionnaire and it was considered necessary to establish the feasibility of this approach prior to commencing the full research project (see 4.5.1).

5.1 Feasibility Study Aim and Objectives

The aim of this initial or 'feasibility' study was to establish whether it was possible to collect appropriate data to validate the tasks and timings of the RSPWC by the use of a questionnaire based survey. Specific objectives were as follows:

1. To design a questionnaire to capture data relating to tasks, timings, resource requirements and 'unavailable' time in the delivery of pharmaceutical care

2. To distribute the questionnaire to a small number of participants to establish if the data is available for this to be adequately completed and to understand the operational and governance challenges that may present in completing it.
3. To identify additional tasks that are not routinely completed at RSUH and therefore not captured by the RSPWC.
4. To identify 'unavailable' time that exists in the employment of different grades of pharmacy staff.

5.2 Feasibility Study Methods

5.2.1. Ethics and research approval

This was sought and received from the Keele School of Pharmacy Research Ethics and Governance Committee and UHNM Trust Research and Development (R&D) department. The project was registered with UHNM audit department as per R&D advice and subsequently with the audit departments of participating Trusts, again as per R&D advice. NHS ethics approval was not required.

5.2.2. Questionnaire design

The questionnaire design followed the guidance identified in the methodology (see section 4.5.1). The questionnaire was limited to 6 pages(107,124), with clear instruction for completion(124). Transition statements were included between sections to guide the respondent through the process(124). Each section was contained on a single page and all technical language that was essential was clearly defined. The content of the questionnaire was divided into four sections (see Appendix 3).

Section 1 – Identification of tasks and times

This related to the tasks performed for the delivery of pharmaceutical care. The tasks identified in the RSPWC were converted into a questionnaire with participants requested to identify if their staff routinely complete the tasks identified. If so, how long it takes for these to be completed, by which staff group and the frequency with which they did so in normal practice. It was also explored if this was guided by local standard operating procedure (SOP) or personal practice. To establish if this was the full extent of the phenomenon, participants were given the opportunity to identify additional tasks routinely completed by their staff along with the same details relating to staff group, time and frequency.

Section 2 – Scenario based resource requirements

This asked the participant to identify the resource they would request for the delivery of pharmaceutical care in a number of scenarios and the issues they would take into consideration. These scenarios are shown in Figure 5.1 and are representative of real-life situations in which the RSPWC has previously been applied.

Figure 5.1 Staffing scenarios presented in feasibility study questionnaire

Scenario 1:	A new medical ward is planned to open. This will have 28 beds and an average length of stay of 5 days. You have to identify the pharmacy staff (WTE) required to deliver your standard ward based service.
Scenario 2:	An existing 28 bed medical ward with average length of stay of 4 days is being converted to a short stay (48 hour) unit. What impact will this have on your pharmacy service and what if any additional staff would you request?

Section 3 – Identification of 'unavailable time'

Here the participant was asked to identify the 'unavailable time' associated with employing various grades of pharmacy staff. Examples of this were given; including travel time between departments, mandatory training, professional training, meetings, rest time and other participants had opportunity to add other issues they wished to identify. Unavailable time for annual leave and sickness absence were not included as these are already identified in Agenda for Change(76) This was a key element included in both WISN(23) and the Australian study(40) (see section 2.3 and 2.5) but had not been considered in the RSPWC in its initial development. This needs to be addressed for the tool to generate a resource which is sufficient across a full year, allowing for expected absences.

Section 4 – Demographics

Finally participants were asked to identify the nature and size of their organisation and any speciality services it provides. This was included to allow analysis of the influence that organisational differences may generate. No site identifiable data was collected in this document.

5.2.3. Participant identification and project registration

For the purposes of the feasibility study an invitation to participate in the evaluation of the RSPWC was issued through a United Kingdom Clinical Pharmacy Association (UKCPA) online forum. When pharmacy managers responded and volunteered to participate, the relevant Trust Audit Department was contacted to register the project at the individual Trust and gain permission for participation in the study.

5.2.4. Questionnaire distribution

Once authorisation from the individual trust was received, the pharmacy manager was sent, by email, a participant information sheet (Appendix 4), consent form (Appendix 5) and questionnaire (Appendix 3) and asked to complete the information and return the data by email in a 2-week timeframe. Those not returned in this timeframe were sent a polite reminder with a second copy of the paperwork attached. A third and final reminder was sent if necessary.

5.2.5. Data analysis

Returned data was entered into a bespoke Microsoft Excel® spreadsheet which allowed data to be filtered by category for ease of analysis. A study register was established which identified to the researcher the site name and key contact details. However, each participant site was allocated a consecutive number and the data recorded was anonymised to all but the researcher, by the use of this number in all further documentation. Data was analysed using descriptive statistics.

5.3 Feasibility study results

5.3.1. Data return and quality

From the original invitation to participate in the study, responses were received from ten pharmacy departments. Two of these expressed interest in the project but were unable to participate in the feasibility study due to current work commitments that precluded data return within the required timeframe for the study completion. Authorisation from the relevant Trust audit departments was requested for the eight remaining departments. This was received in a timely manner from six sites and study documentation issued to the pharmacy personnel. Of these authorised sites, data from five sites was returned, analysed and is presented below. From the remaining site no data was returned for analysis at this

stage, despite several reminder emails. Finally, Trust authorisation was not received from the last two sites who had agreed to participate and so they were excluded. The pharmacy managers involved were informed of progress difficulties.

From the sites who returned data, fully-completed questionnaires were received from four sites and the fifth only completed data relating to clinical service activity and some demographic details, they omitted data relating to unavailable time and resource requests for the scenarios.

5.3.2. Demographics

All respondent sites were teaching hospitals, one was in New Zealand (this is discussed in detail in the limitations of the study, see section 9.4.1) and the other four were from England. Size of Trust ranged from 246 to 2600 beds. Staffing levels ranged from 9 to 160 pharmacists and 7 to 150 technicians. The specialities provided by the participant sites were largely similar, including the full range identified in the questionnaire. Not all sites provided neurology/neurosurgery, long stay elderly or cardiac surgery. The expression 'T&O', the abbreviation used at RSUH for 'Trauma and Orthopaedics', was not recognised by one participant and so the full term will be used in future versions of the questionnaire. As such, this data demonstrates that different-sized and resourced sites participated in the project but that this small feasibility study did not included specialist units such as mental health trusts or community health care units.

5.3.3. Pharmaceutical care tasks

Data relating to the routine completion of the pharmaceutical care tasks demonstrated that the clinical tasks included in the RSPWC were common to all sites. Dispensary task data was available from four sites and this was largely similar, with the exception of the 'tracking in' task which was not routinely completed in all sites.

5.3.4. Time required to complete tasks and frequency with which performed

A range of timings existed for many of the reported tasks and are displayed in Table 5.1. Some of these were based on existing local data, some collected for the purposes of the study and the rest were the 'best guess' of the pharmacy manager. For MR the reported range of 10-20 minutes reflects that found in the literature but a larger sample is needed to understand whether the extremes fall within an acceptable range. Dispensary tasks timings were variable and the values in the RSPWC were at odds with those reported by other sites (see highlighted rows in Table 5.1). This largely related to non-comparable data sets generated by the questionnaire. This was addressed in the main study. For other tasks, timings and frequency of completion by staff groups were similar to the RSPWC.

Table 5.1 Feasibility study task timing results

Pharmacy tasks included in RSPWC	Participant Sites					
	RSPWC	A	B	C	D	E
	TIME TAKEN (minutes)					
Medicines Reconciliation (pharmacist confirmed and signed off)	10	10	15	20	10	10
Check of PODs	5	7	7	10	5	5
Clinical Review of Notes	5	5	5	3.5	NK	5
Review of Blood results	1	3	3	3.5	NK	1
Initial review of Drug Chart	5	3	3	2.5	5	5
Initial endorsing of Drug Chart	2	5	4	1	5	2
Subsequent review of Drug Chart	2	1	2	3	5	2
Subsequent endorsing of Drug Chart	0.5	1	2	2	3	1
Completion of Paperwork	2	1	NK	0	NK	3
Ordering of Non Stocks	2	0	5	2	NK	2
Clinical Check of TTO	5	5	5	3	17	5
Talking to patient about their medicines	5	5	10	1	NK	5
Making interventions on patient care	5	10	5	2	10	5
Booking on to tracker system	2.5	0.5	NR	NR	1	N/A
Dispensing	20	3	4	NR	NK	5
Checking	8	2	3	NR	NK	5
Booking onto tracker system	2.5	0	NR	NR	1	1
Triage (Clinical Check)	5	0	5	NR	17	5
Dispensing	20	10 - 15	7	NR	NK	5-10
Checking	8	3	5	NR	NK	5-10

Key: NR= not reported NK=not known

Table 5.2 shows the frequency with which each of the tasks was reported to be completed and whether this was determined by local SOP or personal practice; for some tasks this was not reported. It can be seen that for many of the tasks the frequencies are broadly similar across the sites and on the whole was guided by local SOPs. Where 'variable' or 'daily' frequency timings were reported conversion to a numerical value is needed for application of the calculator to the service data.

Table 5.2 Feasibility study task frequency results

Pharmacy tasks included in RSPWC	RSPWC	A	B	C	D	E	RSPWC	A	B	C	D	E
	Frequency task completed/admission						Frequency determined by?					
Medicines Reconciliation (pharmacy confirmed and signed off)	1	1	1	1	1	1	SOP	NR	SOP	SOP	SOP	SOP
Check of PODs	2	1	1	2	1	1	SOP	NR	SOP	SOP	SOP	SOP
Clinical Review of Notes	2	3 to 5	3	variable	3	1	SOP	NR	SOP	PP	PP	SOP
Review of Blood results	2	3 to 5	daily	variable	3	2	SOP	NR	SOP	PP	PP	SOP
Initial review of Drug Chart	1	1	1	1	1	1	SOP	NR	SOP	SOP	SOP	SOP
Initial endorsing of Drug Chart	1	1	1	1	1	1	SOP	NR	SOP	SOP	SOP	SOP
Subsequent review of Drug Chart	2	3 to 5	daily	daily	2	1	SOP	NR	SOP	SOP	SOP	SOP
Subsequent endorsing of Drug Chart	2	3 to 5	daily	daily	2	1	SOP	NR	SOP	SOP	SOP	SOP
Completion of Paperwork	2	3 to 5	2		NK	1	SOP	NR	PP	SOP	NK	SOP
Ordering of Non Stocks	2	3 to 5	3	1	2	1	SOP	NR	SOP	SOP	SOP	SOP
Clinical Check of TTO	1	1	1	1	1	1	SOP	NR	SOP	SOP	SOP	SOP
Talking to patient about their medicines	1	3 to 5	variable	2	1	3 TO 5	SOP	NR	PP	SOP	PP	SOP
Making interventions on patient care	1	3	variable	variable	2	1	SOP	NR	SOP	SOP	PP	SOP
Booking on to tracker system	1	1		NR	2	N/A	SOP	NR	NR	NR	SOP	SOP
Dispensing	1	1	2 to 3	NR	2	1	SOP	NR	SOP	NR	SOP	SOP
Checking	1	1	2 to 3	NR	2	1	SOP	NR	SOP	NR	SOP	SOP
Booking onto tracker system	1	0	NA	NR	1	1	SOP	NR	NR	NR	SOP	SOP
Triage (Clinical Check)	1	0	1 to 2	NR	1	1	SOP	NR	SOP	NR	SOP	SOP
Dispensing	1	3	1 to 2	NR	1	1	SOP	NR	SOP	NR	SOP	SOP
Checking	1	2	1 to 2	NR	1	1	SOP	NR	SOP	NR	SOP	SOP

Key: NR=not reported SOP=standard operating procedure PP=personal practice

5.3.5. Additional tasks identified

Data was provided by two sites for additional tasks routinely performed by their staff when delivering pharmaceutical care. This demonstrated an average additional 33 minutes of care that was not incorporated into the RSPWC. Moreover there was one activity identified in both responses (the writing of the discharge prescription, either electronically or manually) which may need to be incorporated into the tool. This requires further investigation in a larger sample size to determine whether this is an activity which is commonly conducted across many sites or maybe limited to a small number of sites with pharmacist prescribers and therefore not generalisable to the whole country.

5.3.6. Resource scenarios

Table 5.3 shows the resource requested for Scenario 1 ranged from £25.5k to £150k and for Scenario 2 the range requested was £0 to £85.5k (see Table 5.3). This represents a substantial variation in staffing requested across the study population, given that the roles these staff will be expected to carry out were described very similarly in the first part of the results.

Table 5.3 Feasibility study resource requested for staffing scenarios

Staffing scenarios	Participant Sites					
	RSPWC	A (£/annum)	B (£/annum)	C	D (£/annum)	E (£/annum)
Scenario 1	£68,359.00	£150,000	£0	No data supplied	£34,057	£25,431
Scenario 2	£85,449	£0	£0		£0	£3,547

5.3.7. 'Unavailable' time

Participants were asked to identify 'unavailable' time that is inherent in the employment of staff. Pre-identified examples listed in the questionnaire included travelling time from department to ward, mandatory training, professional training, meetings. Sites were asked to identify time taken by different grades of staff to fulfil these duties and identify any others that applied. Data was returned from three sites (A, B & D) and compared to that for RSUH. Table 5.4 shows that on average 0.25 WTE pharmacists and 0.2WTE technical staff is absorbed through annual leave and non-operational activities.

Table 5.4 Feasibility study 'unavailable time' results

AfC grade	Site	Non-operational activities 'unavailable time' (minutes)											
		Travel (mins/ week)	Mandatory training (mins/ week)	Professional training(mins /week)	Meetings(mins/ week)	Rest Time	Other	Total Additional time(mins)/ week	Total Additional time(hrs)/ week	Non-operational employment time (WTE)	Annual leave (WTE)	Total	Average
8a	A	100	7.5	100	90	0	17.3	314.8	5.2	0.14	0.1	0.24	0.28
	B	150	1.25	30	300	0	0	481.3	8.0	0.21	0.1	0.31	
	D	100	14	30	400	0	0	544.0	9.1	0.24	0.1	0.34	
	RSUH	100	7.3	17	120	0	0	244.3	4.1	0.11	0.1	0.21	
7	A	150	7.5	50	60	0	17.3	284.8	4.7	0.13	0.1	0.23	0.23
	B	150	1.25	60	200	0	0	411.3	6.9	0.18	0.1	0.28	
	D	50	14	90	120	0	0	274.0	4.6	0.12	0.1	0.22	
	RSUH	150	8.4	17	60	0	0	235.4	3.9	0.10	0.1	0.20	
6	A	150	7.5	100	60	7.5	2	327.0	5.5	0.15	0.1	0.25	0.26
	B	150	1.25	120	160	0	0	431.3	7.2	0.19	0.1	0.29	
	D	50	14	90	120	0	0	274.0	4.6	0.12	0.1	0.22	
	RSUH	150	8.4	150	60	0	0	368.4	6.1	0.16	0.1	0.26	
5	A	75	7.5	50	60	0	4	196.5	3.3	0.09	0.1	0.19	0.20
	B	300	1.25	0	30	0	0	331.3	5.5	0.15	0.1	0.25	
	D	100	14	30	60	0	0	204.0	3.4	0.09	0.1	0.19	
	RSUH	150	7.3	0	45	0	0	202.3	3.4	0.09	0.1	0.19	
4	A	75	7.5	50	60	0	4	196.5	3.3	0.09	0.1	0.19	0.20
	B	300	1.25	0	30	0	0	331.3	5.5	0.15	0.1	0.25	
	D	100		30	30	0	0	160.0	2.7	0.07	0.1	0.17	
	RSUH	150	7.3	0	30	0	0	187.3	3.1	0.08	0.1	0.18	
2&3	A	75	7.5	30	60	0	4	176.5	2.9	0.08	0.1	0.18	0.13
	B	No data for this staff group											
	D	50	0	30	30	0	0	110	1.8	0.05	0.1	0.15	
	RSUH	150	7.3	0	30	0		187.3	3.1	0.08	0.1	0.18	

Key: RSUHNL=Royal Stoke University Hospital WTE=whole time equivalent

5.4 Discussion of feasibility study results

Analysis of the data returned by participant sites suggests that regardless of size of hospital or staffing resource available and the lack of formal guidance as to the delivery of pharmaceutical care, the tasks performed by pharmacy staff to ensure the safe and effective use of medicines maybe consistent and reproducible. Also data is available around how much time each task takes at different hospital sites and for several of the tasks a wide range of times was reported which is reflective of the literature(41,55-57,59,59-61,63,64,66-69).

Additional duties not captured by the RSPWC were identified in this feasibility study. These amounted to around half an hour of extra time required for each patient, which is substantial and so this element needs to be fully understood. Transcribing of discharge medicines on the discharge letter is a task reported by both respondents in this section of the study and one which may need incorporating into the calculator should it generate the same level of consensus as other tasks which are included in the RSPWC. The full range and significance on staff time of duties not included in the RSPWC will be better understood with the larger sample size of the main study. Finally the issue of 'unavailable' time was identified as one that needed to be better understood for the RSPWC to more accurately calculate the resource required to deliver pharmaceutical care.

The results from this study were not intended to demonstrate conclusive findings or establish consensus as participant numbers were too small. The intended outcome was to determine the feasibility of this approach to data collection and this too is relatively limited by the small data set and predominance of teaching hospitals (i.e. it is not possible to identify whether smaller, specialist units are able to complete the questionnaire adequately

enough to establish consensus for their areas of practice). Limitations also result from incomplete data sets, as full comparison of all elements of the service could not be made.

5.5 Implications of this research for the main study

The numbers of participants in this feasibility study were limited, not by the enthusiasm of the pharmacy departments, but by the process of registering the study with the relevant body in each Trust. The nature of the project meant that it does not sit comfortably within 'audit' and therefore some audit departments were not happy to approve as it was not in their remit, so passed responsibility on to someone else, until eventually someone was prepared to give approval. This generated an inherent delay in the study timeframe and was discussed at length with the R&D team at RSUH prior to the main study, to explore the level of registration required to meet R&D governance standards, whilst not creating unnecessary barriers for participation. The decision reached by the R&D manager was that the project should be considered 'service development' and not audit, thereby removing the need for the involvement of audit and research departments at other sites.

Another issue was that return of the questionnaires from the participants was slow and did not meet the initial 2-week deadline in most cases. Questionnaire return is an inherent problem in this type of research(107) and this might limit data collection in the main study. A robust reminder process was therefore incorporated in to the main study design.

For both clinical and dispensary tasks further clarity on units and denominators was required in the main study to allow reliable comparison between sites. In relation to clinical activity some sites did not put a figure to the frequency, but simply said 'daily' or 'variable'. 'Daily' can be translated into figures by multiplying by average length of stay (LOS) of patients, but 'variable' requires interpretation, which may be incorrect.

Consideration needed to be given as to whether the questionnaire needed to be more explicit, whether further comment would be requested if a figure is not reported or whether this would be done informally through follow up with the participant or in the qualitative stage of the study. A balance needed to be struck between data clarity and questionnaire complexity, to avoid a detrimental effect on the volume of data returned.

For dispensing activities in the RSPWC these figures were constructed from an average time to complete the dispensing tasks for each patient at RSUH. This is driven by the number of factors within the medicines supply process, which may differ between sites and therefore result in non-comparable data sets. To address this in the main study, data at a more granular level were requested, which included dispensing and checking times *per item,* the average number of items on an inpatient prescription and questions relating to the types of medicines dispensed and the level of automation existing in the process.

This 'unavailable time' element is required to bring the RSPWC in line with the WISN formula(23) and data from this feasibility study suggested that this is a substantial part of any whole time equivalent (WTE) hours. Identifying consensus on this element was important for the main study as without it services will always be under-resourced. The risks associated with inclusion of it in any final version of the tool also needed to be considered. On the basis of this early data it is suggested that for every WTE post funded through application of the calculator, the funds requested will have to be increased by another 25% to account for the 'unavailable' time, substantially increasing the value of staffing resource identified. .

Finally, consideration was given prior to the main study to the statistical analysis of data generated. These are described later in the Main Study Methods section.

5.6 Summary of findings from the feasibility study

The development of a workforce calculator tool required the identification of a consensus on what tasks are required, how often they should be done and how long these take. Data from this feasibility study, suggested that the tasks that drive the RSPWC were routinely completed at other sites and some of the timings were consistent. This reflected the published literature(41,55,56,56,57,59-61,63,64,66-69). A larger sample size was required to determine more robust timings for all activities.

The use of a questionnaire appeared to be an effective method of capturing this data and, with modifications to address identified limitations, could be applied as a first round in a consensus project using Delphi methodology.

Non-operational time inherent in the employment of pharmacy staff is significant and consideration of its incorporation into the RSPWC is essential if the resource the tool calculates is to be sufficient to deliver the defined service.

Changes to the methods used in the main study in light of the findings of the feasibility study are shown in Table 5.5.

Table 5.5 Summary of changes to study methods in response to feasibility study results

Method section	Changes made
Governance	• Removed need for audit department authorisation at each participating Trust
Questionnaire design	• Wording changes for clarity and removal of local abbreviations • Change of approach to capturing dispensing activity times from 'per admission' to 'per item' for improvement in data comparability • Inclusion of questions relating to e-prescribing and automation
Questionnaire distribution and return	• Establishment of a dedicated email address for all study communication • Inclusion of specific follow up process for non-responders
RSPWC development	• Inclusion of 'unavailable time' in algorithm

6. Main study methods

The feasibility study (as described in Chapter 5) informed the methods in the main study. Changes made are described in Table 5.5. For the main study research there were three distinct parts (as shown in Figure 6.1)

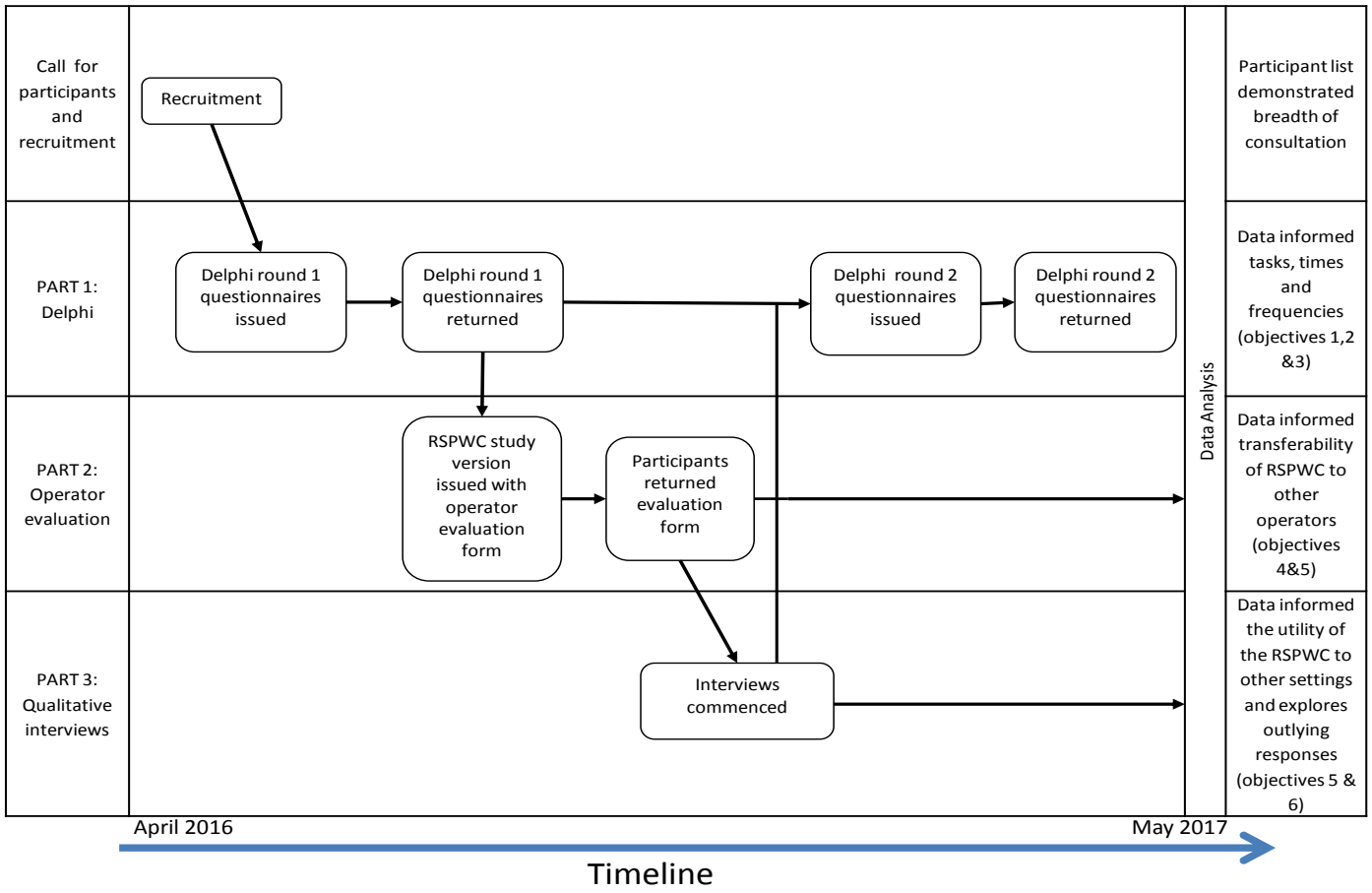
- Part 1: A two round Delphi consensus study to generate agreed tasks, times and frequencies for activities required for the delivery of pharmaceutical care
- Part 2: A scenario-based questionnaire evaluation to understand the transferability of the tool to different operators
- Part 3: a series of semi-structured interviews to further investigate reasons for outlying data and the utility of the RSPWC

The research methods applied to each of these parts will be discussed separately.

6.1 Ethics and NHS Research and Development (R&D) approval

Prior to participant recruitment full applications for approval were submitted to both the Keele University Ethics Review Panel and to University Hospitals of North Midlands (UHNM) R&D for NHS management approval. Copies of all study documentation and planned communication were submitted. The study received University Ethic approval in December 2015 (see Appendix 6) and NHS R&D approval in March 2016. Participant recruitment commenced in April 2016. From the R&D NHS perspective the study was deemed service evaluation and as such required no further NHS research registration.

Figure 6.1 Validation of the RSPWC – project plan



6.2 Study population

6.2.1. Sampling

The methodological considerations on sample size discussed in section 4.3 guided the identification of sample size. For the purposes of this study a 'homogenous' population was defined as 'from the same hospital setting' e.g. acute hospital trust, with distinctions made between district general hospitals (DGH) and teaching hospitals, mental health units and community hospitals. The desired study sample size was identified to be in the region of 10-15 participants from each contributing sector for consensus from within each sector to be achieved. Excessive participant numbers were not anticipated from the responses in the feasibility study and so the 'selection' of participants to form this population was considered unnecessary.

6.2.2. Recruitment

Inclusion criteria for study participants were

- Clinical pharmacy managers currently employed in a hospital setting
- Authorised to participate by their Chief Pharmacist
- Able/willing to complete the questionnaire in the required timeframe as indicated by their email communication following reminder emails.

There were no exclusion criteria in this study.

For the main study, participants were recruited via invitations issued through a number professional network forums (United Kingdom Clinical Pharmacy Association management on-line forum, Royal Pharmaceutical Society hospital pharmacy on-line forums, Chief Pharmacist Regional Network meetings and Clinical Pharmacy Congress) and direct email approach to selected individuals, where specific regional contacts were identified from the

professional forums. These invitations explained the background of the study, the expected requirement of participants and requested that interested parties contact the study investigator by email to register their interest. A dedicated email account was set up to receive and send emails relating to the study.

Participants were informed of their ability to withdraw from the study and assured of the anonymity of their data i.e. no data or direct quotes would be directly attributable to any participant.

6.3 Data collection – Parts 1 and 2

As outlined in Figure 6.1 there were three parts to the main study. Parts 1 and 2 required the design, delivery and analysis of questionnaires and the details of the approach taken in these activities are considered below. Data collection for Part 3 of the study, the qualitative semi-structured interviews, is considered in section 6.4.

6.3.1. Data collection – questionnaire design

Following the feasibility study some changes were made to the questionnaire for the first round Delphi (see Table 5.5). As discussed in the findings of the feasibility study the timings for supply related tasks (dispensing and checking) were very disparate and this was thought to be due to non-comparative data being submitted, caused by imprecise language in the questionnaire e.g. time to dispense a prescription was interpreted as a single item prescription or as multiple items on one prescription. In addition the existence of electronic prescribing and automated dispensing was considered to be a factor in the timings of tasks. These issues were addressed by asking more specific questions in the first round Delphi questionnaire (Appendix 7) of the main study.

The questionnaire complied with core elements of questionnaire design as described in the literature (discussed in section 4.5). The feasibility study acted as a pilot of the questionnaire and modifications were subsequently reviewed by the project supervisor and independent colleagues. Data from the feasibility study was included in the main study results of round one, though the elements relating specifically to the supply timings were not collected from feasibility sites and so data for this section was from a reduced number of participants.

Following receipt and subsequent analysis of the first round data a summary of findings was produced and each participant sent a copy of this compared to their own responses and asked to review and amend their data as they saw fit in light of the results. In addition to the results of the first round, early information identified through the qualitative interviews conducted as Part 3 of the research, identified the need to explore the issue of patient pharmaceutical acuity. This was addressed as part of this second round questionnaire. This process is indicative of the reflexive nature of this work. Guidance from a participant in Part 3 helped to shape the structure of the question asked around the management of an exemplar patient (see Appendix 8).

The design of the Part 2 operator evaluation questionnaire (Appendix 9) also followed guidance from the literature and built on the results of the feasibility study. The scenarios presented for the participants to use the RSPWC to calculate the required resource were the same as in Part 1, questionnaire 1, so as to allow direct comparison of resource requests.

6.3.2. Data collection - process

The data collection for the Parts 1 and 2 of the main study ran in parallel (see Figure 6.1) and followed the steps outlined below.

- On receipt of an expression of interest, each participant was sent a 'Participant Information Sheet' (Appendix 10), a consent form (Appendix 11) and a copy of the Delphi round one questionnaire 1 (Appendix 7) for them to complete and return by email within a four week period.
- Following receipt of all data sets from round one, Questionnaire 2 was issued to all participants. This included a personalised summary of the data, allowing them to compare their data with that submitted by their peers (see Appendix 8). For questions where consensus was not achieved in round one, additional questions were asked to explore these issues further. This related particularly to frequency of completion of tasks, which respondents suggested "depends on the patient". In this second round, patient characteristics which would generate increased pharmacy input were explored and exemplar patient cases were provided for participants to indicate 'typical' service delivery. Participants were asked to review the data and return answers to Questionnaire 2.
- On return of the first round Delphi data set, each participant was sent a copy of the study version of the RSPWC (Appendix 12) and the Operator Evaluation form (Appendix 9) to complete and return.

For each part a reminder email, including a copy of the questionnaire, was sent if the response was not received within the allocated four week time frame, followed by one further contact two weeks later. If no response was received after this point, no further contact was made.

6.3.3. Data collection – administration and analysis

All data was collected electronically via email. This study was planned as a two-round Delphi, with the qualitative stage intended to explore the ongoing outstanding data. On

receipt of completed first round questionnaires, the data was entered into a Microsoft Excel® spreadsheet which was copied into an SPSS® database. Both programmes were used, as each offered different functionality e.g. SPSS® allows easy plotting of distribution graphs which identifies skewed data and outliers more easily, whilst data filters in Microsoft Excel® enables simple subgroup analysis. Data analysis was done using descriptive statistics, as consensus studies do not always generate data suitable for inferential statistical analysis. Guidance on statistical analysis was provided by statisticians working with the Research and Development team at the University Hospitals of North Midlands NHS Trust (UHNM).

The objective of Part 1 of the study was to gain consensus or agreement on the tasks that are required to deliver pharmaceutical care. The establishment of consensus is not well defined, with different authors taking different approaches (see section 4.3)(88,92-95). For the purposes of this study the measure of 'agreement' was determined as the most common response i.e. the 'mode' and this was taken as the measure of consensus for each task, time and frequency. Prior to data collection it was agreed by the research team that consensus should be classified into two levels. 'Strong' consensus was defined by an arbitrary, but substantially, 'greater than 2/3'(88), value of 70% or more of the respondents sharing the same opinion. This data was rated as 'green'. Where that value represented the opinion of 50-69% of respondents, 'moderate' consensus was deemed to be achieved and data was rated as 'amber'. If the mode value represented less than 50% of respondents' views, consensus was deemed to have not been achieved, even if there was plurality in that mode and the data was rated 'red'. This Red/Amber/Green (RAG) rating of the data allows a reviewer to see at a glance the strength of consensus on the details that drive the RSPWC.

Following this first review of the data, a summary was issued to participants along with their own data set for comparison and, if they wished, amendments to their data could be made

at this stage. This second round data was first analysed in the same way. More detailed analysis was done for components where consensus (as defined above) was not achieved. In particular this related to staff groups, where participants had given complex answers including more than one staff group completing an activity. In these cases the staff groups were split out and analysed individually. The RAG rating of the data was adjusted after this second analysis, where evidence for this change could be demonstrated.

In relation to the time a task took, where consensus was not achieved as described above (i.e. >50% agreement with a mode figure) a different approach was taken. The continuous nature of this data meant that consensus was less likely as there were infinite numbers of options. This might have been resolved by grouping data into periods of time 0-4 minutes, 5-9 minutes etc and consensus achieved that way, but the RSPWC requires a discrete number not a range for the algorithm to work and so an alternate approach was taken. The mean time was calculated, using existing local data where provided and triangulated against the mode and median figures. From this a 'national best representative' figure was identified.

At this stage the only remaining outliers related to frequency of a small number of activities and these were explored using the responses to exemplar patient cases and through the qualitative stage of the project. The stability of opinion was also assessed – how much did the views change across the two rounds? This would also indicate if further rounds would be required prior to the qualitative process.

6.4 Semi-structured interviews – Part 3

The qualitative element part of the study, Part 3, was initially designed to explore the utility of the RSPWC in different settings – what were its applications, benefits and limitations During the course of the study it became apparent that this element of the study would also allow exploration of the outlying data sets and issues where consensus had not been achieved.

6.4.1. Sampling and recruitment

Traditionally in qualitative research sample size is dependent on data saturation i.e. when no new themes are being identified(88). The number of participants is not usually predictable and depends on the nature and complexity of the subject being investigated. All participants who remained in the process until the end of the second round Delphi were invited to participate in the qualitative stage of the research. As numbers were low, all volunteers were selected for interview, as each could offer insight into outlying data or areas of non-consensus.

6.4.2. Interview Guide

The interview guide was developed to give insight into issues not covered by the quantitative element of the research and to further explore key themes that arose during the data analysis of the first stage. These included the current challenges they face with respect to staffing, their experience of using the RSPWC and, finally, explored the participant's out-lying data (if appropriate) and their views and opinions on the issues where consensus had not been achieved (see Appendix 13). The core questions were prepared in

advance of the first interview. The reflexive nature of this research allowed these to be modified in subsequent conversations to allow clarification of issues or further exploration of new themes as they emerged. Interviews started with open questions about factual elements of the Trust and Department in which the participants worked. This allowed them to get into the conversation on comfortable subjects and gave context to the rest of the data. Questions were in no fixed order and not all were specified in the interview guide. Minimal prompting was given by the interviewer, allowing the participant to respond in their own words and further questions used to probe or clarify initial answers.

6.4.3. Qualitative data collection and analysis

Conversations were conducted by the principal researcher by telephone or in person, at times pre-arranged by email correspondence. Participants were sent separate participant information sheets and consent forms (Appendices 14 and 15) for the qualitative part of the research prior to commencing the interviews. All interviews were conducted in October and November 2016 and ran concurrently with parts 1 and 2 of the study. These sessions were recorded using a digital recorder and transcribed verbatim by a professional transcribing service. These transcripts were read alongside the recording and further details added where necessary (e.g. where recording quality was poor) by the researcher from notes made at the time of the interview and in post-interview reflections. Following final preparation of transcripts a detailed review of the data was conducted allowing the familiarisation of the researcher with the detail of their contents. Subsequently a thematic framework was developed (as described in section 4.5.3) and the data then coded against this structure. The final step prior to analysis was the charting of the data into a matrix to allow a holistic view of the data and to facilitate the emergence of connected and disparate

themes. The analysis was conducted to extract the key themes and ideas from the data. These gave greater richness to the quantitative data and explanation of non-consensus which informed the final version of the RSPWC. In addition this data gave insight into the application and future developments of the tool.

6.5 Summary of main study methods

A mixed methods approach was taken for this validation study. The research utilised electronically distributed questionnaires and semi-structured interviews. Participants were recruited through professional forums and networking. The results of this study are presented in the following chapter.

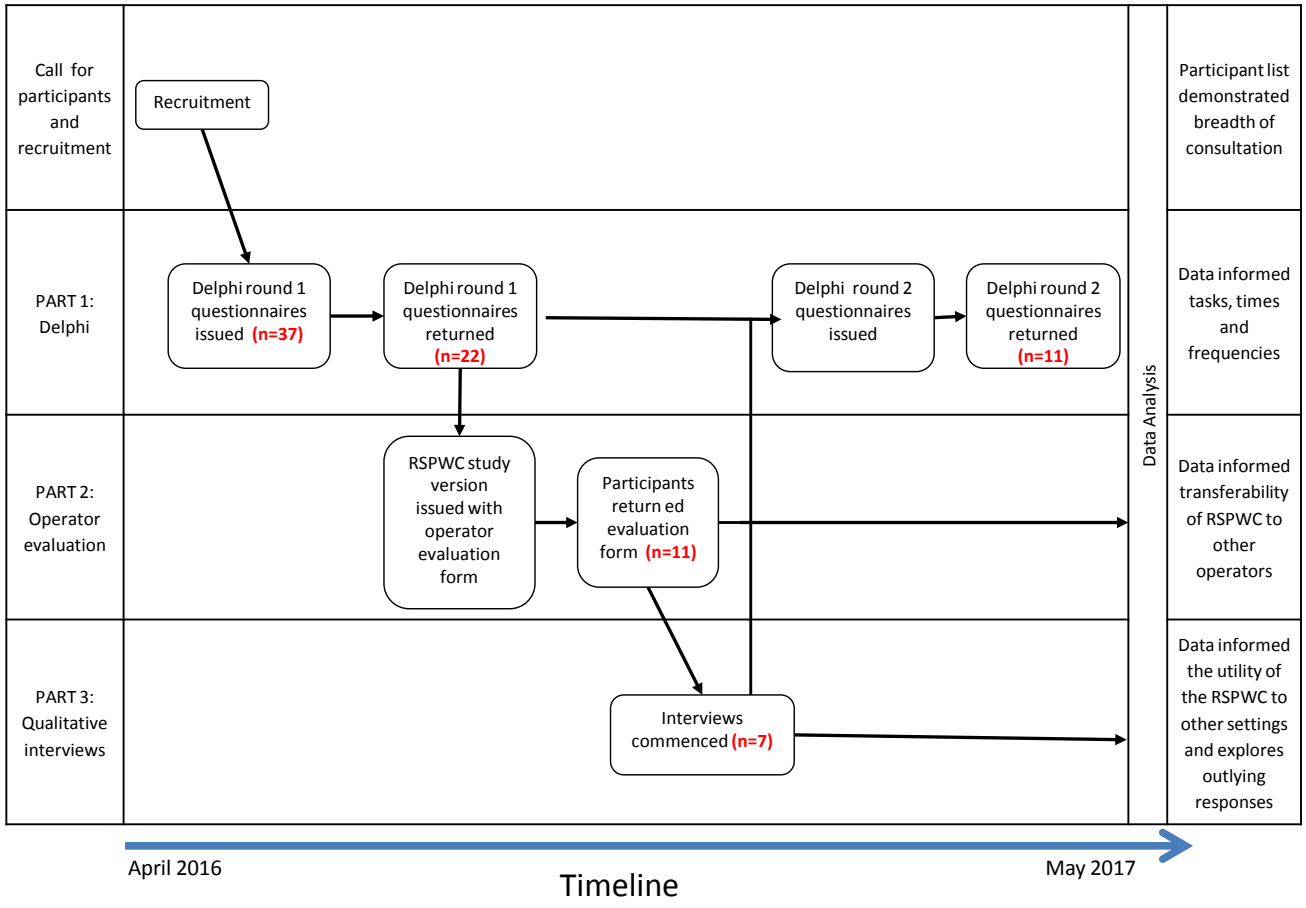
7. Results

The delivery of this study was achieved through three distinct parts. The results of each of these are reported in turn in this chapter. The context for these results is provided first in a summary of study participant demographics.

7.1 Demographics

Through the recruitment process described in Chapter 6, 37 participant sites were identified and sent study documentation and the first round Delphi questionnaire. From this cohort questionnaires were returned by 23 (62%) sites. It is from this sample that all data for this study was received (this includes the participants from the feasibility study as data was comparable). Participating Trusts are listed in Appendix 16. This sample included those sites who had participated in the feasibility study, as data sets were comparable. One site, whilst returning the study documentation was unable to provide data for the study as they felt that their service delivery was so different it did not apply. This is explored in Part 3 results. Another site returned data but the electronic file was corrupted and the participant failed to respond to all requests for a second delivery attempt. Therefore analysable data was returned by 21 sites (57%). Not all sites returned data for all questions and 'n' values are shown throughout. As expected with Delphi studies(88) participation fell away as the study progressed. Study participant numbers in each part of the research are shown in Figure 7.1.

Figure 7.1 Study participant numbers at each part of the study



The consensus and qualitative data that follow need to be considered in the context of the populations from which they were drawn. Demographic details of participant sites are shown in Table 7.1. Of these 21 sites, nine identified themselves as NHS Foundation Trusts and three were tertiary referral centres for a number of specialities. Participants were drawn from across the UK - 17 English hospitals, three Welsh and one Scottish hospital submitted data. No data was submitted from Northern Ireland despite several different approaches to recruitment. Data was received from one non-UK site in New Zealand.

Table 7.1 Participant site demographics (n=21)

Type of setting	Number	
Teaching hospital	11	
District General Hospitals (DGH)	8	
Mental health unit	1	
Intermediate care unit	1	
Size and Staffing	Mean	Range
In-patient beds	1072	190-2096
Pharmacist WTE	51.75	8-160
Technician WTE	43.85	3-129
Assistant Technical Officer (ATO) WTE	25.97	0-69
Beds/Pharmacist	20.72	7.5-38
Beds/Technician	24.46	10-88
Beds/ATO	41.29	16-70

From a sample size perspective, the target of 10-15 for each setting was achieved for teaching hospitals (eleven) but fell just short for DGH sites (eight). Both of these settings deliver acute services for medicine and surgery, so the target was met for “acute hospital sites” (nineteen). Consensus sample size was not achieved for mental health or intermediate care beds.

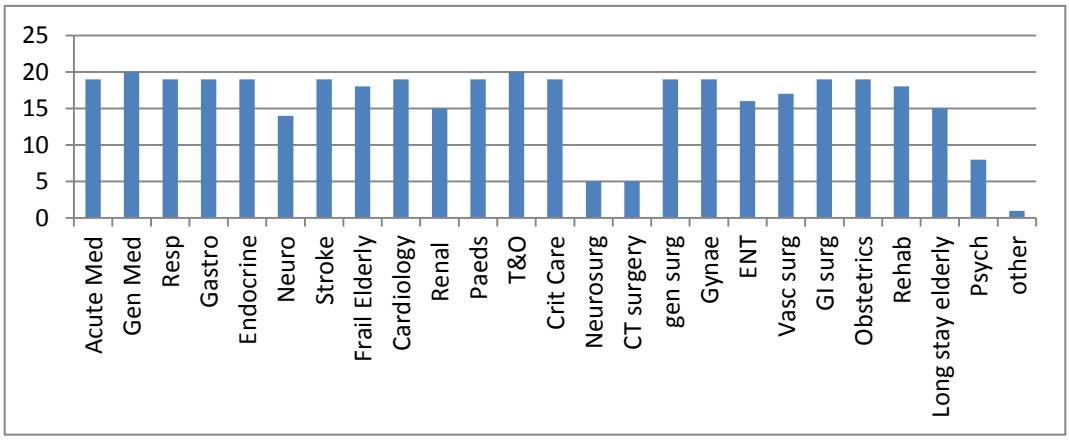
It can be seen that staff group/bed numbers vary widely across participant sites. Sub-group analysis of this by setting (Table 7.2) shows that teaching hospitals have almost double the staffing levels of their DGH counter parts for only a third more beds.

Table 7.2 Sub-group analysis of staffing levels

Type of hospital	Demographics (mean)						
	Beds	Pharmacists	Beds/ Pharmacist	Technicians	Beds/ Technician	ATOs	Beds/ ATO
Teaching Hospitals	1172	74.79	19.56	58.28	32.10	34.30	40.30
DGH	827	37.53	23.66	33.99	25.90	28.82	34.54
Study population mean	1072	51.75	20.72	43.85	24.46	25.97	41.29

Figure 7.2 displays the medical/surgical specialities delivered by the participant Trusts. It can be seen that patient groups cared for by pharmacy staff at participant sites are largely consistent across the study population, with the exception of neurology, neurosurgery and cardiothoracic surgical specialities.

Figure 7.2 Speciality services delivered by participant sites



This demographic data suggests that similar patient groups are cared for across all participant sites.

7.2 Part 1: Delphi Round 1 (Questionnaire 1 results)

The responses from the first round Delphi questionnaire began to form the consensus on the tasks, times and frequencies that drive the calculations in the RSPWC and gathered data on other elements of the service and staffing issues.

7.2.1. Round 1: Consensus on tasks, times, frequency & staff groups

These are the figures which drive the algorithm that calculates the staff resource generated by the RSPWC and the first round Delphi explored consensus amongst the participant group on these issues. The first level of analysis was a face value review of the level of consensus achieved in this data set.

For each component task the percentage agreement with the mode response was identified and the level of consensus RAG rated as described in the methods (R<50% agreement, A 50-69% agreement, G>70% agreement.) Table 7.3 identifies the level of consensus achieved in round one for the clinical tasks associated with the delivery of pharmaceutical care to hospital inpatients.

This data demonstrates that consensus was achieved in round one on 33 of 52 (63%) data sets which drive the RSPWC. 'Green' data was considered complete and required no further validation (unless RAG rating changed in second round). The amber and red data was further explored in round two of the Delphi and parts 2 and 3 of the study.

Table 7.3 Delphi round 1 result on tasks, times and frequency (clinical duties)

Direct patient care activities completed for each patient admission	% Agreement with task necessity n=21	Staff group required to deliver task. Mode response (%) n= 21	Mean time task takes in minutes. Mode response (% and range)	Frequency which task should be done for each patient admission. Mode response (% agreement & range)
Medicines Reconciliation (pharmacy confirmed and signed off)	100	P / MMT = 81%	n= 21 10 (29%) & 20 (29%) 6-30	n=21 1(85%) 1-2
Check of Patients Own Drugs (PODs)	95	P/MMT= 43% MMT= 48%	n=17 5 (58%) 4-15	n=20 1(65%) 1-2
Clinical Review of Notes	90	P=81%	n=18 5 (66%) 2-10	n=20 "Depends" (45%) Daily - 7
Review of Blood results	90	P=81%	n=17 5 (35%) 1-5	n=19 "Depends" (52%) Depends-3
Initial review of Drug Chart	100	P=38% P/MMT=57 %	n=18 5 (50%) 2-5	n=19 1 (79%) Depends-1
Initial endorsing of Drug Chart	95	P=43% P/MMT=48 %	n=17 5 (40%) 1-10	n=17 1 (82%) Depends-1
Subsequent review of Drug Chart	95	P=33% P/MMT=57 %	n=17 5 (41%) 1-5	n=18 "Depends" (44%) Depends-Daily
Subsequent endorsing of Drug Chart	90	P=38% P/MMT=47 %	n=17 2 (30%) 0-5	n=17 "Depends" (41%) Depends-daily
Completion of Paperwork (Pharmacy handover/care plans etc)	86	P=14% P/MMT=47 % MMT=5%	n=9 5 (66%) 1-5	n=11 "Depends" (27%) Depends-Daily
Ordering of Non Stocks	90	P/MMT=43 % MMT=29%	n=16 5 (44%) 1-5	n=17 "Depends" (47%) Depends-3
Clinical Check of Discharge prescription	100	P=76%	n=21 5 38%) 2-17	n=21 1 (100%)
Talking to patient about their medicines	95	P/MMT=81 %	n=17 5 (47%) 1-15	n=17 1 (40%) Depends-2
Making interventions on patient care	100	P=33% P/MMT =67%	n=16 5 (56%) 1-10	n=19 "Depends" (57%) Depends-Daily

Key: P=pharmacist MMT=medicines management technician PODs=patient's own drugs
P/MMT = pharmacists or MMTs "depends"=depends on patient characteristics

Four sites identified the use of electronic prescription and medicines administration systems (ePMA). The impact of this application of IT in terms of task times was considered and is shown in Table 7.4 though the limitation of a small sample size needs to be recognised.

Table 7.4 Comparison of task times between ePMA and non-ePMA sites

	Mean time task takes (minutes)								
ePMA	Medicines Reconciliation	Review of notes	Review of bloods	Initial review of drug chart	Initial endorsing of drug chart	Subsequent review of drug chart	Subsequent endorsing of drug chart	Ordering of non-stock items	Clinical check of TTOs
Yes (n=4)	19.50	5.50	3.75	9.00	6.00	3.75	2.00	3.50	10.75
No (n=7)	29.17	5.00	3.33	5.50	4.00	3.33	2.33	3.33	7.00
Limited (n=1)	30.00	5.00	5.00	5.00	2.00	5.00	5.00	5.00	15.00
Not reported (n=8)	13.63	4.29	2.43	5.00	3.29	3.00	2.13	3.29	7.00
Study mean	20.63	4.81	3.13	6.13	3.93	3.38	2.33	3.47	8.21

This data would suggest that MR activities are quicker with ePMA but chart review – whether in-patient or TTO appears to take longer

7.2.2. Round 1: consensus on tasks and timings for dispensary tasks

The dispensary tasks required for service delivery were also reviewed and are shown in Table 7.5. Once more it can be seen that full consensus is reached on these tasks, with the exception of tracking in of inpatient dispensing which demonstrated a moderate consensus.

Table 7.5 Dispensing tasks consensus

Dispensing Activity	% Agreement with task necessity n=21
In-patient Dispensing	
Booking on to tracker system	67
Dispensing	100
Checking	100
Discharge Dispensing	
Booking onto tracker system	76
Dispensing	100
Checking	100

The times these tasks take proved to be difficult to collect in the feasibility study due to interpretation of 'per admission' and so for the main study more specific questions were asked relating to the number of items and time taken to dispense and check a single item (see Appendix 7). Data from this section of the questionnaire is shown in Table 7.6

Table 7.6 Dispensing and checking times (minutes) for a single item

	Dispensing			Accuracy checking		
	S	CD	MDS	S	CD	MDS
RSPWC time	2.13	6.48	2.35	0.82	3.1	1.15
Average time from data set	2.68	5.62	4.79	1.61	2.42	2.58
Average time including RSPWC	2.4	6.1	3.6	1.2	2.8	1.9
Data set (n=)	14	12	7	14	12	6

Key: S= standard item CD= controlled drug MDS= monitored dosage system

Eleven sites identified the use of automated systems (dispensing robots) within their dispensaries. The impact of automation was considered on this data and is shown in Table 7.7. This shows that reported times for dispensing at automated sites takes longer than at non-automated sites. This applies to CD and MDS dispensing too which in most cases would not be impacted by automation. It might be, therefore, that these sites have other components to their process which increases the time for dispensing. This was outside of the scope of this study.

Table 7.7 Impact of automation on dispensing/checking times (excluding Royal Stoke data)

	Mean time to dispense			Mean time to accuracy check		
Automated Dispensing	Standard Item	CD Item	MDS item	Standard Item	CD Item	MDS item
No (n=6)	2.40	4.88	2.50	2.30	2.13	2.50
Yes (n=11)	2.83	6.00	5.17	1.23	2.56	2.60
Combined	2.68	5.62	4.79	1.61	2.42	2.58

7.2.3. Round 1: Additional pharmaceutical care tasks identified by participants

The tasks included in the first round Delphi were those that were already identified in the RSPWC and represented the existing practice standards at RSUH. The existence of additional activities required for patient care was considered and respondents were asked to identify what, if any additional activities were routinely delivered as part of pharmaceutical care within their service delivery models. Additional tasks were identified by respondents and are shown in Table 7.8. Tasks identified by more than one respondent, highlighted within the table as shown, were added to the second round Delphi questionnaire for wider review of consensus (see Appendix 8)

Table 7.8 Additional pharmaceutical care tasks identified in first round Delphi

Additional task description	No. of participants citing as routine practice
MR on ePMA	1
Discharge prescribing	2
CQUIN related activity	1
Discharge counselling and compliance aid completions	**1**
Post take ward rounds	2
Referral to primary care for follow up post discharge	4
Reporting clinical incidents	1
Education of ward staff	1
Pharmacist prescribing	3
Antibiotic and MR audits	1
Complex MR	1
Lithium register referral	1
Clozapine clinic	1
TDM	1
Pharmaceutical care plan	1
Smoking cessation	1

7.2.4. Round 1: Staffing questionnaire Identification of 'unavailable time'

A key element in the algorithms used to calculate staffing time(23,40) is identification of the fraction of employed hours which are 'unavailable' for clinical care. The literature gives examples of these being annual leave, sickness and training. This was explored in Part 1 of this validation study (see Table 7.9).

Table 7.9 Mean employed time unavailable for clinical duties by grade

	Non-operational activities (mins/week) reported by particpant sites									As per NHS policy		
AfC grade	Travel	Mandatory training	Professional training	Meetings	Rest Time	Other	Total Additional time(mins/ week)	Total Additional time(hrs/ week)	Non-operational employment time (WTE)	Annual leave (WTE)	Sickness (WTE)	Total
8a	90.00	14.00	71.95	179.75	5.56	112.36	473.62	7.89	0.21	0.10	0.03	0.34
7	108.33	14.37	86.22	94.17	10.30	47.15	360.54	6.01	0.16	0.10	0.03	0.29
6	103.44	14.99	106.25	64.38	8.43	21.57	319.06	5.32	0.14	0.10	0.03	0.27
5	127.50	16.07	21.39	35.50	0.00	11.11	211.57	3.53	0.09	0.10	0.03	0.22
4	101.75	14.00	19.47	28.42	0.00	11.41	175.05	2.92	0.08	0.10	0.03	0.21
2&3	101.76	16.71	36.18	28.24	0.00	12.13	195.02	3.25	0.09	0.10	0.03	0.22

Key: Travel – denotes travel time from ward to department. Meetings – staff meetings/MDT. Rest time - compensatory rest time for out of hours duties

Sites were asked to identify this time by grade of staff. Data was returned for all grades and the average unavailable time by grade is shown in Table 7.9 (page 124). To this was added expected absence for sickness and annual leave as per NHS policy.

Time allowed for mandatory training is consistent across the grades, which is in line with NHS employment regulations. It is noted that the 'unavailable' time increases with staff grade, which reflects training (highest for Band 6) and meetings (highest for Band 8a). The 'other' categories included teaching, audit, weekend working and directorate work.

These values are used to calculate the WTE required to deliver a service sustainable 52 weeks of the year and will add to the standard 'on-cost' which is routinely added in business cases which covers pensions and national insurance costs (22%).

7.2.5. Round 1: Staffing questionnaire - Staff resource requested for scenarios

Participants were asked to identify the resource they would request for specific scenarios (see Table 7.10). Eighteen sites returned data in this section and the results (shown in Table 7.11) demonstrate a disparate range of values. Most challenging though was Scenario 3 for which half of the respondents did not identify a resource but submitted only a narrative discussing issues.

Table 7.10 Service scenarios

Scenario 1
A new general medical ward is planned to open. This will have 28 beds and an average length of stay of 5 days. The average number of items on an in-patient prescription is 8. You have to identify the pharmacy staff (WTE) required to deliver a standard ward based service to this new ward
Scenario 2
An existing 28 bed general medical ward with average length of stay of 4 days (average items 8) is being converted to a short stay (48 hour) unit. What impact will this have on your pharmacy service and what if any additional staff would you request
Scenario 3
Finally, you are approached by a directorate manager about to submit a business case for 200 new bariatric surgical patients. No new beds will be opened, but these cases will go through and existing 28 bed surgical ward with a length of stay of 3 days. These patients have an average of 6 items on their prescription. He asks what resource implications this will have for you and what he should include in the business case

Table 7.11 Staffing resources requested for service scenarios

Value of staff resource requested	Scenario 1	Scenario 2	Scenario 3
Mean	£58,347	£34,812	£30,795
Median	£51,806	£28,204	£17,461
Minimum	£15,680	£0.00	£0.00
Maximum	£150,000	£81,732	£93,583
Differential (max-min)	£134,320	£81,732	£93,583
n=	18	16*	9*

**remaining sites gave no value but submitted a narrative about approach*

This data suggests there is a lack of consistency in the staff resource requested for the delivery of the same service across the country. Yet from earlier data (see Table 7.3) there appears to be broad consensus on the required tasks, how long they take and the frequency with which they should be done.

Data was analysed by sub-groups to identify if there were differences in staffing resources requested between DGH, teaching trusts and foundation trusts. This is shown in Table 7.12.

It suggests that teaching trusts request 35% more resource for a standard ward service than non-teaching trusts which explains the reason for the staffing levels shown in the demographics (see Table 7.2), though for the other scenarios the difference is smaller or reversed. This might suggest that they 'front load' their staffing and then have capacity to absorb change more effectively than their non-teaching counterparts.

Table 7.12 Comparison of resource requests by hospital type

	Scenario 1		Scenario 2		Scenario 3	
	Non-TH	TH	Non-TH	TH	Non-TH	TH
Mean	£42,092	£64,767	£28,627	£32,854	£32,404	£11,938
Minimum	£13,634	£31,338	£0	£0	£10,908	£0
Maximum	£81,534	£150,000	£66,040	£81,732	£98,763	£23,876
Median	£37,290	£58,615	£26,360	£30,049	£17,690	£11,938
n=	10	8	10	7	5	3

Key: n= number of sites stating figure, other sites returned narrative only
TH=teaching hospital Non-TH= non teaching hospital

7.3 Part 1: Delphi round 2 (Questionnaire 2 results)

As discussed in section 6.3 of the main study methods, following receipt of all round 1 data, the results were summarised and returned to the participant sites for a second review. They were shown their data and a summary of that of the group. They were asked to consider their own data in the light of the results generated and given the opportunity to revise their data set. In addition they were asked to consider the additional tasks identified in round one. Finally, in response to the consensus on several of the task frequencies being 'it depends on the patient', respondents were asked to identify patient characteristics which would result in more frequent pharmacy input and also to identify the pharmaceutical care requirements of exemplar patients.

7.3.1. Delphi round 2 respondents

Of the original 21 participants only 11 sites returned data for round two. This population is small for the other non-consensus aspects and so results cannot be statistically analysed. Of the 11 respondents to this round, five chose to amend their original data in response to their review of the study summary. Each of these was single item changes to the task, time and frequency data and none altered the consensus identified in the first round.

7.3.2. Round 2: Consensus on staff groups to deliver services

In round 1 consensus was not achieved in identifying all the staff groups which should deliver the agreed tasks. This was unchanged by the responses in round 2. The 'mode' responses fell short of 50% agreement for five of the thirteen tasks. The research team concluded from a more detailed review of this data following round 2 that the agreement of participants on individual staff groups, rather than the combined suggestions made in round 1, would be an appropriate step. For example when considering the staff group who should deliver the task 'check of patient's own drugs' 43% of respondents stated this could be pharmacists **or** MMTs and 48% stated it should be MMTs only. It therefore seems reasonable to suggest that a consensus has been achieved for the use of MMTs to complete this task with 91% of respondents identifying them as a staff group who should be involved i.e. some sites would only use technicians for this role, whilst other would use the staff group interchangeably. Using this analysis consensus was achieved for the staff groups required to deliver all the tasks. This is shown in Table 7.13.

Table 7.13 Consensus on staff groups to deliver identified tasks

	% Participants' agreement n=21	% Participants' response/staff category n= 21
Medicines Reconciliation (pharmacy confirmed and signed off)	100	P & MMT = 81%
Check of Patients Own Drugs (PODs)	95	P&MMT= 43% MMT= 48% so MMT = 91%
Clinical Review of Notes	90	P=81%
Review of Blood results	90	P=81%
Initial review of Drug Chart	100	P=38% P&MMT=57% so P=95%
Initial endorsing of Drug Chart	95	P=43% P&MMT=48% so P =91%
Subsequent review of Drug Chart	95	P=33% P&MMT=57% so P= 90%
Subsequent endorsing of Drug Chart	90	P=38% P&MMT=47% so P= 86%
(Pharmacy handover/care plans etc)	86	P= 14% P&MMT=47% MMT=5% so P= 61% & MMT= 52%
Ordering of Non Stocks	90	P&MMT=43% MMT=29% So MMT =72%
Clinical Check of Discharge prescription	100	P=76%
Talking to patient about their medicines	95	P&MMT=81%
Making interventions on patient care	100	P=33% P&MMT =67% P=100%

Key: P= pharmacist MMT= medicines management technician

>70% agreement on first analysis	>70% agreement on second analysis	50-70% agreement on second analysis

7.3.3. Round 2: Consensus on the time to complete tasks

Consensus on how long tasks take to complete was achieved for five of the 13 tasks. As previously described, consensus on time is more difficult to identify due to the continuous rather than categorical nature of the data. Grouping the data into time slots might achieve consensus but it is not helpful for the purposes of the calculator development, which

requires a single discrete figure to allow the algorithm to function. To validate the calculator a time for each task that is representative of current national practice needs to be identified. Therefore where consensus on time was not identified, data was analysed to calculate a mean. To increase the homogeneity of the population from which this mean was derived, data from the overseas site and the mental health Trust were excluded. If sufficient data sets based on 'existing local data' were submitted the mean was calculated from this subset. If inadequate 'existing local data' was available this value was based on all data submitted including the 'best guess data'. Following this analysis a 'best national representative figure' was identified for each task which will be used to drive the validated version of the RSPWC. A summary of this analysis is shown in Table 7.14, with its associated 'key', shown in Figure 7.3. It should be noted that no timings achieved 'strong' consensus through this process but 'moderate' consensus was achieved for a number of components.

Figure 7.3 Key to Table 7.14

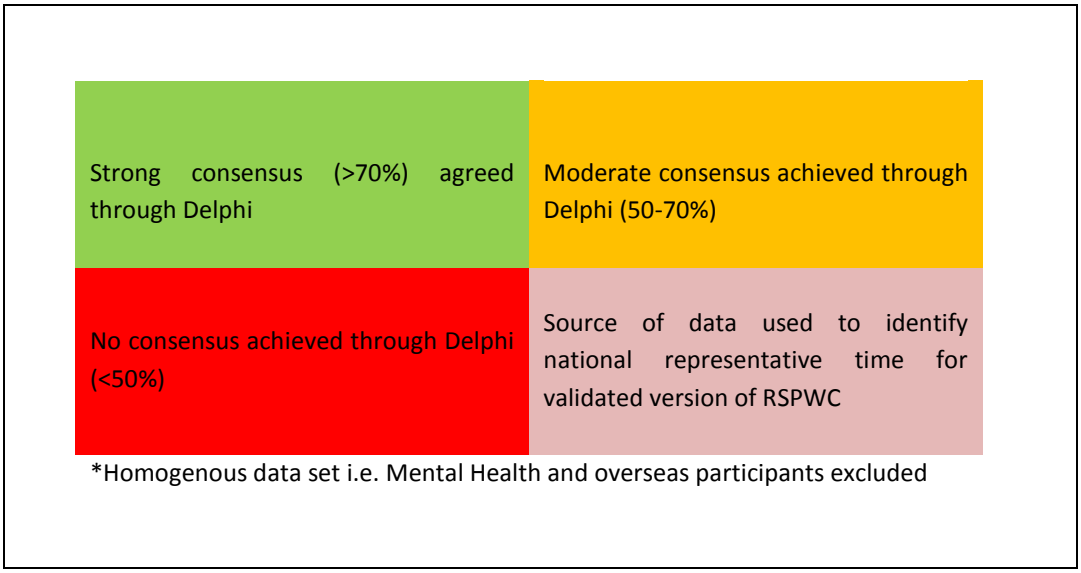


Table 7.14 Identification of time required to complete tasks

Data type	Time in minutes required to complete task												
	MR	POD check	Review of notes	Review of bloods	Initial review of chart	Initial endorsing of chart	Subsequent review of chart	Subsequent endorsing of chart	Paperwork	Non-stock time	Clinical check of TTO	Talking to patient about medicines	Interventions
RSPWC study version	20	5	5	1	5	2	2	0.5	2	2	5	5	5
n (all data)	18	17	18	17	18	17	16	17	9	17	20	17	16
Mean time (all data)	17.61	6.53	5.11	3.12	6.11	3.94	3.33	2.43	4.00	3.18	7.70	7.18	6.13
St Dev (all data)	6.71	2.96	2.00	1.65	3.14	2.38	1.50	1.64	1.58	1.63	4.27	3.88	2.94
Mode (all data)	20	5	5	5	5	5	5	3	5	5	5	5	5
Mode count	6	11	12	6	10	7	7	4	6	6	8	8	9
Mode %	33.33	64.71	66.67	35.29	55.56	41.18	43.75	23.53	66.67	35.29	40.00	47.06	56.25
Median	20	5	5	3	5	5	3	2.5	5	3	5	5	5
Minimum	10	4	2	1	2	1	1	0	1	0	2	1	1
Maximum	30	15	10	5	15	10	5	5	5	5	17	15	10
ELD n=	8	NA	NA	1	NA	1	1	1	NA	1	5	1	
Mean time (ELD)	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.6		
ST DEV (ELD)	8.05										5.02		
National 'best representative' figure	20	5	5	3	5	4	3	2	5	3	10	7	5

7.3.4. Round 2: Patient characteristic determining frequency of review

In round 1 the consensus identified for the frequency with which certain tasks should be done was that 'it depends on the patient'. This is reality but for it to be captured in numerical(46) form for the purposes of a calculator requires additional exploration. If frequency of review 'depends on the patient' it therefore follows that certain patients exhibit specific characteristics that result in them requiring more frequent pharmacy input than others. In round 2 of the Delphi study, respondents were asked to identify what patient characteristics these might be.

The data collected was compared to the Scottish prioritisation tool(46) discussed in the literature review (see section 2.5) to identify if the characteristics identified by this study population matched those in the tool (see Table 7.15)

Table 7.15 Patient characteristics requiring more frequent review

Patient characteristic	Number of sites identifying characteristic	% sites identifying	How characteristic rated by prioritisation tool(46)(RAG)
Complex Rx	7	87.5	
TDM	5	62.5	
AKI	5	62.5	
High risk meds	3	37.5	
Multi-morbid	3	37.5	
Hepatic impairment	3	37.5	
NBM	2	25	
Poor compliance	1	12.5	
Frailty	1	12.5	
Length of stay	1	12.5	
De-prescribing	1	12.5	
Interactions	1	12.5	
Course of meds	1	12.5	

Key to prioritisation tool:

Red = daily review	Green - review at discharge	Amber 2-3 days	Not mentioned

Respondents were also asked to identify how often they would review a patient if they exhibited these characteristics. This data is shown in Table 7.16

Table 7.16 Frequency of pharmacy review for patients with high risk characteristics (n=8)

Frequency of review	No. of respondents
Daily	6
as per RAG rating	1
2-3 weekly	1

Review of the data in these two tables demonstrates a consistency between professionals in identifying 'priority' patients and agreement about how often they should be reviewed. It should be noted that the only additional characteristic identified in the prioritisation tool(46) as 'Red' is 'incomplete medicines reconciliation' which all participants have already agreed is essential to patient care. That there is no 'green – review at discharge' is additional intra-professional correlation on patient characteristics requiring review i.e. no characteristics were identified in this study that had been deemed low priority by the Scottish group

Anecdotal data from use of this prioritisation tool suggests that 25% patients are 'red', 50% are 'amber' and 25% are 'green' in a general hospital patient population. This would justify taking the 'average' approach to the frequency in the RSPWC and the final section of round 2 explored what this 'average' might be.

7.3.5. Round 2: Pharmaceutical care requirements of exemplar patients

If the 'average' patient is the basis of service calculation, frequency of review of typical or 'average' patients should give an indication as to the time requirement per patient. Participants were asked to indicate for different patient cohort what activities they would typically perform and when they would perform them for an 'average' patient in each

cohort. Data for these responses is shown in detail over the following tables (Tables 7.17-7.22). Seven of the eight participants provided data for this section. Full data, rather than summarised data is displayed as the reader needs to see the pattern of responses from the 7 sites which conveys the lack of consistency in approach. The key for the following tables is shown in Figure 7.4

Figure 7.4 Key for exemplar patient results tables

MR	Medicines Reconciliation
L2	Level 2 check – clinical review of medical notes, blood results and drug chart
L1	Level 1 check – safety review of drug chart
POD	Check of patients own drugs
TTO	Supply of discharge medicines
LOS	Length of stay

Table 7.17 Pharmaceutical care activity of a typical respiratory patient

Typical respiratory patient - activities/day of in-patient stay									
Site	Day of admission						Summary (LOS 5 days) n=7		
	1	2	3	4	5		Activity	Count	mean frequency/ admission
5	MR L2 POD		L2	TTO POD L2			MR	7	1.00
7	MR L2 POD	L2		L1 TTO	POD		L2	19	2.71
8	MR L2 POD		L2		L2 TTO		L1	6	0.86
17	MR L2 POD			TTO POD			TTO	7	1.00
22	MR L2 POD	L1	L2	L1	L1 TTO		POD	11	1.57
26	MR L2 POD	L1	L2	L1	L2 TTO POD				
35	MR L2 POD	L2	L2	L2	TTO L2				

Table 7.18 Pharmaceutical care activity of a typical hysterectomy patient

Typical hysterectomy patient - activities/day of in-patient stay								
Site	Day of admission					Summary (LOS 4 days)		
	1	2	3	4		Activity	COUNT	mean frequency/ admission
5	L1[ǂ]			TTO L1		MR	6	0.9
7	MR L2 POD	L1	L1 TTO POD	POD		L1	13	1.9
8	MR L2 POD			TTO		L2	3	0.4
17				TTO		POD	6	0.9
22	L1 MR	L1	L1	L1 TTO		TTO	7	1.0
26	L1 MR L2 POD			L1** TTO**				
35	MR L1 POD	L1		TTO L1				

*[ǂ]MR/L2 done in pre-admissions **Only if supply required*

Table 7.19 Pharmaceutical care activity of a typical elderly patient

Typical elderly longer stay patient - activities/day of in-patient stay														
Site	Day of admission											Summary (LOS 10 days)		
	1	2	3	4	5	6	7	8	9	10		Activity	Count	mean frequency/ admission
5	MR L2 POD		L1		L2		L1		TTO L2 POD			MR	8	1.1
7	MR L2 POD	L2	L1 POD	L1	L1	L1 POD	L1	L1 TTO	L1 POD	POD		L1	22	3.1
8	MR L2 POD			L2				L2		L2 POD		L2	19	2.7
17	MR L2 POD							MR L2 POD	TTP POD			TTO	0	0.0
22	MR L2 POD	L1	L1	L1	L1	L1	L1	L1	L1	L1 POD TTO		POD	16	2.3
26	MR L2 POD		L2		L2			L2		L2				
35	MR L2 POD	L2	L2	L1	L1	L1	L1							

Table 7.20 Pharmaceutical care activity of a typical short-stay patient

Typical short stay - activities/day of in-patient stay							
Site	Day of admission				Summary (LOS 3 days)		
	1	2	3		Activity	COUNT	mean frequency/ admission
5	MR L2 POD		L2 POD TTO		MR	7	1.0
7	MR L2 POD	L1	TTO L1		L1	5	0.7
8	MR L2 POD		TTO		L2	10	1.4
17	MR L2 POD		TTO		TTO	6	0.9
22	MR L2 POD	L1	TTO L1		POD	9	1.3
26	MR L2 POD	L2	L2 POD TTO				
35	MR L2 POD	L1	L1				

Table 7.21 Pharmaceutical care activity of a typical vascular patient

Typical vascular patient - activities/day of in-patient stay										
Site		Day of admission						Summary (LOS 6 days)		
		1	2	3	4	5	6	Activity	Count	Mean frequency/ admission
5	MR L2 POD			L1		TTO POD L2				
7	MR L2 POD	L2	L1		L2	L1 POD	POD			
8	MR L2 POD		L2		L2		L2 TTO	MR	7	1.0
17	MR L2 POD			L2		TTO POD		L1	13	1.9
22	MR L2 POD	L1	L1	L1	L1	L1	TTO POD L1	L2	21	3.0
26	MR L2 POD	L2	L1	L2	L1		L2** TTO **	TTO	6	0.9
35	MR L2 POD	L2	L2	L1	L1	L1	TTO	POD	12	1.7

*** if supply required*

Table 7.22 Pharmaceutical care activity of a typical complex medical patient

Typical respiratory patient - activities/day of in-patient stay										
Site	Day of admission							Summary (LOS 7 days)		
Site	1	2	3	4	5	6	7	Activity	COUNT	mean frequency/ admission
5	MR L2 POD	L1	L2	L1	L2	TTO POD L2				
7	MR L2 POD	L2	L1	L1	L2	L1 TTO	POD			
8	MR L2 POD		L2		L2		L2 TTO	MR	7	1.0
17	MR L2 POD		L2			TTO POD		L1	4	0.6
22	MR L2 POD	L2	L2	L2	L2	L2	TTO POD L2	L2	31	4.4
26	MR L2 POD	L2	L2	L2	L2		L2 TTO POD	TTO	7	1.0
35	MR L2 POD	L2	L2	L2	L2	L2	TTO L2	POD	11	1.6

From reviewing this data it can be seen that the consensus on MR, POD and TTO that has already been identified in the Delphi section of the study (see Table 7.3) is confirmed by this data. The tasks for which consensus was either not achieved or identified as 'depends' on the patient were the review and endorsement of drug charts and the review of notes and blood results. This was explored in more detail in this data set which demonstrates the lack of standardisation of approach. For the purposes of the construction of the 'validated'

version of the calculator this data is summarised in table 7.23 as the mean frequency of these tasks for each patient type and length of stay.

Table 7.23 Frequency of activity by length of admission

LOS	2	5	4	7	7	10
Type of patient	Medical	Medical	Surgical	Surgical	Medical	Medical
Clinical review of chart and endorsing	2.1	3.6	2.3	4.9	5.0	5.9
Clinical review of notes/bloods	1.4	2.7	0.4	3.0	4.4	2.7
Chart & endorsing/LOS	1.1	0.7	0.6	0.7	0.7	0.6
Notes & bloods/LOS	0.7	0.5	0.1	0.4	0.6	0.3

If the summary data is further summarised (as shown in Table 7.24) it can seen be seen that some differences begin to emerge for medical and surgical patients with respect to the notes and bloods review frequency

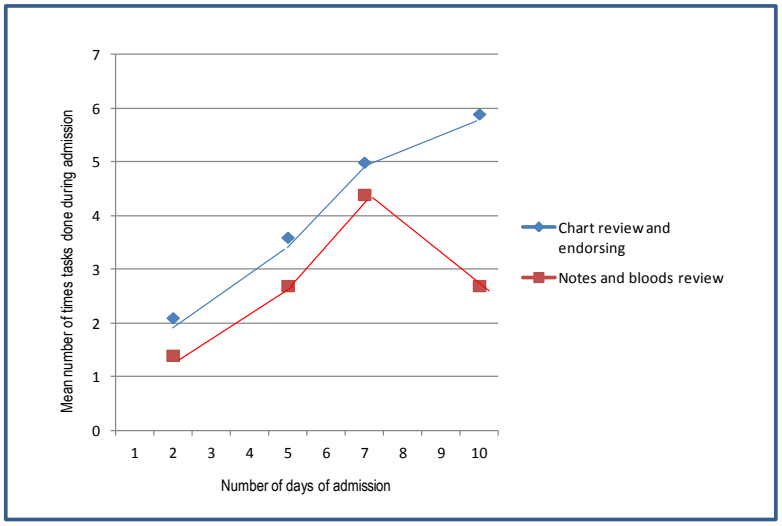
Table 7.24 Summary data of mean times tasks done per day of admission by patient type

Tasks	Mean number of times task done per day of admission ALL patients	Mean number of times task done per day of admission for MEDICAL patient	Mean number of times task done per day of admission for SURGICAL patient
Review of chart and endorsing	0.7	0.77	0.63
Review of notes and endorsing	0.4	0.54	0.3

The data set for this part of the study is very small. However, if this limited data is plotted in a scatter chart a linear pattern appears to begin to emerge though this cannot be statistically confirmed. For medical patients (Figure 7.5) the linear pattern appears to peak

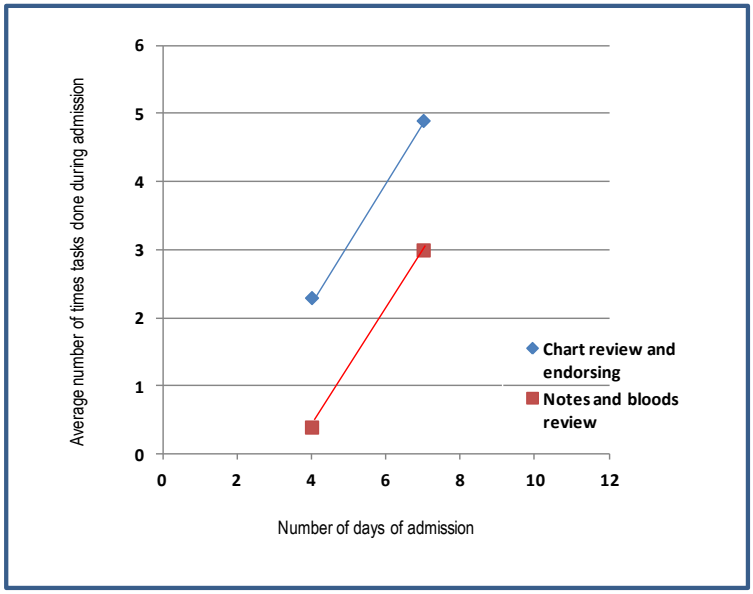
at 7 days at which point the frequency of activity appears to reduce as length of stay progresses. This might be explained by the continued stay in hospital beyond 10 days often being due to delays in care package availability rather that active acute illness.

Figure 7.5 Medical patient activity frequencies



For surgical patients, (see Figure 7.6) the limitation of two data sets makes interpretation even less robust. Two data points will always give a straight line. Of note, however, is the point at which these lines would cross the x axis as it suggests that for less than two days limited clinical input is given beyond MR. This reflects current practice for day case surgery. Long length of stay in surgical patients is often associated with complexity of surgery and the need for closer review post operatively which would explain the need for this continued pharmacy input, though, as for medical patients a peak would be expected at some point.

Figure 7.6 Surgical patient activity frequencies



For robust conclusions to be drawn further research is required for both areas. However the impact of these potential variations on resource calculated needs to be considered – does it matter or is this just semantics? To explore this the different variables were used to populate the RSPWC to understand the different values that were produced and the impact on the resource that it generates for a 28 bed ward with a length of stay of four days (Scenario 1). This analysis identified that the study version of the RSPWC generates a lower resource value than any of the versions using frequencies suggested by the results of the research. This is explained by the fact that the study version was based on UHNM minimum standards of practice rather than the average which has been suggested as appropriate through this research. However, as shown in Table 7.25 when the average for all patient groups is compared to those for medical and surgical specific data it can be seen that the difference calculated amounts to at most £5,000 (5.4%) of the value and 0.11 WTE pharmacist, with no difference in the other staff grades. The differential between minimum and maximum resource requests in this exercise is £8k, compared to the variability in resource requested by participant sites for this same scenario in Part 1 (£138k). Whilst this

data is from a small sample set it demonstrates greater accuracy than the RSPWC in its post-study form and though there may be nuances between surgical and medical patient in resource requirements, in general terms, the calculator generates adequate resource. To increase the accuracy of this tool further research is required.

Table 7.25 Comparison of resource requirements for a 28 bed ward using speciality variables

Value calculated using study version of RSPWC		
REQUIRED STAFF GROUP	WTE REQUIRED	COST
ATO	0.05	£1,003.17
Technician	0.37	£9,431.41
MMT/Pharmacist	0.63	£20,342.66
Pharmacist	1.05	£46,356.87
	Total resource value	**£77,134.12**
Value calculated using study data for ALL patient using mean frequency of activity/day of admission		
REQUIRED STAFF GROUP	WTE REQUIRED	COST
ATO	0.05	£1,003.17
Technician	0.37	£9,431.41
MMT/Pharmacist	0.80	£25,724.56
Pharmacist	1.23	£54,324.46
	Total resource value	**£90,483.61**
Value calculated using study data for MEDICAL patient using mean frequency of activity/day of admission		
REQUIRED STAFF GROUP	WTE REQUIRED	COST
ATO	0.05	£1,003.17
Technician	0.37	£9,431.41
MMT/Pharmacist	0.80	£25,724.56
Pharmacist	1.34	£59,225.73
	Total resource value	**£95,384.88**
Value calculated using study data for SURGICAL patient using mean frequency of activity/day of admission		
REQUIRED STAFF GROUP	WTE REQUIRED	COST
ATO	0.05	£1,003.17
Technician	0.37	£9,431.41
MMT/Pharmacist	0.80	£25,724.56
Pharmacist	1.14	£50,582.11
	Total resource value	**£86,741.26**

7.3.6. Round 2: Consensus on the additional tasks identified in Part 1

Tasks identified by more than one respondent in Part 1 were summarised and included in Part 3 for participant review. They were asked to consider if these activities, identified by their peers were required for delivery of routine patient care. The responses are shown in Table 7.26 and suggest that no additional duty identified in Part 1 met the required level of agreement to reach consensus at this time and so the list of tasks in the RSPWC should remain unchanged.

Table 7.26 Review of sites in agreement with additional routine duties

Additional duty in routine practice	Round 2 responses			No. of Round 1 sites in agreement	New sites in agreement Round 2	Total No. sites in agreement across 2 rounds	% agreement across 2 rounds
	Yes	No	Maybe				
Pharmacist prescribing discharge medicines	2	4	1	2	2	4	19
Post-take Ward Rounds	6	1	0	2	5	7	33
Referral to community pharmacy on discharge	4	3	0	4	3	7	33
Pharmacist prescribing in-patient medicines	6	1	0	3	4	7	33

7.4 Part 2: Operator evaluation

Eleven of the original 21 sites (52%) returned the operator evaluation questionnaire (see Appendix 9). This part of the study focussed on the transferability of the tool to other operators and began to explore their opinions of the utility of the tool for their setting.

7.4.1. Transferability of tool between operators

The same 3 scenarios were presented as in Part 1 (see Table 7.10). Participants were given basic instructions on how to use the RSPWC (see Appendix 12) and asked to apply it to these scenarios. Table 7.27 shows the summary of responses received from participants using the RSPWC compared to the resources they requested in Part 1 of the study.

Table 7.27 Resource requested for staffing scenarios: Part 1 data cf operator use of RSPWC

	Scenario 1		Scenario 2		Scenario 3	
Value of staff resource requested	Part 1 data	Using RSPWC	Part 1 data	Using RSPWC	Part 1 data	Using RSPWC
Mean	£58,347	£75,824	£34,812	£75,165.00	£30,795	£33,445
Min	£15,680	£62833	£0.00	£35,3174	£0.00	£6488
Max	£150,000	£78336	£81,732	£92,674	£93,583	£117,014
Differential (max-min)	£134,320	£15,503	£81,732	£39,500	£93,583	£110,525
n=	18	11	16	11	9	11

For Scenario 1 there is a much smaller differential in the value requested which suggests that the use of the RSPWC has made this a more consistent response. The mean value requested is substantially more using the RSPWC. For Scenario 2 the differential is less but still sizeable and for Scenario 3 the differential is greater than in Part 1. This might indicate that the use of the RSPWC is not generating consistent resources in the hands of other operators. To explore this effect further, a more detailed review of the data is required. This is shown in Table 7.28. With this perspective it can be seen that for Scenario 1, 8 of the 11 (72%) respondents generated the same value. Two respondents made additional changes to the data entered into the RSPWC which matched *their* service provision. This was not the instruction given to answer the question and so the answer is 'wrong' but it demonstrates

that the operator understood how to use the calculator. The final respondent chose to provide a narrative on their perspective of the application of the tool for each scenario rather than give a numerical answer. The detail of this is captured in the qualitative data analysis.

When data for Scenario 2 are reviewed six of the eleven (55%) generated the same correct answer (as per the RSPWC). One respondent rounded the value up – so the figure appears different by a small amount and another gave the value for the 'post-change' service rather than the difference between the before and after service delivery as requested in the question. This skewed the 'maximum' value. Two others used different data sets tailored to their settings which generated different values.

Finally for Scenario 3, once again six operators (though different individuals than for Scenario 2) generated the same correct value. Once more a 'post-change' figure was quoted by one operator skewing the data and, as for the previous scenarios, one operator chose to apply local data to the question rather than that provided in the summary. However in this scenario two operators generated incorrect (as per the RSPWC) values which could not be explained by examination of the calculation.

Table 7.28 Resource requested for staffing scenarios by operators using RSPWC

	Resource requested (£)		
Site number	Scenario 1	Scenario 2	Scenario 3
2	77,134.12	92,674.00	6,488.80
7	78,336.19	53,174.00	12,847.00
8	77,134.00	75,895.00	6,488.80
13	77,134.00	76,000.00	6,488.80
17	77,134.00	169,898.00	6,488.80
18	Narrative	Narrative	Narrative
22	77,134.00	75,895.00	117,014.00
25	77,134.00	75,895.00	6,488.80
27	77,134.00	75,895.00	6,838.00
34	77,134.00	75,895.00	6,488.80
35	62,833.00	75,85595.00	110,525.00
Mean	75,824.00	75,165.00	34,455.00

Key
Resource as calculated by correct use of RSPWC
Rounded up value or correct post change value - not subtracted baseline figure for difference - calculator used correctly
Value incorrect as used scenario 1 for baseline but LOS was different - calculator used correctly
Operator changed % prescription type for dispensing data and/or number of items dispensed
Incorrect - reason unclear
Instructions for answering question not followed

Overall the transferability of the tool between operators has been demonstrated if the tool is used correctly and unchanged

7.4.2. Utility of tool in different settings

The operators were asked a number of closed questions around the utility of the tool (see Appendix 9) to their setting. A summary of this data is shown in Table 7.29. In addition participants were given the opportunity to express their views and opinions of the tool and

give explanation of their responses in their own words. This data allowed clarification of the quantitative data and was also included in the thematic framework analysis of Part 3.

Table 7.29 Responses to questions relating to the utility of the RSPWC (n=11)

Questions	Number of respondents			
1. Does the RSPWC generate the workforce to deliver pharmaceutical care in your setting?	Yes	No	Partly	
	6	4	1	
2. How did the value compare with what you would have requested without using it?	More	Less	Same	
	8	1	2	
3. Were the instructions easy to understand?	Yes	No	Other	
	9	1*	1	
4. How long did it take you to use the RSPWC to calculate the answers	<10 minutes	10- 20 minutes	21-30 minutes	>30 minutes
	4	5	1	1*

**Same respondent*

Review of Table 7.29 suggests that most (81%) respondents found the instructions easy to follow and that the tool was not time consuming to use. One respondent disagreed and wanted additional information to be able to understand the tool's calculations, though they were not one of the participants calculating 'incorrect' answers, so had understood how to use the tool in practice.

Most users (73%) identified that the resource requirements generated by the RSPWC were greater than they would routinely ask in practice. The one site which identified that it generated a smaller value than they would ask for the service acknowledged that this was due to their way of completing medicines reconciliation, which this takes longer than the RSPWC would suggest is necessary.

Of concern in the data, from a validation perspective is that four respondents (around a third) reported that the RSPWC overestimated the workforce resource required to deliver their services. Differences in the way that medicines were supplied in their organisation were cited as a reason for asking for less resource. One of these respondents was based in a mental health trust and the applicability of the RSPWC in that healthcare setting has already been questioned by another respondent from that type of setting.

In order to explore this data further, to understand the potential limitations of the RSPWC, an exercise was undertaken to cross reference resource requirements generated using different data sets to populate the RSPWC algorithm for the remaining three sites. The RSPWC in its 'un-validated' form which is being explored in this study uses tasks, times and frequencies measured previously at the RSUH. For this exercise the data submitted in Part 1 of the study by each of the sites in question was used to create a 'site-specific' version of the RSPWC and the staffing scenarios re-run through the tool to identify the resource required for each site based on what their clinical manager believed should be the level of service delivery. These results were then compared to the responses received from each site in Part 1 and in the Operator Evaluation ie using the study RSPWC. The results from this exercise are shown in Table 7.30.

This demonstrates that the RSPWC generates a far greater resource requirement for the suggested scenarios than these sites are currently requesting. However, the resource calculated by 'site-specific' versions of the RSPWC are much closer match to the RSPWC for Site 8 and 22, suggesting that in reality the RSPWC calculates a reasonable resource to deliver the defined service. It should be noted that both sites provided existing local data for several of the timings and so this data is evidence based not best guess. Site 13's site-specific data suggests the need for almost twice the value of that generated RSPWC (and

the other versions too) and almost four times what they would request. All of these sites generated outlying data in other elements of the research and so are included in the qualitative stage of the study in Part 3.

Table 7.30 Resource requirements generated by site-specific RSPWC compared to local methods

	Resource requested by site lead using current methods	Resource requested by site lead using RSPWC (study version)	Resource required if site-specific version of RSPWC used
Site 8			
Scenario 1	£20,370	£77,134	£69,171
Scenario 2	£16,964	£75,895	£84,200
Scenario 3	narrative	£6,489	£6,146
Site 13			
Scenario 1	£31,371	narrative	£108,118
Scenario 2	£0*	narrative	£135,149
Scenario 3	£0*	narrative	£10,157
Site 22			
Scenario 1	£15,680	£77,134	£76,099
Scenario 2	£22,113	£75,895	£75506
Scenario 3	£10,908	£6,884	£5,937

**would be expected to redistribute resource*

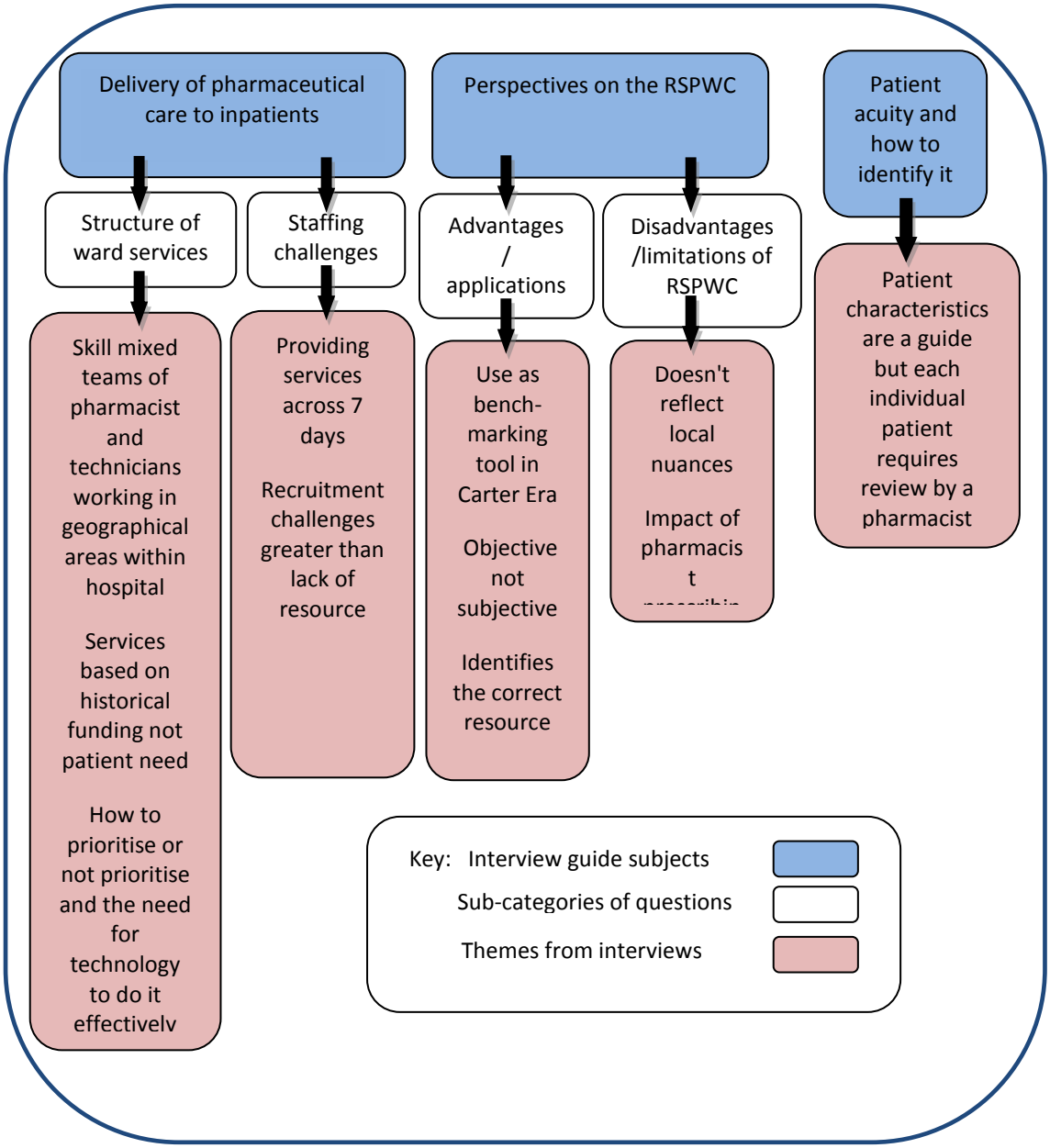
7.5 Part 3: Qualitative data results

As a final stage in the research, qualitative data was collected in Part 3 of the study to explore the utility of the RSPWC in different settings, to gain greater understanding of outlying quantitative data and to explore the issues of patient acuity. There were seven participants in this part of the study, three from teaching hospitals, three from district general hospitals and one mental health trust. There were five male and two female participants. Interviews were predominantly conducted by telephone, with one exception

which was done in person, recorded using a digital recorder and transcribed verbatim. Data saturation was reached with no new themes presented over the final 2-3 interviews. The themes identified from the participant in the one mental health unit, reflected those of the acute settings, but the details clarified earlier outlying data sets relating to tasks and timings which may indicate that the activity standard in the RSPWC is not applicable in this setting. Data from these interviews was drawn into a thematic framework analysis. This allowed consideration of the key themes that emerged from the study.

Figure 7.7 depicts the key themes and ideas which will be discussed in further detail in this section. The headings reflect the structure of the interview guide (see Appendix 13) which guided the following analysis of the data. Quotes are attributed to participant numbers e.g. [P1] = participant 1, with the anonymity of participants being maintained throughout.

Figure 7.7 Summary of framework analysis of qualitative data



7.5.1. The delivery of pharmaceutical care to in-patients

There was much similarity in all the experiences reported by participants. They described skill-mixed, team approaches to ward-based pharmacy, with senior pharmacists (Bands 8a and 7) leading geographically located teams, including technicians and tasks delegated to different staff groups.

"...we have teams of pharmacists working in 'clusters'..." [P1]

They reported a reliance on the technical staff to complete the information capture element of medicines reconciliation and facilitating the availability of medicines on the wards for patient use.

"...technicians gather a lot of information in terms of medication history and then sort out stuff in terms of patients on drugs and what formulations they might need" [P3]

Pharmacists were reported to undertake clinical reviews of patients to optimise medicines use and there were reports of increased used of pharmacists as prescribers. A number of managers reflected that it was likely that this would, in time, change the structure of the service around those practitioners, but that as yet, that was ill-defined. Participants also described how the team-based approaches facilitated the supervision and development of junior colleagues to give governance assurances regarding the safety and quality of service.

"...depending on which clinical scenario they [senior pharmacist] will either be working closely with that junior on the ward or will be remotely supervising from the kind of ward next door.." [P4]

Along with the acceptance of the need to skill mix, it was also reported that there were situations, particularly where a Trust has sites spread across a wide geographical area, the distances preclude skill mixing. This was primarily because of the financial and operational time lost in multiple staff travelling, when one staff member (i.e. pharmacist) could do the job alone.

"...where we'd like to skill mix, sometimes we can't just because actually sending three people 40 minutes up the road doesn't make sense." [P5]

Another common theme, which appeared to be a source of frustration in a number of individuals, was the historic nature of some of the service structures. It was repeatedly reported that services were often delivered to different specialities based on the level of funding received a number of years previously, rather than on the needs of the current patient population. None of the participants described having taken action to resolve this issue, either in terms of seeking funding, or in redistributing existing resource more effectively.

"... we have three levels of service we offer.....bronze silver and gold....like your basic Kardex® check, you're keeping the patients safe basically, silver keeping the patients safe and a bit of meds rec, perhaps not every day .... and your gold is like the all singing all dancing skill mixed pharmacy service on the ward.....so some of it is driven by what the service will pay for rather than the patient." [P5]

The role of the pharmacy team in facilitating 'patient flow' through NHS hospitals was widely identified and the need for close working with the MDT to achieve this flow was described. These were new activities (e.g. board rounds which are a multi-disciplinary team meeting held at the patient-list board to discuss individual patient's progress and problems requiring review, to facilitate discharge) and delivered within existing resource.

"we send techs or pharmacists to the board round every morning" (P3)

The activities that should be done for each patient have been described earlier (see Table 7.3) and with almost full consensus achieved on these. However, it was also commonly

reported in the interviews that there are not generally enough staff to do all activities for all patients and that the advent of 7-day pharmacy services has stretched this further. Different Trusts appeared to approach this shortage in different ways with often diametrically opposed approaches.

> *"We have to see every chart every day and just do a safety check.....to prevent the catastrophic errors where there's a gentamicin overdose or omission of immunosuppressants and a transplant is rejected....rather than a mega intensive pharmaceutical review."* [P6]

> *"We are trying to triage everyone on admission so there's a relatively high in-put to the admissions unit.....we use a standard triage tool red amber green....the idea being you go to the patients who need in put rather than going around everyone many of whom don't actually need much*." [P2]

Participants suggested that the prioritisation of patients would be much improved by better access to technology which allowed a real time 'pharmacy-need' status for each patient to be identified. This in turn would facilitate a more efficient and targeted service. Only one participant identified the availability of this technology and it was key for their service provision.

> *"the key challenge is use of information technology and real time information about what patients you need to see and where are those patients because otherwise you're back to the old scooting around to identify it before you actually do some work"* [P3]

7.5.2. Pharmacy staffing challenges

Staff resource seemed to be a substantial challenge faced by all participants. None of those interviewed suggested they were adequately staffed to provide the service they felt was required. Whilst the issue of funding of staffing establishment was identified as a challenge by several of the participants

> *"one of the key challenges is workforce and finance for workforce"* [P3]

it was not was not considered to be the only challenge they faced. Indeed more than one participant identified that increasing available funding would not have entirely resolved the staffing issues. A number of themes emerged.

One theme, common to several of the participants interviewed, was the difficulty in recruiting suitably trained staff, across all grades. The concept of 'growing your own' was described as one solution, but it was reported that this does not happen quickly enough.

> *"...but it's not just having quantity; it's about having them all at a standard that is useful for the department."* [P6]

> *"We could have recruited sort of 12 Band 7 or Band 8a pharmacists but they're just not out there in those sort of numbers."* [P3]

> *"We don't have the facilities to train enough technicians to actually meet the demand that we have of the kind of increase in service."* [P4]

Participants were drawn from across the UK and for some departments geographical location provided the greatest challenge in attracting and retaining staff. Whilst 'location'

was defined as the 'problem' the issue took a variety of forms. Remote locations in the UK prove challenging either for attracting people to move to them or trying to find the resource from within the existing population.

> *"We've had to advertise three times in [town name], actually looking for somebody who lives in [town name] as it's so far away from anywhere else. You wouldn't want to commute there really"* [P5]

However, being within proximity, yet not part of, large centres of population also produces challenges. It was reported that staff seem to be often lured either by the social opportunities of city life or the professional variety that larger NHS organisations seem to offer.

> *"We are just a little bit too far away from the bright lights of ..... so it's getting staff to stay here.....will travel for two years and maybe stay on for a year but then get fed up of the travelling"* [P7]

> *"...because of the location we are, a large majority of the band 6s in the region will go to the tertiary centres and so we have struggled with kind of recruitment of Band 6s"* [P4]

The other staffing challenge described by the participants was that of staffing a 7-day service. Several participants expressed the difficulty of trying to stretch existing resource across the full week reporting the limiting of services in some areas or struggling to maintain the specialist level of cover throughout the week. Different approaches were described to address these challenges resulting in variation in the services offered.

"we didn't get any extra money for developing a seven day service..... The challenge that that then provides is what resource you've actually got remaining to provide as service to the district general sites ..... sometimes you might just have a few pharmacists and a few technicians and sometimes even less than a few and you've got a number of wards to cover" [P3]

In addition the majority of participants expressed the view that that delivering 7-day services places a burden on the work-life balance of their team. The drive for this extension of service came around the same time as funding being made available for pharmacists to work in GP practice posts which, at present, do not have the weekend commitments. A number of participants reported that their staffing levels had been adversely affected by the increased availability of these perhaps more attractive roles.

" big increase in the GP recruitment of pharmacists in particular. We're trying to run a 7/7 service and those jobs are very attractive. Just recently we have lost 4 or 5 of our more senior pharmacists." [P1]

In summary, when considering the phenomenon of 'delivery of pharmaceutical care' the results of this study suggest that there may be a common approach and understanding of what this entails. The variation that is described here and in the work for the Carter report(21) may have arisen from different approaches taken towards service delivery in the light of insufficient staff resource to deliver the 'full' service to each patient. Staff resource might have been limited historically by lack of funding, which may be exacerbated by the need to extend services across the whole week. However, the impact of changing roles for pharmacists seems twofold, firstly in stripping resource from traditional services and secondly in generating skills gaps in the profession which will take time to fill.

7.5.3. Perspectives on the RSPWC

The challenges of delivering pharmaceutical care in a modern health service have been described above and the fundamental impact that staffing resource adds to that challenge have been outlined. The next part of the qualitative research explored participant perspectives on the RSPWC, its applications and advantages, its limitations and disadvantages. Participants expressed understanding of the variation in service delivered between Trusts and that this would not be acceptable in the future. Participants suggested that it would be useful to have a tool which facilitated a standard approach to staffing.

> *"in this era of standardisation, rationalisation, benchmarking and Carter it [the RSPWC] will support some agreed standardisation of pharmacy so it fits nicely in the political context"* [P1]

In particular, with the advent of Strategic Transformation Partnerships (STPs), having a more standardised approach may allow more effective comparison of services between sites and facilitate more effective decision making.

> *"we are maybe going to be working more closely with neighbouring Trusts and then we can have a closer understanding about what our service make-up is to then be able to kind of join up services in that new STP kind of environment"* [P4]

It was identified that historically workforce resource requirements have been largely identified subjectively and may not have changed as services developed. The 'best guess'

approach to resource calculation and the subsequent rejection or reduction of requests by business managers, was articulated by many of the interviewees.

> *"I think historically capacity and demand planning have been very much feeling based, but it's nice to have something that either backs up that feeling or completely challenges it I guess"* [P5]

This then expanded into the main advantage of the RSPWC, which is the more objective, rather than subjective nature of its function, which makes its output much more tangible. There was a recognition that once validated this would become an even more powerful tool.

> *"I think the main thing is that it's based on, it's not sort of made up and it's not the usual thing sort of finger in the air or based on sort of well, 'in my experience type of thing"* [P4]

> *"...so I think in that sense particularly if it's recognised as a validated tool it gives you something to say well 'I've used this calculator"* [P3]

Interviewees discussed their experience of using the RSPWC and their opinions as to the value of the resource it calculated. Several of them, following their responses to the study questions, had applied it to issues in their own settings and expressed satisfaction that the output was reasonable as a core requirement for a pharmacy service

"I did try it just for a ward we've got at the moment and one that I thought was reasonably functional and it came out with roughly what we've got" [P7]

Potential limitations or disadvantages of the tool were also explored. The main theme in terms of disadvantages relates back to the current non-standardisation of services across different sites i.e. that the tool may not quite 'fit' their service model in terms of skill mix.

".....whether it takes into account the nuances of our service" [P1]

Specifically these related to the supply functions which are included in the tool and particularly in relation to Carter(21) which suggests that supply is an 'infrastructure' activity that should be outsourced or done collaboratively. Some participant reported having already taken these steps and so questioned the inclusion of this staffing resource.

"...there was a lot of staffing tied to the operational type dispensary type tasks which we don't do" [P5]

"....for example we've got heavy dependence on over labelled pre-packs so we've got 30 odd automated cabinets in the trust .....some of these things are coming through Carter as well as to how much time you spend on the operational side" [P3]

Some concerns were raised about the robustness of the calculation and the need to trust the tool if it were to be used so that its output could be defended or justified. It was

suggested that greater detail relating to the functioning of the tool should be issued so that questions are answered and users reassured.

> *"I felt a little bit unsure about how it was calculating everything via the Excel spreadsheet...at a glance I couldn't figure it out quickly.... "* [P6]

Several participants commented that the out-put from the tool is a numerical and cautioned that it should not be used as a "magic answer" [P3]. They recognised that this needed to be applied to the context of the relevant Trust and used as a starting point to demonstrate the correct 'ball park' figure.

> *"as long as I am aware of what numbers we're putting in there and how that compares with how we currently deliver anything, in other words you can sense check it, then I don't think that's a great disadvantage in that sense"* [P3]

Finally a caution was raised that the research was largely based on the experience of senior pharmacy managers and their 'best guess' on timings would be based on their own practice and might not reflect that of service delivery by a more junior team.

The overall response to the tool was very positive with the managers identifying its benefits, particularly in the current political context.

> *"I think I generally thought this could be really useful"* [P4]

> *"I think it's a fab tool"* [P7]

Potential applications of the tool in practice were seen to be twofold. Firstly in giving a baseline resource requirement for new or changed services, which could then have local nuances applied, particularly around developing junior staff resource

> *"if you've got a new commissioned ward or if you've had some change in ward configuration it allows you to say well what's the impact upon service"* [P6]

The second application would be using the tool 'backwards' i.e. if a fixed amount of funding was made available which is insufficient for a full service the tool could be used to demonstrate what tasks are possible within the available funding envelope

> *"it will be really useful to then be able to go back to kind of care groups and say that with the amount of resource you have provided we could then provide this service"* [P4]

However other participants commented that tailoring the tool to specific local situations reduces its validity and that not over complicating it at this stage was probably the best approach.

> *"The strength of it is that you've got a validation to it haven't you? And if we have it so it's too kind of changeable then we lose that validation..... so then all that comes is a local tool to then develop which is not as powerful"* [P4]

> *"....you could get drawn into the tool doing too many things for too many people and I wouldn't go that far"* [P1]

7.5.4. Pharmaceutical acuity – patient characteristics

Through the Delphi study consensus was largely achieved on the tasks required to deliver pharmaceutical care and the time it takes to complete these. However, the consensus on how often these tasks should be completed was frequently 'it depends on the patient'. This may be so but is not helpful for calculation purposes that require a finite figure to drive the algorithm. This was explored further in the earlier results (see Tables 7.17 – 7.22) confirming further disparate results. This qualitative part of the study also explored the issue to try to add greater detail. Interviewees were asked to describe what they believed to be patient characteristics which would generate the requirement for increased pharmacy input. Responses were similar and remained in the same broad categories identified in the second round of the Delphi study in Part 1 (Table 7.15). However several participants articulated that it is often not possible to predict which patients you need to see. Whilst the use of prioritisation tools is becoming more widespread, it was identified that these are not infallible. This reflects the recent work in Manchester(47) and Birmingham(45). Overall these interviews identified the 'art' of clinical pharmacy which makes it difficult to quantify in tangible numbers

> *"I'm a scientist but sometimes it comes down to clinical judgement"* [P3]

> *"I think that is perhaps why kind of pharmacy is quite interesting because of the nature of, you could list everything down but it doesn't kind of give you the whole picture of that patient because you have got a squidgy human in the middle of it who it actually all revolves around and that's what makes it challenging or so interesting"* [P4]

7.6 Main study results summary

Through the Delphi process consensus was identified for the majority of elements of the RSPWC. Where consensus could not be achieved data analysis identified a 'national best representative' figure for inclusion in the calculator. For several activities relating to the delivery of pharmaceutical care the consensus on frequency was that 'it depends on the patient'. This was explored in more detail in a small sub group of the original study population and allowed the generation of average frequencies of activities for the purposes of a calculator tool.

The qualitative data identifies that Pharmacy workforce is at a challenging point nationally due to the current political arena and, whilst funding is important, it is not the only challenge currently facing pharmacy managers, recruitment of staff with the correct skills in sufficient numbers often being the limiting factor in service provision.

The RSPWC is identified as a potentially very useful tool and the resource requirements it generates are considered reasonable. A number of applications of the tool in acute health care settings were identified. The applicability of the tool in mental health and community hospital settings has not been established. Indeed there is some evidence to suggest that, in its current format, it would not apply to mental health units due to differing requirements of tasks relating to the delivery of pharmaceutical care in these settings, which are driven by compliance with various elements of the Mental Health Act 2007(125).

Finally, finite conclusions on how much pharmacy time is needed to deliver patient care may never be achieved because of the intangible nature human response to medicines which impacts on the individual patient's requirement for pharmaceutical care.

8. Validation of the RSPWC

The final objective of this research was to explore whether it was possible to develop a validated pharmacy workforce calculator. This chapter explores the extent to which this has been achieved by revisiting the various elements of validity and reliability outlined in the methodology (see section 4.4) and discussing the study results within the context of these issues. The summary of validity, as presented by Sim and Wright(100) will form the basis of this review.

8.1 'Face' validity

Face validity is the extent to which the tool 'appears' to be valid when assessed by impartial 'experts'. This is important for the credibility of the data generated – if it does not 'look right' then its out-put will not be believed. Face validity for the RSPWC was achieved through presentation at conference. This peer review suggested that at 'face value' the tool was worth developing

8.2 'Content' validity

Content validity measures the extent to which any tool addresses the full scope of the phenomenon being measured. The RSPWC is calculating resource for the delivery of ward based pharmaceutical care. In order to demonstrate content validity it needs to measure of all elements of a ward based pharmacy service. As discussed in the introduction and identified through the literature review, there is no accepted standard model for service delivery. The study sought to identify a consensus nationally on what tasks are necessary for the delivery of pharmaceutical care, how long they take and how often they have to be performed, by which staff groups i.e. to establish an 'activity standard' for the delivery of

pharmaceutical care. The RSPWC algorithm comprises of 74 individual figures. Content validity is robustly demonstrated through the consensus study data for 48 of these (65%) of the elements of the tool on which the algorithm is based this is shown in the green highlighted sections of Table 8.1.

Table 8.1 Content validity of RSPWC

Royal Stoke Pharmacy Workforce Calculator© University Hospital of North Midlands NHS Trust. All rights reserved 2016						
Template for Pharmacy time for delivery of pharmaceutical care to hospital in-patients						
Number of beds on ward				28.00 beds		
Average length of stay				5.00		
Number of patients per year based on beds and length of stay				2044.00 per year		
Extra number of elective patients per year as a result of business case:				0	per year	0.00 per week
Extra number of emergency admissions per year as a result of business case				0	per year	0.00 per week
Extra number of elective patients & emergency admissions per year as a result of business case				2044	per year	39.31 per week
Average number of prescribed items on drug chart				8		
	Standard item	Controlled Drug	Monitored dosage system			
Percentage of items in category	85%	10%	5%			
Dispensing time (mins)	2.4	6.1	3.6			
Checking time (mins)	1.2	2.8	1.9			
CLINICAL ACTIVITY						
ACTIVITY	STAFF GROUP REQUIRED TO PERFORM ACTIVITY	TIME TAKEN ON AVERAGE (per prescription in	ESTIMATED NUMBER OF OCCASIONS ACTIVITY TAKES PLACE PER ADMISSION	TOTAL TIME REQUIRED FOR ADDITIONAL	TOTAL TIME REQUIRED FOR ADDITIONAL CASES PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY
CLINICAL ACTIVITIES						
Obtaining Drug History	MMT	16	1	628.92	10.48	0.28
Check of Drug History	Pharmacist	4	1	157.23	2.62	0.07
Check of PODs	MMT	5	1	196.54	3.28	0.09
Clinical Review of Notes	Pharmacist	5	2.00	393.08	6.55	0.17
Review of Blood results	Pharmacist	3	2.00	235.85	3.93	0.10
Initial review of Chart	Pharmacist	5	1	196.54	3.28	0.09
Initial endorsing of Chart	Pharmacist	4	1	157.23	2.62	0.07
Interventions	Pharmacist	5	1	196.54	3.28	0.09
Subsequent review of Chart	Pharmacist	3	2.5	294.81	4.91	0.13
Subsequent endorsing of Chart	Pharmacist	2	2.5	196.54	3.28	0.09
Completion of Paperwork	Pharmacist	5	5	982.69	16.38	0.44
Ordering of Non Stocks	Pharmacist	3	1	117.92	1.97	0.05
Counselling	MMT	7	1	275.15	4.59	0.12
Clinical Check of TTO	Pharmacist	10	1	393.08	6.55	0.17
TOTAL				4422.12	73.70	1.97
DISPENSING ACTIVITY						
Booking in	ATO	2.5	1	98.27	1.64	0.04
Dispensing time (mins)	ATO or Technician	22.64	1	756.44	12.61	0.34
Accuracy Checking (mins)	ACT	11.16	1	372.87	6.21	0.17
TOTAL				1227.58	20.46	0.55
GRAND TOTAL				5649.69	94.16	2.51

REQUIRED STAFF GROUP	GRADE REQUIRED (According to speciality needs)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY	MID POINT OF AfC GRADE (+22% oncost)	COST
Administrative tasks - ATO	2	98.27	1.64	0.05	19973	£ 1,064.24
Dispensing tasks -TECHNICIAN	4	756.44	12.61	0.40	25683	£ 10,361.37
Accuracy checking and drug history - MMT/PHARMACIST	5	1473.49	24.56	0.80	32090	£ 25,638.56
Clinical activities - PHARMACIST	7	3321.50	55.36	1.90	44225	£ 84,218.85
VALUES ENTERED BY OPERATORTO DEFINE SERVICE				CLINICAL STAFF TOTAL		£ 121,283.02
VALUE CONFIRMED BY CONSENSUS ACHIEVED THROUGH DELPHI STUDY						
VALUE DERIVED FROM MEAN OF STUDY SAMPLE						
VALUE EXTRAPOLATED FROM EXEMPLAR PATIENT SCENARIOS (AVERAGE/DAY OF ADMISSION)						
TOTAL COST FOR CLINICAL PHARMACY SERVICE					£	121,283.02

For a further 18 (24%) components of the algorithm, relating to timing of tasks, consensus proved more difficult to determine on a single figure which is required for the functioning of the algorithm. Values for the RSPWC were confirmed using data values from the study population (amber highlight in Table 8.1). The robustness of this data may be challenged due to the relatively small sample size. The study achieved participant numbers which were sufficient for meaningful consensus data(96) but is underpowered for quantitative and inferential statistical analysis.

The remaining eight (11%) components, relating to the frequency of ongoing review of patients during their hospital admission, achieved a consensus which was 'it depends on the patient'. Suggesting that it was not possible to put a single figure to 'how often' a task should be completed. This is due to the unpredictable nature of patient response to medicines and the requirement of professional judgement on the part of a pharmacist in assessing the need for subsequent pharmaceutical review. This phenomenon is also recognised by Suggett and Marriott(45). Their work investigated the potential to develop a risk score to identify patients that require pharmaceutical in-put by using patient characteristics e.g. age, renal function, drugs prescribed, for patients in whom pharmaceutical interventions had been made. Their review of over 59,000 admissions and the characteristics of the patients involved concluded that whilst a numerical figure could be allocated to each patient, it was neither specific nor sensitive enough to accurately predict pharmaceutical care need. This was reflected in the words of one participant during the semi structured interviews of this study

> *"you could list everything down but it doesn't kind of give you the whole picture of that patient because you have got a squidgy human in the middle of it who it actually all revolves around and that's what makes it challenging"* [P4]

This is also identified in the paper by Scott(75) which identified that normal productivity measures do not apply to medical practice as patient response is often not predictable or reproducible.

This issue is the subject of much debate in pharmacy network meetings, with a divide in practitioner views as to whether one should see every patient every day, to what level that review should be done or whether one should prioritise those patients to be seen, by what method and what risks either approach produces. This is reflected in the data returned on the exemplar patient section of Part 3 of the study.

It, therefore, seems that defining this part of pharmaceutical care in finite numerical terms may not be possible. For the purposes of development of the RSPWC though a figure is necessary. This study began to explore how often the 'average' patient was reviewed and the values for these elements (red highlighted frequencies in Table 8.1) are derived from an extrapolation of that data. This is again limited by sample size and the recognition that there is no agreement amongst experts as to what these values should be.

What must be recognised is that even data from the two extremes of service delivery i.e. no subsequent review of patient to full daily review of patient, are applied to the tool the differential in out-put from the calculator is almost 2.4 times less of that identified from current manager best guess (£57k for no subsequent review v £134k for daily review). So whilst this 'average' might not be absolute it generates a greater level of accuracy of resource requirement that the current available methods.

On the basis of this summary the content validity of the RSPWC has been demonstrated within the identified limitations. Further research on identification of patient need for pharmaceutical care may improve the accuracy of the tool.

8.3 Criterion validity

Criterion validity covers three types of validity; 'concurrent', 'predictive' and diagnostic' validity.

8.3.1. Concurrent validity

This compares a tool with an existing 'gold standard'. The development of the RSPWC has followed the WISN(23) process. WISN is the WHO 'gold standard' approach to calculation of workforce requirements and as such the RSPWC can be considered a 'gold standard method' for the task in hand. There is no current 'gold standard' calculation for pharmacy resource with which to compare the output of the RSPWC. The 'Purkiss Model'(38) is not reflective of current practice. Direct comparison of the RSPWC with current literature requires presentation of results to indicate the number of beds per pharmacist. Following this extrapolation it can be seen in Table 8.2 that the output of the RSPWC matches two of the three reference sources. The outlier in the data set is the figure identified from NHS benchmarking 2015/16(22).

Table 8.2 Comparison of staff resource requirements identified in the published literature

Reference source	Beds/WTE pharmacist
O'leary, Stuchberry & Taylor(40) (Average hospital- wide, average LOS 6 days)	19.5
Onatade, Miller & Sanghera(36) (average across 7 London sites)	18.19
NHS Benchmarking(22)	55
RSPWC (24 bed ward, LOS 6 days, 5 day service)	22

NB For a 28 bed ward with average LOS of 6 days

8.3.2. Predictive validity

This relates to how the prediction of a tool is borne out in reality. Does the RSPWC generate the resource required for the consistent sustainable delivery of a clinical pharmacy service? It was recognised that the study version of the RSPWC

underestimated the required resource as it was based on minimum service standards and did not include the 'unavailable' time recognised as necessary in all workforce calculations. These elements have been addressed and included in the validated tool. Data gathered (Tables 7.29 and 7.30) suggests that the tool does generate the resource needed for service delivery. Predictive validity has been demonstrated.

8.3.3. Diagnostic validity

This considers whether a tool identifies true or false positives/negatives which is not applicable to the RSPWC as that is not the nature of its out-put and so has not been considered in this study.

8.4 Construct validity

Construct validity is demonstrated if out-puts of some elements of the tool can be correlated with values calculated by different methods. This is particularly important if the tool being validated is theoretically novel and this is directly relevant to the validation of the RSPWC.

This has been demonstrated in a number of ways. As previously shown (Table 2.1.) some elements of the RSPWC have construct validity in comparison with the literature. This is particularly relevant for medicines reconciliation which is the single longest task completed for pharmaceutical care and has the greatest influence on the value generated by the tool as it is required for all patients and done consistently in the same frequency. The same can be demonstrated for clinical check of a prescription. Within this study data collection several elements were corroborated by different sources e.g. the consensus established on the activities of MR, POD check and TTO supply within the Delphi part of the study were confirmed and replicated within the exemplar patient section of the research. Construct validity of the RSPWC has been demonstrated.

8.5 Internal and external validity

8.5.1. Internal validity

This requires the computational elements of the model to be proven i.e. are the calculations correct. The algorithm which drives the RSPWC has been checked by an independent reviewer and confirmed to be accurate. These calculations are made available to users for their own verification, as the formulae within the Excel® worksheet are visible to any operator

8.5.2. External validity

For this to be demonstrated the forecasts of a model have to be proved in reality so that its output can be seen to generate realistic figures. This remains difficult to achieve in the case of the RSPWC as the pharmacy workforce has not been thoroughly described and agreed upon previously. With no agreed formula to quantify staffing need, the tool cannot be checked against reality. The results of the study suggest that the RSPWC generates a greater resource requirement than is currently identified by many pharmacy managers; however that does not necessarily make it invalid. In general the managers involved in the study felt that the resource requirements identified by the RSPWC were realistic in terms of need, though a number questioned their ability to recruit to that level. If required staffing levels are not achieved, the question is then raised as to what service you deliver and how that should be risk assessed.

8.6 Transparency

In the field of validation Eddy *et al.*(101) required a further element of 'transparency', requiring the developer to provide users with technical details of how to utilise the tool so they understand the way in which the calculation works and provide sufficient detail so that the computational basis can be checked or developed. This is covered in the case of the RSPWC as instructions for use are provided to a user in the form of a step

wise guide. The majority of users found this easy to follow and the tool quick and straight forward to use. One user was concerned about how the spreadsheet worked and felt that without having full understanding it would be difficult to 'sell' to peers within his organisation. In response to this, further clarity will be provided with the release of the validated tool, along with the summary of the validation results to give confidence to a user of their credibility.

8.7 Reliability

The consistency and reproducibility of the data generated by a tool represents its reliability. The two types of reliability relevant to this setting are considered in the context of the RSPWC.

8.7.1. Equivalence

The tool has to produce consistent measurements in the hands of two or more investigators for equivalence to be demonstrated. Part 2 of this study considered this element. To increase the reliability of the tool the bulk of the spreadsheet was locked from editing purposes – allowing the user to manipulate the minimum required fields and yet allow the tool to function correctly. Equivalence was demonstrated between users of the RSPWC. The risk to validity of allowing operator manipulation of the tool was also illustrated, as the outputs from some operators were not exact due to changing fields within the calculator which were not part of the instructions for the study. However, this manipulation did demonstrate their understanding of how it worked and their ability therefore to apply it appropriately in their setting.

The need to be able to 'bespoke' the tool to a specific setting is a point for ongoing discussion. The 'validated' tool requires limited manipulation by an operator. However, one of the applications of the calculator that has been identified is 'using it backwards' i.e. rather than using the calculator to identify the resource needed to deliver the

service, use it to identify what service can be delivered within a defined resource. This will require a version with increased numbers of unprotected cells to be issued and this needs then to be used with caution as the validity of the tool may be diminished in individual hands. Prospective users need to be aware of this risk.

8.7.2. Stability

This element of reliability – that results produced by one operator remain stable over a period of time - has already been established through routine and regular application at the Royal Stoke. A key assumption of reliability though is that that the phenomenon being measured remains the same between measurements. For the RSPWC this has the implication that as technology progresses and pharmacy practice changes the tool will need to be recalibrated – it will not be a one-time process. In this era of post-Carter Report practice, those responsible for the delivery of pharmacy services are challenged with transforming the service and doing things differently. However, Trusts are not all starting from a level playing field and the value of the RSPWC will largely be in establishing what should be the baseline resource upon which transformation of service is based. It will need to be reviewed when extended pharmacy practice becomes the 'norm' and the impact of the practice of increased numbers of pharmacist prescribers is understood and how that changes the pharmacy services within that model.

8.8 Validity within different healthcare settings

The research question being posed was

"Can the resource required to deliver pharmaceutical care to hospital in-patients be calculated by a single tool applied to multiple settings?"

The outcomes of this study suggest that the answer to this is 'Yes' but only for acute hospital sites.

The tool has been demonstrated as transferable and applicable across district general and teaching hospital settings delivering acute medical and surgical care. This is based on the level of consensus achieved in a homogenous sample of an acceptable size. For other settings e.g. mental health units and community hospitals the tool has not been fully validated. Inadequate numbers of sites were recruited from those settings to generate a consensus, although within the limited sample available it became apparent that processes of service delivery are substantially different. In mental health in particular, due to requirements for compliance with elements of the Mental Health Act 2007, and so different values for the 'activity standard'(23) in the algorithms are required. The development of those could be done with a repetition of this study in a mental health cohort with some minor modification, but is outside the scope of this study.

In addition the tool is also not validated for application in critical care or renal medicine settings. It is recognised that these complex medicines use areas require a different level of pharmaceutical in-put and prior to the development of the RSPWC, nationally accepted patient/pharmacist ratios had been established and continue to be applied. For this reason these areas are excluded from its application. It may be argued that in some tertiary referral centres, general wards have more complex patients than the calculator provides for. This will require local, case by case consideration. Again this identifies the need for the opportunity to 'bespoke' the tool and the need for further research to explore the 'it depends on the patient' element of frequency of review.

8.9 Validation summary

Following review of the results of this study the RSPWC has demonstrated most elements of validity in calculating the resource required to deliver pharmaceutical care to hospital in-patients in acute hospital settings. The out-put from the tool is however

only a model and should be interpreted in the context of the situation in which it is being applied.

9. Discussion

The overall aim of this study was to explore whether a tool, developed to calculate the staff resource required for delivery of pharmaceutical care to in-patients at a RSUH, could be applied to equivalent services delivered at other hospital sites (see Chapter 3, page 60 for aims, objectives and research questions of this study) . A number of research questions were posed around the equivalence of the pharmacy service at RSUH to those in other hospitals. The results presented of this study in Chapter 7 have demonstrated that the service model on which the RSPWC is based is representative of those in other sites. Where consensus was achieved on tasks, times and frequencies, these matched the RSPWC. In those areas where sufficient consensus could not be achieved from the study population, the components of the RSPWC were amended to reflect national best representative figures. This allows the RSPWC to be used to calculate resource in different acute hospital settings, both district general and teaching Trusts. The applicability of the RSPWC to other settings e.g. mental health and community hospitals was not established and there is some direct evidence to suggest that it may not apply in mental health trusts. However, the model could be adapted, through establishment of different activity standards. The validation of the RSPWC was covered in detail in the previous chapter.

This chapter will discuss the results in the context of the study objectives and research questions, in relation to the wider literature and assess the place of the tool in the context of the current political landscape. In addition, limitations to both the study and the tool itself will be considered, along with the implications of reflexivity and the role of the 'researcher-practitioner' in this type of research. Finally further work suggested by these findings will be described.

9.1 Discussion of results in the context of the study objectives

The study objectives fell into two sections. The first two study objectives related to the development of an evidenced-based pharmacy staffing calculator using the WISN (23) methodology and the remainder of the objectives related to the validity and transferability of the resultant tool in different settings.

9.1.1. Objective 1: The development of an 'activity standard' for pharmaceutical care

The first objective in developing a staffing calculator based on the WISN(23) approach is identifying an 'activity standard' for pharmacy i.e. a description of the tasks required to complete the 'job' for one patient so that it can be extrapolated for all patients in the specific population. WISN requires this activity standard to be agreed by 'experts in the field' and this approach has been applied to other professions in the NHS(18,20) but has not been previously been applied to pharmacy services. The method was utilised in this study by creating a 'virtual' panel of experts and establishing their consensus in an electronically-applied, two-round Delphi consensus study(52). The study population met the accepted size for consensus to be established within homogenous groups(96,97). It can, therefore, be demonstrated that the *process* of establishing the activity standard was evidence-based and recognised in national and international approaches to staffing calculations.

When considering the detail of the 'activity standard', consensus was achieved on more than two thirds (65%) of the components of the clinical pharmacy service and the list of tasks and the staff groups to deliver them were almost unanimously agreed. A number of additional tasks were identified by the participants that were not included in the RSPWC, but none of these reached the predefined level of consensus to be included in the calculator at this stage. However, two of the identified tasks, namely referral to community pharmacies post-discharge and pharmacist independent prescribing, were

included in the 'Carter metrics' i.e. activities that are to be measured as part of progress in the Hospital Pharmacy Transformation Plan(21). This will require review over the next couple of years as it is likely that these activities will become more common-place in clinical pharmacy services, if they form part of the measurement of 'what good looks like'. However, during that time other duties (particularly relating to supply functions) might be lost through out-sourcing or collaboration and the resultant time for the activity standard remains fairly constant i.e. one task is simply replaced by another. The 'activity standard' will then require review and possible updating.

The time the tasks should take was more challenging due to the continuous rather than discrete nature of time data and the need to identify a specific number for the purpose of developing an algorithm. Consensus was reached on a specific number for several tasks but for others it was necessary to triangulate two or more of data sources to generate a 'national best representative' figure. It was the 'frequency' of the tasks that proved the most difficult to identify for an activity standard and consensus, or at least plurality, was achieved for all task frequencies. In multiple cases, however, that consensus was that it 'depends on the patient'. Again this proved problematic for the purpose of identifying a specific figure for an algorithm, but this was explored further using exemplar patient management (participants identifying frequency of activities for different patient cohort scenarios) and qualitative interviews to understand the participants' perspectives on the management of the 'typical' or 'average' patient.

From this process a 'frequency' was derived for each task and the activity standard for the delivery of pharmaceutical care identified. This could be criticised on the grounds of using small respondent numbers but there are a number of defences to such criticism, supported by the literature. Firstly, the subject of patient acuity and prioritisation is of increasing interest to the pharmacy profession, with several research teams trying to identify the 'magic' number(45) or a successful tool to direct pharmacist activity(47)

with little current success. The work by Suggett and Marriott(45) considered 59,000 admissions - sample size was not their limitation - but their work demonstrated that the 'magic number' was at best elusive. The work by Hickson(47) *et al.* suggests that, even if a tool to direct pharmacist activity were developed, pharmacists do not necessarily follow it because their use of 'professional, clinical judgement' which has not been fully described. Indeed, as this study identified, whilst delivered by scientists, there appears to be an "art" to clinical pharmacy, the "*squidgy human in the middle of it ..... makes it challenging"* (P4) and this phenomenon is not yet fully understood. This part of the study could have included further participants, but the evidence suggests that the 'magic number' might still have proved elusive(45). Pharmacists may be, by nature and training, focussed primarily on accuracy and detail; it is what makes them safe and able to fulfil their professional role. The difficulties faced in identifying a specific number for the frequency with which some tasks are completed for patients might result in it being put into the 'too hard' pile by some members of the profession This might lead to the RSPWC being discounted. However, as was identified by Ghosh and Cruz(27), whilst striving for perfection and precision in identification of staffing levels, there is a need for a pragmatic solution to act as a starting point in the here and now. Such a pragmatic approach was taken with RSPWC and the resource generated by the algorithm, using the activity standard identified through this extrapolation, produces resource results which appear to sit comfortably within the range of those already being requested in reality by pharmacy managers nationally. So the view could be taken that the challenge to dissenters should be to *disprove* these figures, as there is no other method currently available. This should either generate a more accurate calculator or confirm the figures in the RSPWC. It is therefore suggested that an activity standard for acute hospital pharmacy has been identified that can be applied to the relevant patient population and therefore the study objective relating to the establishment of an activity standard has been met.

The application of the activity standard to pharmacy services in other healthcare settings has not been proved for a number of reasons. Primarily the study population did not include sufficient numbers of representatives from mental health or community health trusts for consensus to be deemed to have been achieved for these types of settings. Moreover, those participants from the mental health sector identified a number of key differences, both in service structure, out-sourced dispensaries, typically increased length of stay and prevalence of electronic prescribing, and legislation documentation required under the Mental Health Act 2007, which rendered the timings and frequencies of tasks unrepresentative of their service. The clinical task list however was agreed by these participants and it is therefore postulated that the approach could be repeated with a larger sample of staff from this setting to identify the activity standard for mental health pharmaceutical care. However, this was outside the scope of this study. Objective one of this study has therefore been met by the identification of an activity standard for the delivery of pharmaceutical care in acute hospital settings.

9.1.2. Objective 2: The identification of 'unavailable' time

Objective two required the identification of 'unavailable' time inherent in the employment of staff i.e. that time when they are not available for direct patient care for whatever reason, so that the WISN method could be employed. For each staff group this needed to be described; it is necessary to understand this variable as, without it, the staff resource would always be insufficient to deliver a sustainable service. The participants identified very similar figures for the junior grades (Agenda for Change bands 2-7) but a wider variation in available time was seen for bands 8a and above. This seems reasonable since the justification of a post at Agenda for Change 8a is often on the basis of the delivery of wider roles than just on routine ward service delivery. This staff grade is generally involved in guideline development, governance issues, financial analysis of medicines expenditure and, increasingly,patient consultation in out-patient

clinics i.e. their work time is only partly based on delivery of ward services. For this reason the RSPWC utilises AfC Band 7 as its standard ward pharmacist grade. There may be scenarios where lower or higher grades of staff can/need to be utilised(44) and these can be substituted in the calculator with the relevant 'unavailable time' by grade identified. The validated version of the tool allows this modification to be made by the operator.

The completion of these first two objectives i.e. the identification of an activity standard for clinical pharmacy and the 'unavailable' time inherent in employing pharmacy staff, allowed the derivation of the algorithm to drive the calculator to generate a resource for the delivery of an in-patient pharmaceutical care service. All of the research questions posed (see page 60) were also addressed by the completion of these objectives.

i. It has been demonstrated that the delivery of pharmaceutical care at other sites does appear to require the completion of the same task list as at RSUH.
ii. In broad terms pharmaceutical care activities appear to take the same time at other sites, though there were some challenges as previously discussed. The impact of automation on these processes was explored and it was demonstrated that use of electronic prescription and administration programmes is still not wide-spread. Where they are employed, some tasks are reported to take longer (e.g. chart review) but others reported to be quicker (e.g. MR). Automated dispensing is more common, particularly amongst the teaching hospitals and the data here suggests that whilst the overall process of dispensing and checking is accelerated by use of automation, dispensing takes longer. This seems illogical and so is discussed in more detail in the discussion of the limitations of the study (see section 9.4). However, the implications of these technology developments are not yet sufficiently universal to require modification of the RSPWC at this time, though they will require review over the coming years.

iii. It has been demonstrated that the use of skill mixed teams to deliver services is common across different services, with many places utilising the skills of the pharmacy technician team in the same way as at RSUH.

iv. The question as to how often the pharmaceutical care tasks are completed was more challenging to answer and this has already been discussed earlier in the chapter. Finally, it was demonstrated that consensus on the activity standard for pharmaceutical care was reached.

The remaining objectives considered the place of this calculator within the context of current service delivery.

9.1.3. Objective 3: Exploring current staffing levels at participant sites

To demonstrate the transferability and applicability of the RSPWC to other healthcare settings, it was first necessary to understand the processes being used currently by pharmacy managers and the value (£) of the resource they would routinely request to deliver pharmacy services. When asked to identify this necessary resource for specific scenarios a substantial variation was identified across the participant population (£15,000 to £150,000 – Table 7.11). This seems to be an example of 'unwarranted variation' as described by Carter(21), but why this should be remains unclear. A simple answer could be that non-comparable services are being delivered, i.e. this data is comparing 'apples with pears' as pharmacy managers across the country have differing views on what service should be delivered and so ask for different levels of funding. However, the initial part of the study demonstrated, through strong consensus for the majority of components of the algorithm that all participants appear to have the same understanding of the service that should be delivered, but that this is not translated necessarily into the identification of the same level of resource with which to deliver it. A number of reasons may be postulated to explain this variation. It might be that new

requests are based on historic agreements e.g. where funding has been low in the past, managers asking for what they think they might get, rather than what they actually need. Alternatively, it may be simply that they perceive no way of objectively calculating the resource that is needed to deliver the service. The best-guess 'finger in the air' technique of identifying staffing requirements was certainly recognised by the participants in the qualitative section of the study. The reality of service provision seems to be that, whilst pharmacy managers largely agree on the standards of care that should be achieved, patients across the country will tend to experience different levels of service. The challenge is how to standardise care to remove the 'unwarranted variation'(21) against standards? The first step for this seems to be to set standards and then identify the gap or excess in the current models. The values generated for a clinical pharmacy service using the RSPWC sit around two thirds of the way up the range (table 7.11). They are not excessive, but are substantially more than many sites currently request or receive, whatever the reason for that might be. If the profession is being asked to standardise, then the RSPWC may be the first step in this process, though it might not be the final destination.

9.1.4. Objective 4: The transferability of the tool to different operators

For the RSPWC to be part of the establishment of national standards, demonstrating the transferability of the tool between operators is required, i.e. completion of objective four. This was not as straightforward as might have been expected or hoped since the 'right' answer was not generated by all operators and differences in degree and cause of 'wrongness' were found in each of the three scenarios. This needs to be explored to understand the implications for the RSPWC in practice (see Table 7.28). One participant failed to follow the instructions in the questionnaire for any of the scenarios and only provided a narrative to their approach rather than a value that had been produced by using the calculator. This participant appeared to have understood the scenarios as this

was demonstrated in the resource they identified in round 1 of the Delphi study, but reasons for not following the instructions in the questionnaire were not clear. Their response might have been based on finding that 'knowing' how much resource was needed (in reality the calculator identifies substantially more than they requested in round 1) might in some way be too uncomfortable professionally or morally and so blissful ignorance was a better position to maintain i.e. they knew they did not have enough staff, but did not want to know the size of the gap. This response was not explained during the course of the study and whilst recognising the need to ensure clarity in instruction in further issues of the RSPWC, this participant was considered an outlier in this section and is excluded for the purposes of this discussion.

If we then consider the three scenarios separately, a number of different issues were identified (Table 7.28). In the first scenario, which was the simplest – a ward, with a set number of beds and a specific length of stay – 80% (n=10) of operators generated the 'right' number – the 'wrong' figure was because two operators chose to amend elements in the calculator that were not in the instructions (this will be discussed shortl). In scenario 2, a change of patient cohort with a reduced length of stay generated greater variability in answer. The 'right' answer was produced by 60% of operators, three did not complete the full process of calculation outside of the RSPWC and another made active changes to the data entered into the tool. Finally the greatest variation in response was seen in Scenario 3. This was the most challenging situation – the addition of a cohort of patients to an existing ward - and one which in the first round questionnaire generated the most diverse answers, based on diverse approaches to dealing with this question. Once more 60% (though different operators from Scenario 2) produced the 'right' answer, one operator did not follow the mathematical instructions, one changed the variables and two generated 'wrong' answers for which the error could not be explained. The issue of not following the mathematical instructions in the user

guide suggests that greater clarity may be required prior to its wider release. A worked example might be helpful in demonstrating the 'ball park' figure – then 'wrong' answers could be more easily identified by users. If one does not know what is 'right' then one is less likely to know when one is wrong. These operators all demonstrated that they could use the calculator correctly and that it produced the same figures when they did so. What they did not do was then use those figures correctly or fully to complete the calculation i.e. to identify the change in resource required (new service value minus old service value) rather than just calculating the post-change figure.

The diversity of response in Scenario 3 reflected that of the earlier stage. This is a scenario with which pharmacy managers may not be comfortable with or clear on how to approach. It is typically one where, historically, funding may not been considered for pharmacy. Indeed managers may not have had the opportunity to ask for funding (see table 7.30 "we'd be expected to absorb into existing establishment") as the impact for pharmacy only may be considered if the form of the service is clearly understood. That pharmaceutical care is delivered to *patients,* not to *beds* and the bed numbers might be unchanged, but the numbers of patients in those beds over time has changed. If this is not identified then there is a risk that pharmacy staff numbers may not grow alongside activity, although Fitzpatrick and Sanders(49) suggest that this has not happened in the NHS over the last five years, when they revisited their earlier benchmarking project. However, this validation study suggests that the diversity within pharmacy managers in responding to service developments within their organisations is another 'unwarranted variation'(21).

Finally the amendment of data input into the RSPWC by a number of operators serves to further highlight inconsistencies in service provision and the apparent desire by pharmacy managers to do things in their own way. If this is so, these modifications were made because the RSPWC did not quite 'fit' their model, or in the words of one

participant “it didn’t take into consideration our local nuances”. This raises the question of the balance to be struck between validity and adaptability, since it was recognised by Sim and Wright (see section 4.4) that to demonstrate the ‘equivalence’ element of reliability, a tool must produce the same results in the hands of different operators. They identify that ‘equivalence’ is improved when manipulation of the tool by the operator is limited. This is demonstrated in these results of this study, where operators change more than is instructed, and the ‘wrong answer’ is generated and the tool’s validity is undermined. This can be rectified by restricting modifications of input by operators to a minimal number of data sets for example, to number of beds and length of stay, but then the results might not reflect the service delivered in that locality and the tool is seen as lacking adaptability of application to services in transformation. Perhaps the more challenging question for pharmacy managers would be ‘is your service delivery model right?’ If one finds one’s service does not ‘fit’ a model, with service specification components that have been validated nationally by your peers, rather than amending the model, perhaps there is a need to review the service delivery model i.e. to reduce the ‘unwarranted variation’. There is substantial evidence that clinical pharmacy improves outcomes for patients and has positive impact on finances of medicines use(5,8,9,126). However, this evidence was based on delivery of specific clinical pharmacy services. If the model of delivering that care is modified as per Wallestedt, Bladh and Ramsberg(54) then it cannot be presumed that the outcomes remain constant. Pharmacy managers need to consider the impact on patient outcomes when they modify their service delivery approaches. Overall, this element of the study demonstrated that with appropriate instruction, participants are able to use the RSPWC to generate consistent values.

9.1.5. Objectives 5 and 6: To explore the utility of the tool in different healthcare settings and reasons for outlying data

The applicability and utility of the RSPWC in other practice settings was further investigated through the qualitative stage of the study, which addressed objectives five and six. Most sites described the used of skill mixed teams of pharmacists, technicians and assistant technical staff working in co-located wards to deliver pharmaceutical care, including the supply components close to the patient. The 'unwarranted variation'(21) does not seem to be apparent here. In Trusts with multiple smaller sites, in particular the mental health trusts, skill mixing was less apparent and this was driven by the practicalities of logistics, rather than by opinion on best practice.

Across the whole sample it was identified that perceived insufficient staff resource was a challenge to all participants, regardless of size of Trust – again no apparent 'unwarranted variation'. The cause of this insufficiency was multifaceted, with finances only one element of the problem. Geographical location was reported as being problematic for attracting staff to work in some localities, in which instance even a fully funded service may be unlikely to solve this problem. Such instances tended to be in remote or isolated locations, or those in which too close a proximity to large teaching trusts that were reported to result in pharmacy staff moving to the more 'exciting' or varied working environment of the large Trusts. However, even participants from these larger organisations reported staffing challenges. They identified that the rapid increase in extended roles for pharmacists(127), as their expertise is beginning to be recognised and exploited, seems to be generating a skills void which the profession is struggling to fill in a timely manner, and this appears to be at both ends of the spectrum. Training of pharmacist independent prescribers does not appear to be keeping pace with the rate of expansion of roles and junior staff are not coming through quickly enough, with the right skill set to fill the gaps left behind. This challenge is recognised by the profession and was discussed at a recent 'Workforce Summit' at the Royal Pharmaceutical Society(128).

The conclusion of that discussion was there is an urgent need for integration and collaboration across existing professional boundaries i.e. hospital pharmacy and community pharmacy, pharmacists and technicians, alongside the need for investment in funding and access to training of staff with the correct skills to deliver the service.

The drive throughout the NHS to deliver a '7-day service' to meet the standards for patient care set out in the Keogh report(129) appear to have brought substantial financial pressure to bear on hospital Trusts and several participants reported that they had been required to deliver these extended services within existing resource. In such cases, existing staff resource is now being spread even more thinly across 7-days. Participants also reported that introduction of 7-day working, combined with the emergence of roles in GP practices, which may be attractive because usually they do not have the requirement for 7-day working, has resulted in the loss of experienced hospital staff, which has added further to staffing pressures. What therefore it is the place of the RSPWC in this context?

Participants identified the value of the tool being objective and based on "fact not feeling" (see Section 7.5.3) and that it required little data collection at a local level to allow staffing calculations to be made, which is supported by Hurst *et al.*(20) who identified the need for a simple to use tool, requiring minimum local data entry. The pharmacy managers in the study identified applications both in identifying resource requirements for new business, but also in reviewing existing staffing levels against current activity to identify, objectively, where and how large the staffing gap was. They recognised that this would in turn allow objective and tangible decisions to be made about what could or could not be achieved with the available staffing resource. The ability to potentially use the tool 'backwards' was seen as a way of supporting this decision i.e. rather than identifying the resource needed for the number of patients, it could be used to identify the patients that could be managed with the available

resource. This then leads on to the question, if you are not going to do the full 'job' for every patient, what jobs do you *not* do or which patients do you *not* see? This is one area where consensus was not fully achieved and individuals often took diametrically opposed views. It appears therefore from this study that some of the 'unwarranted variation' is not driven from disagreement amongst pharmacy leaders as to what care needs to be given to patients, but rather about how to deliver this care when you do not have enough staff to do deliver the same level of pharmaceutical care for every patient.

Recognising that there may be insufficient resource to see every patient, every day, this research explored participants' perspectives on what makes a patient a priority for a pharmacist and how one identifies those patients. Pharmacists in this study independently identified the same patient characteristics included in a Scottish pharmacy prioritisation tool(46) and similarly reported that these patients should be reviewed daily by pharmacists. If prioritisation of patients is to occur, the identification of those with greatest need within the hospital environment is the next challenge. The recent work by Suggett and Marriott described earlier(45) identified that patient characteristics alone do not appear to be sufficient and that there seems to be need for some sort of 'pharmacy triage' of patients. Hickson *et al.'s* work, however, suggests that a triage process will not always be consistently applied(47) because the patient is an individual and responds to illness and treatment individually i.e. the so called "squidgy human" effect. Predicting which patients have to be seen is one element, knowing where they are in the Trust once they have been identified is another that was raised, and the need for electronic systems that allow these patients to be tracked though their hospital journey was identified. Without this, services are likely to remain inherently inefficient, by using valuable manpower to add limited value to the patient care.

Whilst many of the opinions expressed by participants supported the development of the RSPWC, a number of challenges to both its construct and application were made in

the qualitative stage of the research. The issue of "it doesn't take into account local nuances" has already been discussed, but another was the view that the 'best guess' approach to how long tasks take is based on the experience and training of a pharmacy manager and that these might not reflect the practice of junior members of the team. The inference being that the managers' 'best guess' may underestimate the time pharmacists take to deliver the service in reality. In response to this challenge, in the original development of the tool(12) the time and motion study which identified the times for the tasks was conducted across a range of wards and staff groups and represented a mean time for each task. In this study, mixed data sources have been used including existing local data, where available, and with reference to published timings in the literature. As such, this triangulation reduces the risk of under-estimate and associated under-resourcing of services.

Another frequently mentioned challenge was the inclusion of dispensing activity in the RSPWC, which was expressed as dispensing activities not being 'clinical' and therefore not associated with pharmaceutical care and the issues around these being 'infrastructure' tasks as defined by Carter(21). A defence of the original inclusion of this activity in the RSPWC is based on the definition of pharmaceutical care(2) which focussed on the management or avoidance of 'drug [medicines] related problems' (DRPs). These were outlined by Strand *et al.*(3) (see Table 9.1). Of the 10 DRPs, one they identified was 'the patient does not have a supply of the required medicine'. This suggests that all the 'clinical' activity to optimise medicines in terms of evidence-based drug choice and titration of dose, will be to no avail if the medicine is not available to be administered.

Table 9.1 Drug related problems (adapted from Strand *et al.*(3)) and their management

Drug related problems	RSPWC tasks that facilitate management
Untreated medical indication requiring drug therapy	Review of medical notes
Too little of correct drug prescribed	Drug chart review Blood results
Patient not receiving the prescribed drug	Drug chart review Order of inpatient medicines Supply of discharge medicines
Too much of the correct drug is prescribed	Drug chart review Blood results
Adverse Drug reaction	Drug chart review Blood results Review of clinical notes Speaking to the patient
Drug interaction	Drug chart review
Drug treatment with no valid indication	Review of medical notes
Wrong choice of drug	Review of medical notes Review of drug chart
Compliance with prescribed regimen	Review of drug chart

This view is further supported by the National Patient Safety Agency alert relating to missed doses(130) and with the move towards 'near to patient' supply of medicines as an accepted pharmacy service model it was deemed appropriate in this study to combine the pharmacy workforce requirements to deliver the whole patient-specific pharmacy service.

The supply of medicines is, therefore, fundamental to the delivery of pharmaceutical care, but the Carter review(21) poses a different challenge that does not detract from the importance of efficient supply of medicines; rather it questions who should be fulfilling that role. The suggestion is that highly skilled hospital pharmacy staff should be focused on direct patient-facing care activities and that the supply function could be efficiently delivered by a third party supplier. This might be through out-sourcing to a commercial partner or through greater use of pre-prepared patient packs, produced by a centralised manufacturing unit supporting a number of different sites. This provides

an argument for removing the supply activities from the workforce calculator, but, on balance, it was considered appropriate to retain this element for the 'validated' RSPWC for a number of reasons

- These are tasks that currently have to be delivered and so it remains important to identify the current resource required to do so
- If this element of the service were to be 'out-sourced' then any commercial partner would need to understand the volume of workload involved for delivery of the business for which they are bidding
- If this element were to be out-sourced then it would allow identification of the size of the workforce that could be released for other duties, which in turn may reduce the gap between resource and clinical pharmacy workload identified (assuming these staff were retained by the Trust)

As such, it seems prudent that the staffing associated with the dispensing element of the calculation should be clearly identifiable to allow the above judgements to be made without the need for complex further calculation by individual managers.

The final challenge to the RSPWC that was identified was that the increasing presence of pharmacist independent prescribers may impact on distribution of clinical tasks and therefore the resource needed to deliver them. This seems largely dependent on the source of funding for these prescribers i.e. different models will have different impact. For example, a prescriber funded as a separate role by a clinical speciality, to replace a junior medic or advanced nurse practitioner, would be in addition to the 'pharmacy team' on the ward. In this model it is unlikely that there would be a need to include any other clinical pharmacist time in addition to the prescriber for the medicines reconciliation and clinical review activities. In this scenario you could redirect clinical pharmacist time to ward areas without a pharmacist prescriber and the algorithm for this model would then be different. Alternatively, along Carter report principles,

removing the supply elements from the team may allow realignment of tasks to different staff groups, which then frees pharmacist time to undertake the prescribing. Other service delivery iterations are possible and so it is likely that the RSPWC will have to be revisited once the extent and shape of the impact of pharmacist prescribing and post-Carter service transformations are more fully understood. This reflects the view of Gorin(98) that validation is an ongoing process and will never be a 'job done'.

If the RSPWC is to remain relevant for more than a couple of years then the ability of operators to 'bespoke' the tool to explore the resource implications of different models will be necessary. It is therefore proposed that there are two versions of the RSPWC published. The first will be the fully validated standard as described in Chapter 8. All, but the essential local data entry fields of patient and bed numbers, length of stay and prescription size and type, will be locked and 'un-editable'. This then forms a baseline, a starting or reference point. A second version of the RSPWC would have an increased number of editable fields but changes to service from this baseline would then be recognised as a departure from the validated version and allow objective consideration of the potential service risks and benefits of doing so.

However, since the definition of pharmaceutical care has remained unchanged for almost 30 years(2) and the delivery of pharmaceutical care is the primary objective then it would seem to follow that the elements of the RSPWC that are linked to that definition should remain fixed. These are the tasks and the part of the tool which had the strongest consensus in the research (see Table 9.1). The times, which are based on time and motion data, consensus and literature should remain constant. It is acknowledged, however, that as technology advancements are more widely implemented these too will in time require review. It is, therefore , that the elements of the RSPWC that should be 'editable' are the staff group and grade to deliver the task, which will facilitate skill mix and, perhaps most importantly, the frequency with which

tasks are completed. This is acknowledged throughout the profession and found in this study to be the greatest variable due to the patient acuity issues discussed previously. This would allow adaptation by patient groups relating to acuity and recognition of 'out-sourcing' of specific functions by allowing the frequency to be zero. This approach would be expected to allow sufficient flexibility for practical application in current service settings, whilst retaining the core elements on which consensus was reached. This will remind the manager that if a task is not to be done any longer, they need to consider either alternative options for service delivery, or identification and mitigation of risk.

In summary, the aims and objectives of this study were achieved. A validated workforce calculator has been developed, its transferability to other operators established and its applications identified. The need for users to be able to make some modifications to the tool to ensure relevance to practice has been discussed. Finally, it is recognised that validation of the RSPWC is not a one-off activity and it will need to be reviewed in the light of changes to practice due to technological advancements and impact of the implementation of the Carter review.

The final objective to be considered was that of the development of a validated tool which has been discussed fully in Chapter 8.

The study results have been discussed in the context of the intended aims and objectives and this discussion now focuses on the consideration of their place in the published literature and their implications for pharmacy practice within the current political context.

9.2 Discussion of study results in the context of the literature.

Within the previous section the findings of this research were considered in the context of the fulfilment of study objectives and references were made to relevant literature as

part of that discussion. A broader review of the results and their implications and place within the broader literature is now discussed.

Across the wider healthcare workforce literature several parallels to this study can be found. The methodology used has already been discussed in the context of WISN(23) and therefore the evidence-base nature of the approach used in the construction of the RSPWC has been demonstrated. There is no published version of the application of WISN to the pharmacy workforce and, therefore, this study is novel in both its construct and findings. Ghosh and Cruz(27) described their approach to workforce calculation in their work on nursing workforce in Oman. As with the RSPWC, their calculator allowed the calculation of staffing requirements from a strategic perspective that could facilitate modelling of different workforce needs dependent on service structure, rather than a shift by shift, operational tool. However, they have reported no evidence supporting validity or transferability of their calculator to different settings, which has been demonstrated for the RSPWC. In addition the use of their calculator requires detailed data entry by individual users.

Hughes *et al.*(30) demonstrated the impact of 'admission, discharge and transfer' (ADT) of patients on nursing workload. Whilst their 'multipliers' for these activities are not fully evidenced, it was shown that nurses look after patients rather than beds and that increased numbers of ADTs were associated with increased workload. Unlike Ghosh and Cruz(27) they built this into a tool to calculate operational staffing. The impact of ADT on staff workload is reflected in the findings of the RSPWC study. If the time required to deliver all tasks once for a single patient is considered, this amounts to 113 minutes. Of this time 95 minutes (85%) are required for ADT activities (i.e. MR, POD check, initial review and endorsement of notes and drug chart, clinical check and supply of discharge medicines). Each of the other tasks (subsequent review of notes, chart, patient counselling) would have to be completed five times to have the same impact. Given the

average length of stay for in-patients in hospitals is falling(131) and that there is no agreement from UK study participants as to the appropriate frequency of patient review (see Tables 7.3 & 7.17-7.22) it can be seen that the greatest consistent workload for pharmacists is also in ADT activities. This adds to the justification of workload being calculated per patient admission, rather than by bed and,whilst there may be some value in perfecting the frequency of patient review figures in the RSPWC, the impact of this is unlikely to substantially change the overall value of resource identified

The approach by the team led by Hurst(20) in the UK reflects that used in the development of the RSPWC; their tool too has been demonstrated as applicable across multiple sites, although, unlike the RSPWC it can be used to calculate day to day resource requirements based on census and acuity measurements. Of particular not, however, is the adoption of this work by the NHS Employers website as a standardised tool for identifying nursing workforce requirements(18). This website does not have an equivalent for pharmacy yet and this may be a place for the RSPWC in the future.

The approach recommended by Flynn, Kellagher and Simpson(31) also provides some direction on the possible applications of the RSPWC for the pharmacy profession. Her paper suggested the triangulation of professional judgement with a calculator tool and a review of quality measures. The RSPWC provides the tool, which can be used with the professional judgement of managers. What is missing for pharmacy is agreed quality and outcome measures i.e. what does 'good' look like(21). The risk as identified by Schoo *et al.*(32) is that if the development of these standard outcome measures is not established by the profession, sub-optimal measures will be externally imposed.

Further consideration of this study in the light of the paper by Schoo(32) demonstrates that the priorities they identified for workforce calculation methods for AHPs have been addressed in the development of the RSPWC. Namely, that it is simple to use, only requiring limited, available data to populate the calculator for individual settings. It is

technically acceptable to the managers who will use it, i.e. it reflects the service they deliver. It is comprehensible to lay users i.e. business managers can understand how it generates the values and, finally, it will be flexible in its application for this period of transformation.

A key challenge for AHP workforce calculation identified by Schoo came back to the lack of consistency in service delivery models and, therefore, the belief that calculations have to be done at a local level which prohibits effective benchmarking, an opinion echoed by Rough(51,52). This was reflected in the results of the qualitative part of this study, with participants suggesting that the RSPWC may not address the 'nuances' of a service. However, there is evidence that this challenge is unfounded and that clinical services are probably more alike than might at first be considered(36).

The study by Onatade, Miller and Sanghera(36) ran concurrently with that of the validation of the RSPWC and they, therefore, describe a service provision that is contemporary to the development of the RSPWC. This is important as much of the published literature are historical papers from the US, which may, therefore, not describe comparable services. Their task list was independently compiled and matches the activities in the RSPWC, and the service they described in their introduction reflected that of contemporary practice at RSUH. None of their participant sites were part of my study and so there is no 'double counting' of participants – their data could therefore further supports the results of the current study in terms of task/frequency consensus. They demonstrated across three Trusts and seven different sites that the service description was consistent, but the staff resource to deliver it was widely different. The statistically significant different elements they described were the frequency with which activities were completed, which reflects the data from my study. Reasons for these differences were not discussed, but the evidence presented identifies substantially higher staffing levels at those sites that delivered the activities most

frequently. It therefore may be postulated that the higher frequencies of activity may be driven by already having the resource to deliver them. A counter theory is that this is driven by patient need and maybe the different patient cohorts at their different sites warranted different levels of care, which has subsequently driven different staffing levels. However, as demonstrated by Suggett and Marriott(45) and Hickson *et al*.(47), the means of consistently identifying patient specific pharmaceutical need has not been established and tools are not consistently applied. The argument, once again, returns to demonstrating patient outcomes for the service provided. This paper generates as many questions about the current delivery of pharmacy services in the UK as it provides answers; however, its results are supportive of those of the study validating the RSPWC, adding to its external validation.

The work by O'leary, Stuchberry and Taylor(40) in the Australian pharmacy literature is closest to the development of the RSPWC in terms of tool construction and out-put. Once again the task list concurs with that in the RSPWC and many of the timings of these activities are aligned. The frequency with which they complete these tasks is specified as daily in the Australian national standards(42) a level of clarity which is not found in the UK. The RSPWC however extends this work to consider patient through-put (not just bed numbers) and the role of registered technical and support staff, as well as the delivery of medicines supply functions and allows calculation of staff for specific patient cohorts, as full wards or limited number business cases.

When the literature relating to pharmacy productivity(35,48) is reviewed in the light of this study's findings, a full comparison cannot be drawn. The RSPWC effectively only provides one half of the equation, i.e. the workforce figures and not the output measures. However, the basis of the productivity measures in both of these published studies(35,48) is the 'budgeted staff costs' and in neither paper is the method for the calculation of the baseline budget described or evidenced. The RSPWC would,

therefore, allow a baseline staffing resource to be accurately calculated in a future productivity paper. This would then need to be considered against an output data set to calculate productivity. So whilst not adding to the literature in this field per se, the RSPWC may improve the quality of similar UK papers in the future.

The validation of the RSPWC was a descriptive consensus study, conducted over 22 sites across the UK (excluding Northern Ireland) and consisted in the main part of acute hospital Trusts. It was run in a parallel timeframe with the NHS benchmarking work(22) which allows a number of comparisons to be drawn and may result in a number of limitations. Compared to the NHS benchmarking work mine was a smaller study (22 v 157 participant sites). The mean number of beds per participant site was larger in this study (1072 v 700 beds/trust). This is a likely reflection of the prevalence in participation of acute and teaching hospitals. Of the evidence based pharmacy services described by Bond and Raehl(9) only medicines reconciliation is considered specifically in the NHS Benchmarking data, with a national average reported of 67% of patients receiving MR in 24 hours. Of particular note is that, on average, trusts have 68 hours of pharmacist time per 100 beds each week. If this is converted to beds/WTE pharmacist (AfC contracts 37.5 hours/week) this equates to 55 beds/pharmacist. There is no indication of activity through these beds and this has already been discussed as being a methodology that underestimates resource(27,30).

Accepting the inaccuracies in resource identification that is generated by the use of beds/pharmacist, comparison of this data across the literature and this study's results is useful (see Table 8.2). This serves to demonstrate the potential level of under resourcing in the pharmacy services across the NHS, the extent of the imbalance between London and the rest of the country and the relative place of the output from the RSPWC. This also highlights the risks of using benchmarking data without robust outcome data with which to assess productivity. .

Having discussed the study results in the context of the objectives and the broader literature it is also necessary to consider their implications for pharmacy practice within the current political climate.

9.3 Discussion of implication of results for practice

As has been previously described (see section 2.5) pharmacy practice literature suffers from a lack of consistency in service terminology and study methodology, making comparisons between results difficult. The validation of the RSPWC has gathered, for the first time, a full set of time and motion data, from multiple sites, for the full scope of clinical pharmacy activities required to deliver pharmaceutical care to hospital in-patients and, therefore, sets a benchmark for future comparison.

The results of this study have been discussed in the context of its original aims and objectives, which have been demonstrated to be met. Their place in and contribution to the body of literature on this subject has been considered, but what are the implications of these results in professional practice, within the current political context?

Over the past four years there have been three key government reports into healthcare provision which set the backdrop for this research. In 2013 the Francis Inquiry into the conduct of the Mid Staffordshire NHS Foundation Trust(132) identified many failings in care, resulting in over 400 preventable deaths at that hospital. Identified causes of these failings were a focus on financial savings ahead of safe care, and a breakdown in the delivery of fundamental patient care. Throughout this report the pharmacy profession is not mentioned at all, but there were several hundred references to the sub-optimal use of medicines. The public inquiry was wide ranging and thorough and produced 290 recommendations to prevent similar events occurring at other organisations in the future. The focus of these is patient care, which should be first and foremost in the mind of all healthcare staff. There is consideration of the need for

strong leadership, governance and compliance with standards and recommendation 168 specifies the need for 'safe staffing levels'.

Following that same year the Keogh report(129) was published on the investigations into the increased morbidity and mortality rates associated with reduced service levels at NHS hospitals at the weekends. Amongst the ten standards of care that patients should expect, regardless of day or time of admission, two (Standards 3 & 9) related directly to pharmacy. Namely, patients should be reviewed by a multi-disciplinary team including pharmacy within 14 hours of admission and transfer of care should be efficient (admission and discharge supply of medicines). The implementation of these standards was recommended by the end of the financial year 2016/17. There were some early financial incentives for Trusts to establish the 7-day services through local commissioning projects, though the distribution of this funding varied from Trust to Trust. Therefore, as reported in the results of this study, in some cases pharmacy service extension had to be implemented with no additional resource.

Finally, in 2016, Lord Carter of Coles published his report into productivity within the NHS(21). He identified many 'unwarranted variations' in practice and efficiency across the NHS generally and a number of specific work-streams were identified to address this, one of which focussed on hospital pharmacy services. The basis of much of the evidence reviewed in this investigation was the data from the NHS Benchmarking Network's Hospital Pharmacy project(22). Staffing levels and service delivery metrics were considered and a benchmark (mean or mode depending on the criteria) was established.

A pharmacy manager responsible for the safe use of medicines within a hospital environment, therefore, is faced with many challenges when identifying and deploying staff effectively, with limited national guidance on how to do so. With the exception of medicines reconciliation requirements, there are no national standards which specify

the services that should be delivered, nor the frequency with which this should be done. As a consequence no staffing plan is identified for this service delivery. These decisions are based on local professional judgement and some sharing of practice, but fundamentally dependent on established budgets, many of which are historical. How then do they ensure compliance with these three key reports – that pharmacy services are efficiently and productively delivered, in an equitable manner across the week, and that there are safe levels of staffing to ensure quality of care? The RSPWC could be seen as beginning to offer this structure to support managers. The RSPWC does not identify 'safe' staffing levels as that was not within the scope of this study. However, this is the first time that staffing levels to deliver the tasks associated with a modern clinical pharmacy service have been described. The tasks required to deliver the service have been identified, how long they take has been reported and there is evidence from the literature that delivery of these tasks is associated with improved patient safety(9,10). This calculator allows a pharmacy manager to appraise their staffing levels against a validated tool. In some cases this will identify a shortfall; the RSPWC will provide objective evidence to support requests for additional funding. As Acres(37) identified this might not be forthcoming, but if the gap is known and credible, then informed conversations can begin regarding mitigating the risk associated with reduced staffing levels. In some cases this might identify apparent overstaffing of a department; the challenge to the pharmacy manager is then to demonstrate the productivity of their team or the increased acuity of the illness of the patients for whom they care.

Whilst not disputing that unwarranted variations exist in the delivery of healthcare within the NHS the results of this study suggest the variation in pharmacy is not at the level of opinion on fundamental principles of pharmaceutical care, but on the delivery of this care with often insufficient staff resource. The findings of this study and the validation of the RSPWC may not result in large increases in funding for hospital

pharmacy departments. They should, at a minimum, allow greater recognition of the issues of determining staffing levels and stimulate the profession into developing cohesive, evidenced-based approached to the delivery of safe and effective medicines use for the benefit of patients, within the staffing resource (both funding and personnel) available.

9.4 Limitations of the study

As with all research, limitations of the work can be identified. When reflecting on this work, these limitations fall in to two areas; namely, the limitations of the study and its delivery and the limitations of the RSPWC. These will be considered in turn, but first the presence of a non-UK participant will be discussed.

9.4.1. Overseas participant

As presented in the results (sections 7.1 and 5.3.2) there was one, non-UK participant included in the study population. This is an apparent anomaly and requires explanation. The call for participants was issued through a number of professional forums including the UKCPA and RPS. Whilst both of these organisations are UK based, both have international members. As outlined in the Methods chapter (see 6.2.2), there were no exclusion criteria for this study, if inclusion criteria were met. The participant from New Zealand responded to the call for participation during the feasibility study and was included as the inclusion criteria could be demonstrated. At that time it was not known that there would only be one overseas participant. Had others responded it may have validated the RSPWC internationally as well as nationally. The consensus achieved was not influenced by the presence of this participant; they did not generate any outlying data. Where the difference in their practice might have impacted on the development of the RSPWC, e.g. in mean timings calculated from participants' data, they were excluded in the same way as the mental health trust was at this stage of the analysis, so

that the mean times were calculated from a homogenous (i.e. UK) population. The strong parallels in the practice of clinical pharmacy between the UK and this site in New Zealand should be noted, though the fact that the participant is a UK 'ex-pat' pharmacist may have influenced this, along with the same challenges regarding frequency of activity being reported. In summary, this participant added to the population denominator, but did not adversely influence the results.

9.4.2. Limitations of the study delivery

Moving to the more common limitations associated with research projects, the most obvious limitation of the study is its sample size. The study population was 22 sites, this compares to 156 in the NHS Benchmarking(22) work which ran concurrently with this research. It might, therefore, not seem as 'powerful' data as the NHS benchmarking work to the casual observer. The results and earlier discussion have demonstrated that this sample size is acceptable for the study methodology chosen and considers a different perspective on the delivery of pharmaceutical care from the benchmarking study. However, the parallel timeframes of the two projects might have impacted on participation in the RSPWC research. Sites that were submitting data to the NHS benchmarking project might not have engaged with this study – there is something about 'data fatigue', that there is only so often individuals can summon the enthusiasm to participate in project work outside of the delivery of day to day services

9.4.3. Limitations of the RSPWC

The RSPWC has its own limitations and its use in practical situations needs to be made with due consideration of these limitations. It has been tested only in the delivery of pharmaceutical care in general adult settings. Applications to paediatrics and specialist settings such as renal or critical care have not been established. The figures it generates are for all patients in ward settings across a full year period i.e. 24 hours per day, 7-days a week, and 52 weeks of the year. As a consequence, the staff requirements may need

pragmatic *pro rata* modification by the user if services are not going to be delivered across the full 7 days, all year round. This is of particular consideration when average length of stay for a patient cohort falls at 3 days or below (patients admitted on a Friday may have been discharged before Monday and so miss the pharmacy service).

Justification of the tasks, times and frequencies which drive the algorithm behind the tool has been fully discussed already any user must therefore recognise that this is not an absolute answer to the question of staffing resource, but simply a justified starting point which provides an objective base for discussions around staffing levels.

Another limitation to the RSPWC, which remains ill defined, is the impact of technology on service delivery. The data gathered identifies a small number of trusts with implemented electronic prescribing and administration systems. Despite many years of movement towards this aim, this remains a technology available to the few rather than the many(22). Electronic prescribing and administration (ePMA) has two main effects on the delivery of pharmaceutical care. It alters both how long it takes to deliver services and the model within which this is done. From the data gathered here, some elements of practice may become more efficient, but some may take more time due to the nature of uploading the data into the electronic system and, therefore, the timings in the RSPWC will need to be reviewed against a future backdrop of ePMA being the 'norm'. At this point the timings are a mean of those reported and so include both ePMA and non-ePMA sites. Site numbers with ePMA were too small to produce an analysable subset. The RSPWC is based on a ward-based pharmacy service, as described, where pharmacy staff work in skill mixed teams across geographical or specialist locations. The widespread implementation of ePMA is likely to change that model as the technology will allow a more targeted service to be developed. Gone may be the days of having to 'trawl' a ward of prescription charts to find the patients with newly prescribed or changed medicines, or for whom key medical parameters have

altered since the last review. Some services may be able to be delivered remotely and others by dedicated, specialist teams with focussed activities e.g. discharge or therapeutic drug monitoring. The tasks might not change, but how long they take and how often they are done and by whom will need to be re-calibrated in the light of mature ePMA systems.

In addition, the impact of automated dispensing is not fully captured within this tool. Again, in this data set, only a small sample of sites with automated dispensing was described. Analysis of dispensing times from these sites suggested a paradoxical increase in time to dispense a single item. Automation should surely make it quicker. This was confirmed by local data collection at UHNM(133) where one site is automated and the other still wholly manual. Of note, accuracy checking time was shorter on automated sites (again reflected in UHNM data), suggesting that the benefits of automation may be more about accuracy than speed. This requires additional investigation across a larger sample size. The data currently included is once again a mean time from across all respondents' data and this will need to be revisited through larger sample sizes in the future, although the pressure of Carter may result in this being removed completely rather than being updated.

Finally, a limitation of the tool which must be considered relates to the longevity of its validity. The pharmacy profession and its delivery of pharmaceutical care is in the midst of a period of substantial change. Many service models are changing in the light of the Lord Carter report(21) and in particular the impact of the increasing presence of pharmacist prescribers within in-patient services is as yet unknown. The RSPWC will require re-validation in the 'post-Carter' era when the implications to the pharmacy workforce are better understood.

This study has been conducted in a ‘real-life’ setting and final considerations when discussing its findings are that of reflexivity and the implications of research conducted by a ‘researcher practitioner’. These are considered in the following section.

9.5 Reflexivity and the implications of a ‘researcher-practitioner’

The premise of professional doctorates, such as Doctor of Pharmacy is that knowledge is created from with practice and subsequently influences the future delivery of practice (134). That being the case, it follows that research conducted in this manner is often by ‘researcher-practitioners’ or ‘insider- researchers’ (134). The implications of this on the outcomes of studies must be considered(135). Strengths and weaknesses of research conduction in this manner exist(135) and are considered in the context of this study.

Firstly with insider research there is the risk that one is too close to the subject and consequently cannot see the full picture, or that because one has too great an understanding at the start details are accepted as fact without further exploration. There is also the element that the desire for a positive outcome steers emphasis away from challenges which might suggest alternative or negative outcomes. Moreover, the political influences within the workplace may drive the direction of research. In the case of this study, had the tool been discredited then there might have been significant implications to staffing levels. So the desire to 'prove at all costs' was mitigated by a transparent process and triangulation or corroboration of results from different independent sources. This removes the element of 'fix'. The 'closeness' issue was mitigated by the fact that although I was as the principal investigator of the study and a frequent user of the tool, I was not a principal developer. The early construction of the algorithm had been done by colleagues and in order to understand to tool in sufficient detail to validate all elements, I first had to unpick it and reconstruct it myself. My assumptions weren't just made on historical knowledge but worked through from basic

principles.

Another key challenge of being an ‘insider-researcher’ is that watching and observing your colleagues may, in itself, affect outcomes(135). In qualitative research this might well alter what people are saying to you. It is largely up to the reviewer to recognise this and draw their own conclusions. However, some active mitigation of this effect was taken in this study as the subjects of the investigation, whilst from the same profession, were not from the same organisation and so this effect was at a greater distance than when research is conducted from within a single department.

There are however strengths in the ‘insider- researcher’ model. Having an ‘expert’ researcher means that energy and time is not wasted in orientation or background -one 'hits the ground running'. The ability to access subjects or data maybe greater than for an external researcher e.g. access to professional forums etc. and individuals may be more willing to give time to a colleague that a stranger. In my case, being part of the community of pharmacists gave me contacts for inviting participants which would have been difficult to identify from outside the profession for a small independent researcher. Finally the enthusiasm to deliver the project cannot be underestimated -in many ways the desire to succeed means that the job is completed

A further consideration with regards to reflexivity in this study is borne from the ontological perspective taken that there was not one single reality and that the phenomenon of ‘delivery pharmaceutical care’ is subject to contextual influences. The epistemological step is that data collection therefore had to be from the individuals involved in this phenomenon. This led in turn to the methodological decision to use questionnaires and interviews to capture the data required. These required a reflexive approach to this research and this is seen in both the development of the study

methods and in the results. From a methods perspective reflexivity has run throughout the study, from concept to validation. The RSPWC started as a calculator to simply identify pharmacy staff numbers to cover a ward, which progressed to its application to smaller discreet cohorts of patients to address the need to respond to business case submissions (this element is described in section 1.3). From the feasibility study further modifications were made to both the RSPWC and the questionnaire design and this adaptation continued with the addition of the 'exemplar patient' section of the second round Delphi questionnaire, which was identified in an early qualitative interview. As such this was an iterative process that it is wholly transparent and has added depth and quality to the results.

The final reflexive strand is the socially contingent nature of the use of questionnaires and interviews. There should be recognition that both participant response and researcher interpretation is driven by social contingency. This means that the responses given will be subject to the participants' personal views and experiences of the situations about which they are being questioned, including factors such as their perceptions about whom they thought they were speaking with and the potential use of the information they were sharing. There be may a wish to present peer-acceptable views which may not fully reflect personal perspectives that might be articulated in other settings. Their responses will also be affected by their views and opinions of the researcher asking the questions and the knowledge that this individual was associated with the site developing the calculator. This might have made responses more positive than was really felt as it is always difficult to criticise children in front of their parents. Other factors such as the environment in which the interviews were conducted needs to be considered. As telephone interviews, the researcher was unable to control this to the same extent for each participant. Communication by telephone removes the non-verbal communication which might have added additional insight in the researcher's

notes, and the presence of colleagues in the room with the participant during the interview may have impacted on their answers to questions. These considerations must be made when analysing the data in this type of study particularly in relation to the 'generalisability' of the results. However, the transparency of the reflexive approach to this work allows reviewers to judge the wider application of these findings for themselves.

In summary, 'insider' or 'practitioner' research has inherent challenges based on social contingency and will be reflexive in nature. In this research these have been acknowledged, mitigated where possible and presented in a transparent manner which allows a reviewer to consider the implications.

9.6 Further work

Results from this research have identified a number of future work streams for pharmacy. These fall into three broad categories.

Firstly those work-streams which might bring further clarification on the figures that drive the RSPWC algorithm and, therefore, its accuracy in calculating the resource required to deliver services. This work could include further research on timings relating to the impact of ePMA and automated dispensing, but perhaps should first focus on the issue of how often tasks need to be done as this is the area with the least clarity from the existing study. It is acknowledged that there probably never will be enough funding in the NHS for every patient to be reviewed in detail by the pharmacy team every day of their admission. Accepting this reality, the need to identify those patients that need to be seen most appears to be a key challenge for the pharmacy profession and there appears to be a lack of clarity here about what is driving the 'unwarranted variation'. The 'need to be reviewed' will be dependent on patient acuity, but also on the 'value-

added' of the service, i.e. where are the greatest outcomes achieved. The work by Suggett and Marriott(45) suggests that this might require a focus on more elderly patients (>80 years old) rather than on the more obviously critically ill on critical care units. There is a need to establish, the 'pharmaceutical' acuity rather than medical acuity of patients and a greater understanding of how that changes during the course of an admission.

Secondly there is a need to explore the establishment of consistent, evidence based outcome measures for pharmaceutical care and reliable surrogate markers for these outcomes. The work by Bond and Raehl(9,10) should be updated for modern UK services. The definition of 'what good looks like'(21) needs to be confirmed. Linked to this is work to understand the outcomes of different models of care. The variations in services have been postulated to be due to differences in delivery of care with limited resources. Accepting that this is unlikely to change in the future, there is a need to identify which models of care are the most effective. If we are to remove the 'unwarranted variation' we want to choose the 'right' options, not just the ones that are cheapest or which receive greatest publicity. The Carter report has begun to define this with establishing certain 'metrics', though these are currently high-level organisational demographics, associating the numbers of staff and activities against 100 beds. Is this really what should be defining 'good'? This has been challenged by professional leaders with suggestions made as to alternative measures(128) such as performance related to missed doses, patient experience and readmission. Research to define, describe and measure this is needed.

Finally, as identified by Gorin(98), validation is a continuum not a fixed point. The RSPWC will need to be revisited when the impact of Carter and its resultant hospital pharmacy transformation is fully understood, recognising that hospital pharmacy is not

just about ward services, but with a greater understanding of how this and other elements will be delivered post Carter.

In addition the transferability of this work to other allied health professions maybe should be explored as all these staff groups experience similar pressures and challenges. Initial steps to the sharing of this research with the AHPs at UHNM have begun.

10. Conclusions

The RSPWC was developed to address a local need for an objective way to calculate staffing requirements for the delivery of pharmaceutical care to hospital in-patients. This study, through a 'mixed-methods' approach (including a two-round Delphi consensus study, an operator evaluation and qualitative interviews), across 21 independent hospital Trusts, UK-wide has demonstrated that this tool is both valid and transferable across different acute hospital settings.

It captures for the first time, through strong consensus by participants, a description of the component tasks of a service to deliver pharmaceutical care. The staff time required to deliver these was confirmed either through consensus or the identification of a 'national best representative' figure. In addition it re-affirms work of other teams relating to the challenges of how often these tasks should be done for individual patients. For the purposes of the development and validation of this tool this was achieved through exploring practice using 'exemplar patients'. It is recognised not as perfection or the absolute answer to staffing calculation, but as a pragmatic and robust starting point on which future UK staffing decisions can be based.

In addition to meeting the stated aims and objectives, results of this study have confirmed that 'unwarranted variation' exists within the NHS in the delivery of pharmaceutical care, particularly in relation to staffing levels. It is proposed that this is not due to differences in opinion as to the service which should be delivered or how long they take, but rather to differences in how to do so when available staffing resources are insufficient to deliver the ideal service to all patients.

The study has identified several future research work-streams. Firstly, these include the need to explore the current limitations of the RSPWC. This includes the impact of automation and electronic prescribing on productivity, its application to non-acute

hospital settings and the future impact of pharmacist prescribing activities. In addition the need has been identified to demonstrate the patient benefit outcomes associated with the delivery of pharmaceutical care in the 21st century in the UK.

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Appendices

The following pages include various documents used or received throughout the course of this research and are available for reference purposes.

Appendix 1: Glossary of terms and abbreviations

AfC	Agenda for Change – the NHS employment framework which specifies terms and conditions of employment including a 9-point pay-scale against which all non-medical posts are graded.
AHP	Allied Health Professions. A term used to refer to registered health professionals who are not doctors or nurses e.g. physiotherapists, pharmacists, occupational therapists, pathologists etc.
AKI	Acute kidney injury. The temporary reduction in kidney function in response to illness or drug use.
ATC	Adjusted treatment cost. An expression used in the Lord Carter report to identify the cost of delivering care for one WAU.
Benchmarking	A process by which an organisation compares elements of its service with those of a peer to understand its relative place in terms of performance or productivity.
CD	Controlled Drug. A medicine, the storage, prescribing, supply and administration of which is controlled under the Misuse of Drugs Act 1971.
Clinical interventions	When used in the context of clinical pharmacy practice these are activities conducted by a pharmacist which results in amendment of prescribed medicines to improve safety or efficacy of their use.
Clinical Pharmacy	The science and practice of rational medicines use – ensuring that it is safe, effective and cost-effective.
Clinical verification of prescribed medicines	This is the process by which a pharmacist reviews a medicine prescribed for a patient to ensure that the dose, form, administration is appropriate and that the prescription meets legal and local prescribing standards.
Consensus	General or widespread agreement.
CQUIN	Commissioning for Quality and Innovation. A process whereby a health commissioner associates a portion of funding with the achievement of specified quality or innovation metrics.
Delphi technique	A method of generating consensus amongst a group of experts. First used by the Rand corporation in the 1950s, but now accepted in to social and health research.
De-prescribing	The act of stopping medicines deemed to no longer demonstrate a positive benefit v risk ratio for an individual patient.
Drug related problem	Problems experienced by patients when using medicines for health improvement.

ELD	Existing local data. Service activity data which is routinely collected by a pharmacy manager to describe their staff activity.
ePMA	Electronic prescriptions and medicine administration. A computer system designed to facilitate the paperless prescribing and administration of medicines. These facilitate improved safety, quality of records, information access in the use of medicines within an organisation.
Foundation Trust	An NHS trust which has met the required criteria for independence from Department of Health control and given the freedom to conduct business outside of NHS restrictions, though regulated by an independent regulator 'Monitor'.
Frailty	The degree of vulnerability of patients to ill health. Commonly associated with old age.
High risk medicines	Those medicines considered to be high risk for the occurrence of adverse drug reactions.
LOS	Length of stay – the time a typical patient in a cohort will spend in hospital per admission.
MDS	Monitored dosage system. A method of dispensing medicines into container with compartments allowing identification of medicines that should be taken at specified times and days to facilitate administration of medicines by lay individuals.
MMT	Medicines Management Technicians. Registered pharmacy technicians employed to work at ward level, to engage with patients and ward staff to ensure that medicines are available for safe and timely administration. Their role includes completion of MR on admission, ordering of medicines for in-patient and discharge use, educating patients on the use of their medicines and supporting the ward team in the safe use and storage of medicines.
MR	Medicines reconciliation – this is the process of ensuring that information relating to the medicines required by a patient for managing their health conditions is accurately transferred between health professionals when a patient moves setting i.e. on admission to or discharge from hospital.
Multi-morbid patients	Patients with three or more concomitant illnesses.
'National best representative figure'	The value identified for how long a pharmaceutical care task takes to takes to complete. This is based on triangulation of data from a number of sources identified through the research.
NBM	Nil by mouth. The required state of a patient who is unable to tolerate oral intake of food, drink, medicines for surgical or medical reasons.

NHS Trust	The legal body employing staff and delivering commissioned health care in a specific locality – these may be hospital or community based organisations.
NICE	National Institute of Health & Care Excellence. A UK organisation tasked with reviewing the use of medicines and medical technology to ensure cost effective practice and equity in access to such products across the UK. They conduct appraisals of products, assess their place in practice and issue guidance to support best practice.
OSCE	Objective Structured Clinical Examination. A method of assessing competence of practitioners in practical activities/skills required for the effective delivery of a service.
Patient flow	The movement of patients through a hospital from arrival at the emergency department, transfer to in-patient ward and subsequent discharge back into the community.
Pharmaceutical acuity	The degree to which a patient is in need of the specialist in-put of a clinical pharmacy team, determined by the combination of their underlying health status and the complexity of the medicines they are prescribed.
Pharmaceutical care	Ensuring the safe use of medicines, specific to individual patient situations with the purpose of achieving specified health outcomes.
PODs	Patient's Own Drugs. Those medicines which the patient has brought into hospital from home, or has been dispensed for the use of a specific named patient.
Post-take ward rounds	The consultant-led ward round which occurs in the first 12 hours after a patient has been admitted to hospital.
RAG	Red, amber, green. A rating system used in common practice to identify areas which require improvement (red), those which meet standards (green) and those which either is on route to improvement or failure depending on the direction of movement in successive ratings, amber.
Reflexivity	The phenomenon of human behaviour being influenced by individuals experience, culture, education and environment and the consideration of how this impacts on the conduct of research activities.
RPS	Royal Pharmaceutical Society – a professional representative body for pharmacists, regardless of sector of employment. Establishes national standards for practice and practitioners.
RSPWC	Royal Stoke Pharmacy Workforce Calculator

RSUH	Royal Stoke University Hospital – the acute hospital provider in. Linked with Keele University as a teaching hospital. Part of UHNM NHS Trust.
Shelford Group	A representative body comprising of the ten leading NHS multi-specialty academic healthcare organisations. They aim to achieve excellence in clinical research, education and patient care and provide system-wide leadership for the benefit of patients.
SHPA	Society of Hospital Pharmacists of Australia. A professional representative body for hospital pharmacists in Australia
SSU	Short stay unit. A hospital in-patient ward with an length of stay for patients typically less than 48 hours.
STP	Strategic Transformation Partnerships – geographical grouping of healthcare organisations, working collaboratively to improve quality and efficiency of health services for their local populations.
TDM	Therapeutic drug monitoring. The monitoring of blood levels of drugs whose action or toxicity is dependent or predicted by the achievement of specific concentrations of the drug in the blood system.
TTO	To take out – medicines dispensed for a patient to take home with them on discharge (interchangeable with TTA -to take away or TTH- to take home).
UHNM	University Hospitals of North Midlands NHS Trust. The NHS Trust delivering healthcare in North Staffordshire and neighbouring counties, includes RSUH and County Hospital (CH), Stafford.
UKCPA	United Kingdom Clinical Pharmacy Association – a membership organisation for pharmacists working in 'clinical pharmacy'. These practitioners work in both hospital and community settings and the Association provides peer support, education and training and opportunities for establishing and sharing best practice.
WAU	Weighted activity unit. An expression used in the Lord Carter report to identify one in-patient admission.
WHO	World Health Organisation. An international organisation committed to improving global healthcare delivery.
Winter pressures	The increased use of health care by a local community during the winter months, caused by increased levels of illness due to influenza, norovirus or falls due to icy ground conditions.

WTE	Whole time equivalent. A term referring to the employment of a member of staff for hours equivalent to the expected full time employee. Part time employee hours are expressed as a decimal of this i.e. 1.0WTE = 37.5 hours/week an employee working 15 hours/week = 0.4WTE.

Appendix 2: Original version of the RSPWC

Template for Pharmacy Time for Business Cases

Extra number of beds opening as a result of business case	beds	
Average length of stay		
Extra number of patients per year based on beds and length of stay	#DIV/0! per year	
Extra number of elective patients per year as a result of business case:	0 per year	0.00 per week
Extra number of emergency admissions per year as a result of business case	0 per year	0.00 per week
Extra number of elective patients & emergency admissions per year as a result of business case	#DIV/0! per year	##### per week

CLINICAL ACTIVITY

ACTIVITY	STAFF GROUP REQUIRED TO PERFORM ACTIVITY	TIME TAKEN ON AVERAGE (per prescription in mins)	ESTIMATED NUMBER OF OCCASIONS ACTIVITY TAKES PLACE PER ADMISSION	TOTAL TIME REQUIRED FOR ADDITIONAL CASES PER WEEK (mins)	TOTAL TIME REQUIRED FOR ADDITIONAL CASES PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY
CLINICAL ACTIVITIES						
Obtaining Drug History	MMT	8	1	#DIV/0!	#DIV/0!	#DIV/0!
Check of Drug History	Pharmacist	2	1	#DIV/0!	#DIV/0!	#DIV/0!
Check of PODs	MMT	5	2	#DIV/0!	#DIV/0!	#DIV/0!
Clinical Review of Notes	Pharmacist	5	2	#DIV/0!	#DIV/0!	#DIV/0!
Review of Blood results	Pharmacist	1	2	#DIV/0!	#DIV/0!	#DIV/0!
Initial review of Chart	Pharmacist	5	1	#DIV/0!	#DIV/0!	#DIV/0!
Initial endorsing of Chart	Pharmacist	2	1	#DIV/0!	#DIV/0!	#DIV/0!
Interventions	Pharmacist	5	1	#DIV/0!	#DIV/0!	#DIV/0!
Subsequent review of Chart	Pharmacist	2	2	#DIV/0!	#DIV/0!	#DIV/0!
Subsequent endorsing of Cha	Pharmacist	0.5	2	#DIV/0!	#DIV/0!	#DIV/0!
Completion of Paperwork	Pharmacist	2	2	#DIV/0!	#DIV/0!	#DIV/0!
Ordering of Non Stocks	Pharmacist	2	2	#DIV/0!	#DIV/0!	#DIV/0!
Counselling	Pharmacist or MMT	5	1	#DIV/0!	#DIV/0!	#DIV/0!
Transcription of TTOs	Pharmacist	5	0	#DIV/0!	#DIV/0!	#DIV/0!
Clinical Check of TTO	Pharmacist	5	1	#DIV/0!	#DIV/0!	#DIV/0!
TOTAL				#DIV/0!	#DIV/0!	#DIV/0!
DISPENSING						
INITIAL						
Booking in	ATO	2.5	1	#DIV/0!	#DIV/0!	#DIV/0!
Dispensing	ATO or Technician	20	1	#DIV/0!	#DIV/0!	#DIV/0!
Checking	ACT	8	1	#DIV/0!	#DIV/0!	#DIV/0!
TOTAL				#DIV/0!	#DIV/0!	#DIV/0!
AT DISCHARGE						
Booking in	ATO	2.5	1	#DIV/0!	#DIV/0!	#DIV/0!
Triage	Pharmacist	5	1	#DIV/0!	#DIV/0!	#DIV/0!
Dispensing	ATO or Technician	20	1	#DIV/0!	#DIV/0!	#DIV/0!
Checking	ACT	8	1	#DIV/0!	#DIV/0!	#DIV/0!
TOTAL				#DIV/0!	#DIV/0!	#DIV/0!
GRAND TOTAL				#DIV/0!	#DIV/0!	#DIV/0!

REQUIRED STAFF GROUP	GRADE REQUIRED (According to speciality needs)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (mins)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY	MID POINT OF GRADE (+22% oncost)	COST
ATO	2	#DIV/0!	#DIV/0!	#DIV/0!	19338	#DIV/0!
TECHNICIAN	4	#DIV/0!	#DIV/0!	#DIV/0!	25178	#DIV/0!
MMT/PHARMACIST	5	#DIV/0!	#DIV/0!	#DIV/0!	29066	#DIV/0!
PHARMACIST	7	#DIV/0!	#DIV/0!	#DIV/0!	43354	#DIV/0!
				CLINICAL STAFF TOTAL		#DIV/0!

TOTAL COST FOR CLINICAL PHARMACY SERVICE	#DIV/0!

Appendix 3: Feasibility study questionnaire

Pharmacy Staffing Questionnaire

This has 4 sections; please complete each one to the best of your knowledge. If you do not have data on a particular aspect please complete as 'no data available'.

Section 1: Tasks performed for delivery of pharmaceutical care

This section identifies the key tasks completed during the provision of pharmaceutical care. For each task identified below please complete the following grid using the key and the sample answer below

Tasks: **Direct patient care activities completed for each patient admission**	**Identify if this task is completed by your Pharmacy Team for each patient**	**Identify staff group required to perform task at your Trust** Pharmacist (P) MMT ATO Technician (T) ACT	**How long do you think this activity takes to complete on average (per prescription in mins)?** NB This data can be: 1. Existing local data (ELD) 2. Data collected specifically in response to questionnaire (DC) 3. Best Guess (BG) 4. Not Known (NK)	**Please estimate number of occasions the task is completed per admission.** Please identify if this is dictated by personal practice (PP) or by departmental SOP (SOP)
Sample Answer: **Medicines Reconciliation (pharmacy completed and signed off by pharmacist**	√	**P and MMT**	**ELD 10**	**SOP 1**

Direct patient care activities completed for each patient admission	Identify if this activity is completed by your Pharmacy Team for each patient	Identify staff group required to perform activity at your Trust	How long do you think this activity takes on average (per prescription in mins)?	Please estimate number of occasions activity takes place per admission.
Medicines Reconciliation (pharmacy confirmed and signed off)				
Check of PODs				
Clinical Review of Notes				
Review of Blood results				
Initial review of Drug Chart				
Initial endorsing of Drug Chart				
Subsequent review of Drug Chart				
Subsequent endorsing of Drug Chart				
Completion of Paperwork				
Ordering of Non Stocks				
Clinical Check of TTO				
Talking to patient about their medicines				
Making interventions on patient care				
DISPENSARY BASED				
Booking on to tracker system				
Dispensing				
Checking				
TTO (ward or dispensary based)				
Booking onto tracker system				
Triage (Clinical Check)				
Dispensing				
Checking				

If you think pharmacy teams should routinely complete additional direct patient care tasks that are not identified above, please note them here and provide the same detail about them using the grid below

Additional activities routinely performed but not listed above				
Direct patient care activities completed for each patient admission	**Identify if this activity should be completed by your Pharmacy Team for each patient**	**Identify staff group required to perform activity at your Trust**	**How long do you think this activity should take on average (per prescription in mins)?**	**Please estimate number of occasions activity should take place per admission.**

Section 2: Pharmacy resource to deliver ward pharmacy service

If faced with the following scenarios please identify what resource you would request to deliver your ward service in full time equivalents (fte) of different staff grades eg 1.0 fte Band 6 pharmacist, 0.5 fte band 5 technician and what issues you would take into consideration

1. A new general medical ward is planned to open. This will have 28 beds and an average length of stay of 5 days. You have to identify the pharmacy staff (fte) required to deliver your standard ward based service.

2. An existing 28 bed general medical ward with average length of stay of 4 days is being converted to a short stay (48 hour) unit. What impact will this have on your pharmacy service and what if any additional staff would you request?

Section 3: 'Non-operational Time'

In most roles, pharmacy staff will not be engaged in direct patient care for the entirety of their working day- a certain amount of non-operational (ie other than ward and dispensary) activities are required to maintain staff employment and need to be recognised within a whole time equivalent exists. This section is identifying the average non operational commitment for each fte.

Staff grade under Agenda for Change (AfC)	Travel time ie department-ward (mins/day)	Mandatory training (minutes/ MONTH)	Professional training eg diploma (Mins/week)	Departmental or MDT meetings (mins/week)	Rest time due to on-call	Other (please specify)
Pharmacist AfC 8a (& above)						
Pharmacist AfC 7						
Pharmacist AfC 6						
Technician Band 5						
Technician Band 4						
ATO Band 3 &2						

Section 4: Now we would like some information about your hospital to put the other data into context

a) **Please tick which of the following describes your hospital** (please tick all that apply) ◯ Foundation Hospital Trust

◯ Non Foundation Hospital Trust ◯ Private Hospital ◯ Prison Hospital ◯ Tertiary referral unit ◯ Teaching Hospital

◯ District General Hospital ◯ Intermediate Care ◯ Mental Health Unit

b) Which specialities are practiced at your Trust?

◯ Acute Medicine	◯ General Medicine	◯ Respiratory	◯ Gastroenterology	◯ Endocrinology	◯ Neurology
◯ Stroke	◯ Frail Elderly	◯ Cardiology	◯ Renal	◯ Paediatrics	◯ Orthopaedic
◯ Critical Care	◯ Neurosurgery	◯ CT Surgery	◯ General surgery	◯ Gynaecology	◯ ENT
◯ Vascular Surgery	◯ GI surgery	◯ Obstetrics	◯ Rehabilitation	◯ Long stay elderly	◯ Psychiatry

c) How many in-patient beds in your Trust .....

d) How many pharmacy staff employed at Trust: Pharmacists ..... Technicians ..... ATO .....

e) Location of your Trust - UK Home Nation ◯ Yes ◯ No

If yes please specify ◯ Wales ◯ England ◯ Scotland ◯ Northern Ireland

If no please specify .....

Please now save a copy of this for your records and return a copy to r.bednall@nhs.net. Thank you for your participation in Part 1 of this study. You will shortly receive a copy of the Royal Stoke Pharmacy Workforce Calculator as Part 2 of this project. You will also be asked to confirm or amend your responses to parts 1 and 3 of this questionnaire in the light of the data presented once all first round results are available.

Appendix 4: Feasibility study participant information sheet

Participant Information Sheet

Study title: Evaluation of the Royal Stoke Workforce Calculator – Feasibility Study

Invitation

You are being invited to take part in a research study. You do not have to take part but before you decide, it is important for you to understand why the research study is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. My name is Ruth Bednall, I am Doctorate in Pharmacy student at Keele University and I am doing this research study as part of this degree. Ask me (ruth.bednall@uhns.nhs.uk) if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

The Royal Stoke Pharmacy Workforce Calculator (RSPWC) was developed by the Pharmacy Department at the Royal Stoke University Hospital. Locally this tool has proved an effective method of identifying the pharmacy resource required to deliver pharmaceutical care and securing funding through the business case process to employ the necessary staff. This study seeks to assess its reliability and usability when applied to the ward pharmacy services of other hospital sites.

Why have I been chosen?

You are being invited to take part in this research study because you responded to the invitation issued through a professional forum, expressing an interest to be part of the study.

Do I have to take part?

It is up to you to decide whether or not to take part. If you choose to take part you will first be asked to confirm your consent and you can still withdraw at any time. You do not have to give a reason.

What will happen to me if I take part and what do I have to do?

If you decide to take part you will be invited to contribute in three parts.

Part 1: This is a questionnaire that identifies

a) tasks that are performed by your staff in the course of their provision of pharmaceutical care
b) what resource you currently request to deliver specific services
c) 'down time' in an average working week
d) Demographic information about your hospital

You will be required to complete and return this questionnaire by email.

Part 2: On receipt of the completed questionnaire you will be sent a copy of the RSPWC and asked to use it to calculate the pharmacy resource that would be

required to deliver services in 3 different scenarios. Once calculated this information will be emailed to the investigator and you are then free to continue using the RSPWC for your own purposes.

Part 3: On receipt of your calculations, if you have identified an interest in continued participation, we will send you a final questionnaire to appraise your views of the use of the RSPWC and its perceived or actual benefits/disadvantages to your department.

What are the possible disadvantages and risks of taking part?

We are not aware of any disadvantages or risks to you in taking part in the study.

What are the possible benefits of taking part?

You will have access to the RSPWC tool to use for your own workforce planning purposes.

What if there is a problem or something goes wrong?

You can contact me (ruth.bednall@uhns.nhs.uk) if you wish to complain, or have any concerns about any aspect about any way you have been approached or treated during the course of this study. I will consider such reports promptly and take appropriate action immediately. If you feel that your complaint has not been handled to your satisfaction you can contact my supervisor (Dr Simon White]) at (s.j.white@keele.ac.uk). Alternatively, you can contact the Chair of the School of Pharmacy Research Ethics and Governance Committee (Dr Judith Rees) at j.a.rees@keele.ac.uk.

Who will have access to information about me or my department?

All the information that we collect about you during the course of the research will be kept strictly confidential and no one outside the project will be allowed access to it. Electronic data containing personally identifiable information about you will only be stored on password-protected media that only I and my supervisor (Dr Simon White) have access to. Hardcopies of data and other documentation containing personally identifiable information about you will be kept secure in a locked cupboard that only my supervisor and I have access to. At the end of the study all data and documents containing personally identifiable information about you will be destroyed. You will not be able to be identified in any reports or publications. You will have access to your data benchmarked against other participant sites.

How will information about me be used?

The results (including anonymised short direct quotes) will be included in a research report as part of my doctoral degree in pharmacy at Keele University, and may subsequently be published as research papers in academic journals and presented at conferences. No individual person or organisation will be identifiable in any direct quotes, reports, papers, presentations or summaries. The results of the study might also be used for additional or subsequent research.

Who is organising and funding the research?

The study is being organised and funded by the School of Pharmacy at Keele University and the University Hospitals of North Midlands (UHNM) NHS Trust.

Who has reviewed the study?

The research study has been approved by Keele University School of Pharmacy Research Ethics and Governance Committee and the UHNM Research and Governance team. The study will be registered with the Clinical Audit Departments at participating Trusts

Further Information and Contact Details

If you have any questions or require any further information, either now or at any time during the study, please contact me (Ruth Bednall) at ruth.bednall@uhns.nhs.uk Alternatively, you can contact me in writing at the Pharmacy Department, Royal Stoke University Hospital, Newcastle Road, Stoke on Trent, ST4 6QG

Thank you for taking time to read this information.

Appendix 5: Feasibility Consent Form

Consent Form

Title of Project:

Evaluation of the Royal Stoke Workforce Calculator – Feasibility Study

Name of Principal Investigator: Ruth Bednall

Please tick box

1 I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2 I understand that my participation is voluntary and that I am free to withdraw at any time. ☐

3 I agree to take part in this study ☐

4 I understand that data collected about me during this study will be anonymised before it is submitted for publication. ☐

5 I agree to allow the data collected to be used for future research projects ☐

_____	_____	_____
Name of participant	Date	Signature
Ruth Bednall	27/2/15	Ruth M Bednall
Researcher	Date	Signature

1 copy for participant, 1 copy for researcher

Appendix 6: Research and Ethics approvals

Keele University

Ref: ERP364

21 December 2015

Ruth Bednall
Brook House
College Road
Denstone
ST14 5HR

Dear Ruth

Re: Pharmacy Workforce - validation of staff resource calculation tool

Thank you for submitting the above research proposal for ethical review. The proposal was reviewed at the Ethical Review Panel meeting on Thursday, 10th December 2015 and the Panel would like to commend you for submitting a detailed application, and in particular, for the inclusion of a clear flow chart. The Panel would like to highlight that for future applications, the two page summary is no longer required as this information is captured in Section B of the application form.

The Panel agreed that there are no significant ethical issues within this application, apart from the use of NHS staff time, which the Panel assumes will be dealt with in the R & D application via IRAS. The panel is therefore happy to approve the application, but requests clarification on the following issues. Please supply the information requested below for our records.

General Note

- As mentioned above, the project summary should be included in the application form (Section B2) in approximately 500 words.

Application form

- D1 – please confirm that the individuals mentioned in the last sentence will not be identified by name or location.

Directorate of Engagement & Partnerships
T: +44(0)1782 734467

Keele University, Staffordshire ST5 5BG, UK
www.keele.ac.uk +44 (0)1782 732000

Appendix 4: Participant Information Form

- Under the section **Why have I been chosen**, please clarify that some participants may have been invited directly (rather than via a professional forum).
- Under the section **What do I have to do to take part**, some indication of the time needed to complete each part of the study and clarification whether any/all of these activities will need to be undertaken in work time need to be included.
- Under 'Part 3' of this section make it clear that participants will not be able to identify other participants' data from the tables supplied.
- Under the section **How will information about me be used**, the words '*with your consent*' after '*short direct quotes*' needs to be added
- Under the section **Who has reviewed the study**, this section should state '... approved by Keele University Ethical Review Panel and has received NHS management permission (R&D approval).'

Appendix 5: Consent Form

- The requirement in point 2 should be included in the Participant Information Form.

Appendix 7: Questionnaire 1

- All acronyms in the first and third column headers should be spelt out in full and elsewhere if applicable.

Appendix 12: Participant Information Form and Appendix 13: Consent Form

- The changes as per Appendix 4 and Appendix 5 above should be undertaken to Appendix 12 and 13 as appropriate.

Please forward the revised documentation for the attention of Catherine Bannerman, ERP Administrator via research.erps@keele.ac.uk.

The following documents have been reviewed by the Panel:-

Document	Version	Date
Appendix 1: Protocol Summary	1.0	15/11/15
Appendix 2: Project Plan	1.3	15/11/15
Appendix 3: Invitation to participate (part 1-3) email	1.1	16/11/15
Appendix 4: Participant information sheet	4.0	16/11/15
Appendix 5: Consent form (part 1-3)	2.0	11/11/15
Appendix 6: Cover email	1.0	14/11/15
Appendix 7: Questionnaire 1	2.0	11/11/15
Appendix 8: Questionnaire 2	1.0	11/11/15
Appendix 9: Royal Stoke Workforce Calculator	2.0	16/11/15
Appendix 10: Feedback Form	2.0	11/11/15
Appendix 11: Invitation to participate (Part 4)	1.0	14/11/15
Appendix 12 Participant information sheet (Part 4)	3.0	15/11/15
Appendix 13: Consent form (Part 4)	2.0	11/11/15

If the fieldwork goes beyond the date stated in your application (30 June 2017), you must notify the Ethical Review Panel via the ERP administrator at research.erps@keele.ac.uk stating **ERP3** in the subject line of the e-mail.

If there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator stating ERP3 in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me via the ERP administrator on research.erps@keele.ac.uk stating ERP3 in the subject line of the e-mail.

Yours sincerely

pp C H Bonnerman

Dr Helena Priest
Chair – Ethical Review Panel

CC RI Manager
Supervisor

Directorate of Engagement & Partnerships
T: +44(0)1782 734467

Keele University, Staffordshire ST5 5BG, UK
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Email trail from Dr D Clements, R&D Manager UHNM

Some advice please pharmacy workforce calculator project

> On 11 Feb 2016, at 14:44, Clement, Darren (RJE) UHNS <Darren.Clement@uhns.nhs.uk> wrote:
>
> Hi Ruth
> Based on what you described to me this is not a piece of research and as such does not require NHS R&D Approval.
>
> In terms of the IP side of things I've cc'd our Commercial Development Manager who will pick this up with you.
>
> Regards
> Darren
>
>
> Dr Darren Clement
> Research and Development Manager
> Honorary Senior Research Fellow - Keele University
>
>
> Research and Development Department
> Academic Research Unit
> Courtyard Annexe - C Block
> Royal Stoke University Hospital
> University Hospitals of North Midlands NHS Trust Newcastle Road,
> Staffordshire, ST4 6QG
> Tel: 01782 675379
> PA: louise.barlow@uhns.nhs.uk
>

> -----Original Message-----
> From: Bednall, Ruth (RJE) UHNS
> Sent: 11 February 2016 14:39
> To: Clement, Darren (RJE) UHNS
> Cc: s.j.white@keele.ac.uk; e.r.mills@keele.ac.uk
> Subject: RE: Some advice please pharmacy workforce calculator project
>
> Hi Darren
>
> Thanks for your time to discuss this project - your advice was very much appreciated.
>
> Please could I ask you to confirm the outcome of our discussion in writing/email for my records ie that the nature of the project is service evaluation and as such does not require

NHS management approval through the R&D process.
> On final query, please can you advise if there is a specific template or document I need to complete to clarify the intellectual property rights on this work - in discussion with my tutors we have agreed that the calculator tool, developed at RSUH 'belongs' to UHNM but the research to validate 'belongs' to Keele University. Can you advise how I formalise this agreement please?
>
>
> Best Regards
>
> Ruth
>
> Ruth Bednall MSc MRPharmS
> Pharmacy Team Leader, Specialised Division
>
>
> Pharmacy Department
> Main Building
> Royal Stoke University Hospital
> University Hospitals of North Midlands NHS Trust Newcastle Road,
> Stoke-on-Trent, Staffordshire, ST4 6QG
> Tel: 01782 67451501782 674515
> Email: ruth.bednall@uhns.nhs.uk
>
> -----Original Message-----
> From: Bednall, Ruth (RJE) UHNS
> Sent: 07 February 2016 21:42
> To: Clement, Darren (RJE) UHNS
> Subject: Some advice please pharmacy workforce calculator project
>
>
> Hi Darren
>
> I am aware that Kate Ford has discussed this project with you, but I would appreciate a little of your time to discuss it in person. My problem lies with the fact that the project doesn't fit into a 'typical' type if research an so the 'normal' processes for authorisation don't really work. I'd like to discuss my options with you to see if there's any alternate to the IRAS or audit process.
>
> Can you let me know when might be convenient? Telephone conversation is fine.
>
> Best Regards
>
> Ruth
> Ruth Bednall MSc MRPharmS
> Pharmacy Team Leader, Specialised Division

Appendix 7: Main study Part 1: Questionnaire 1

Pharmacy Staffing Questionnaire

This has 4 sections; please complete each one to the best of your knowledge. If you do not have data on a particular aspect please complete as 'no data available'.

Section 1: Tasks performed for delivery of pharmaceutical care

This section identifies the key tasks completed during the provision of pharmaceutical care. For each task identified below please complete the following grid using the key and the sample answer below

Tasks: **Direct patient care activities completed for each patient admission**	**Identify if this task is completed by your Pharmacy Team for each patient**	**Identify staff group required to perform task at your Trust** Pharmacist (P) MMT ATO Technician (T) ACT	**How long do you think this activity takes to complete on average (per prescription in mins)?** NB This data can be: 1. Existing local data (ELD) 2. Data collected specifically in response to questionnaire (DC) 3. Best Guess (BG) 4. Not Known (NK)	**Please estimate number of occasions the task is completed per admission.** Please identify if this is dictated by personal practice (PP) or by departmental SOP (SOP)
Sample Answer: **Medicines Reconciliation (pharmacy completed and signed off by pharmacist**	√	**P and MMT**	**ELD 10**	**SOP 1**

Direct patient care activities completed for each patient admission	Identify if this activity is completed by your Pharmacy Team for each patient	Identify staff group required to perform activity at your Trust	How long do you think this activity takes on average (per prescription in mins)?	Please estimate number of occasions activity takes place per admission.
Medicines Reconciliation				
Check of PODs				
Clinical Review of Notes				
Review of Blood results				
Initial review of Drug Chart				
Initial endorsing of Drug Chart				
Subsequent review of Drug Chart				
Subsequent endorsing of Drug Chart				
Completion of Paperwork				
Ordering of Non Stocks				
Clinical Check of TTO				
Talking to patient about their medicines				
Making interventions on patient care				
DISPENSARY BASED				
In-patient Medicine Supply (whether that as non-stock or as one stop dispensing)				
Booking on to tracker system				
Dispensing				
Checking				
TTO (ward or dispensary based)				
Booking onto tracker system				
Triage (Clinical Check)				
Dispensing				
Checking				

If you think pharmacy teams should routinely complete additional direct patient care tasks that are not identified above, please note them here and provide the same detail about them using the grid below

Additional activities routinely performed but not listed above				
Direct patient care activities completed for each patient admission	**Identify if this activity should be completed by your Pharmacy Team for each patient**	**Identify staff group required to perform activity at your Trust**	**How long do you think this activity should take on average (per prescription in mins)?**	**Please estimate number of occasions activity should take place per admission.**

Does your Trust have automated dispensing? (Please circle)			**Yes**	**No**
Does your Trust have electronic prescribing? (Please circle)			**Yes**	**No**
What is the average number of items on an in-patient prescription at your Trust?				
	Standard item	**CD item**	**Monitored dosage item**	
How long does it take to dispense 1 item at your Trust?(mins)				
How long does it take to accuracy check 1 item at your Trust?(mins)				
What percentage of your discharge medicines are in the above categories				

Section 2: Pharmacy resource to deliver ward pharmacy service

If faced with the following scenarios please identify what resource you would request to deliver your ward service in full time equivalents (fte) of different staff grades eg 1.0 fte Band 6 pharmacist, 0.5 fte band 5 technician and what issues you would take into consideration

1. A new general medical ward is planned to open. This will have 28 beds and an average length of stay of 5 days. You have to identify the pharmacy staff (fte) required to deliver your standard ward based service.

2. An existing 28 bed general medical ward with average length of stay of 4 days is being converted to a short stay (48 hour) unit. What impact will this have on your pharmacy service and what if any additional staff would you request?

3. Finally, you are approached by a directorate manager about to submit a business case for 200 new Bariatric Surgical patients. No new beds will be opened, these cases will go through and existing 28 bed surgical ward with a length of stay of 3 days. He asks what resource implications this will have for you and what he should include in the business case

Section 3: 'Non-operational Time'

In most roles, pharmacy staff will not be engaged in direct patient care for the entirety of their working day- a certain amount of non-operational (ie other than ward and dispensary) activities are required to maintain staff employment and need to be recognised within a whole time equivalent exists. This section is identifying the average non operational commitment for each fte.

Staff grade under Agenda for Change (AfC)	Travel time ie department-ward (mins/day)	Mandatory training (minutes/ MONTH)	Professional training eg diploma (Mins/week)	Departmental or MDT meetings (mins/week)	Rest time due to on-call	Other (please specify)
Pharmacist AfC 8a (& above)						
Pharmacist AfC 7						
Pharmacist AfC 6						
Technician Band 5						
Technician Band 4						
ATO Band 3 &2						

Section 4: Now we would like some information about your hospital to put the other data into context

a) **Please tick which of the following describes your hospital** (please tick all that apply)

◯ Foundation Hospital Trust ◯ Non Foundation Hospital Trust ◯ Private Hospital ◯ Prison Hospital

◯ Tertiary referral unit ◯ Teaching Hospital ◯ District General Hospital ◯ Intermediate Care

◯ Mental Health Unit

b) Which specialities are practiced at your Trust?

◯ Acute Medicine ◯ General Medicine ◯ Respiratory ◯ Gastroenterology ◯ Endocrinology ◯ Neurology

◯ Stroke ◯ Frail Elderly ◯ Cardiology ◯ Renal ◯ Paediatrics ◯ Orthopaedic

◯ Critical Care ◯ Neurosurgery ◯ CT Surgery ◯ General surgery ◯ Gynaecology ◯ ENT

◯ Vascular Surgery ◯ GI surgery ◯ Obstetrics ◯ Rehabilitation ◯ Long stay elderly ◯ Psychiatry

c) How many in-patient beds in your Trust .....

d) How many pharmacy staff employed at Trust: Pharmacists ..... Technicians ..... ATO .....

e) Location of your Trust - UK Home Nation ◯ Yes ◯ No
If yes please specify ◯ Wales ◯ England ◯ Scotland ◯ Northern Ireland
If no please specify .....

Please now save a copy of this for your records and return a copy to r.bednall@nhs.net. Thank you for your participation in Part 1 of this study. You will shortly receive a copy of the Royal Stoke Pharmacy Workforce Calculator as Part 2 of this project. You will also be asked to confirm or amend your responses to parts 1 and 3 of this questionnaire in the light of the data presented once all first round results are available.

Appendix 8: Main study Part 1: Questionnaire 2

Pharmacy Staffing Questionnaire –Data Summary & Review

Data Summary

Thank you for your participation in this study. Data was submitted from 21 sites across the UK and summarised below for your review. The purpose of this part of the study is to identify if consensus can be achieved on the tasks required to deliver pharmaceutical care, the time these take and how often these should be completed for one patient. Very high levels of consensus (>90%) were achieved on the tasks required for the delivery of care (data set A). Some sites identified additional tasks on which you are now asked to comment.

For the staff delivering the tasks (B) and the time taken to complete (C) there is broad agreement amongst participants – though consensus is not to the same level as for the tasks themselves. Please review this data – your own site's data is shown alongside. For category B all sites responded and the % agreement on staff groups is shown. For data set C, the 'N' number refers to the number of sites which submitted data on each element. The first figure is the 'mode' ie the most common response given followed in brackets by the percentage of participants who returned this response - this represents the percentage agreement achieved so far. Finally in this section the range of responses is shown to give you some context. If you wish to amend your data in the light of the information provided– please complete the blank data set which follows the data summary. If you don't wish to amend data, explanation as to any differences from the mode would be a useful insight and again should be documented in the blank data set provided. Only amendments and explanations need to be recorded here – a full copy of your data is not required on this occasion.

The same principle has been applied to the display of data set D – how often the task should be completed. You will note that there is a level of consensus achieved here which suggests not a numerical value but a dependency on patient characteristics. Please pay particular attention to the questions relating to this which follow.

If you have any questions relating to this summary please don't hesitate to contact me r.bednall@nhs.net .

Please now review the data summarised below.

Data Summary

*Key: *Data was bimodal Depends = depends on the patient D-3 = ranges from depends on patient to 3 times during admission*

Direct patient care activities completed for each patient admission	A Agreement with task necessity		B Staff group required to deliver task		C Time task takes (on average in minutes)		D Frequency which task should be done for each patient admission	
	% Participants' agreement N=21	Your Site Data	% Participants' response/ Category N= 21	Your Site Data	Mode of Participants' Response (% in agreement) Range	Your Site Data	Mode of Participants' Response (% in agreement) Range	Your Site Data
Medicines Reconciliation (pharmacy confirmed and signed off)	100		**P & MMT = 81%**		**N= 21* 10 (29%) & 20 (29%) 6-30**		**N=21 1(85%) 1-2**	
Check of Patients Own Drugs (PODs)	95		**P&MMT= 43% MMT= 48%**		**N=17 5 (58%) 4-15**		**N=20 1(65%) 1-2**	
Clinical Review of Notes	90		**P=81%**		**N=18 5 (66%) 2-10**		**N=20 Depends (45%) D-7**	
Review of Blood results	90		**P=81%**		**N=17 5 (35%) 1-5**		**N=19 Depends (52%) D-3**	
Initial review of Drug Chart	100		**P=38% P&MMT=57%**		**N=18 5 (50%) 2-5**		**N=19 1 (79%) D-1**	
Initial endorsing of Drug Chart	95		**P=43% P&MMT=48%**		**N=17 5 (40%) 1-10**		**N=17 1 (82%) D-1**	
Subsequent review of Drug Chart	95		**P=33% P&MMT=57%**		**N=17 5 (41%) 1-5**		**N=18 Depends (44%) D-Daily**	

Direct patient care activities completed for each patient admission	A Agreement with task necessity		B Staff group required to deliver task		C Time task takes (on average in minutes)		D Frequency which task should be done for each patient admission	
	% Participants' agreement N=21	Your Site Data	% Participants' response/ Category N=	Your Site Data	Mode of Participants' Response (% in agreement) Range	Your Site Data	% Participants' response	Your Site Data
Subsequent endorsing of Drug Chart	90		**P=38% P&MMT=47%**		**N=17 2(30%) 0-5**		**N=17 Depends (41%) D-daily**	
Completion of Paperwork (Pharmacy handover/care plans etc)	86		**P=14% P&MMT=47% MMT=5% Not reported =33%**		**N=9 5 (66%) 1-5**		**N=11 Depends (27%) D-Daily**	
Ordering of Non Stocks	90		**P&MMT=43% MMT=29%**		**N=16 5(44%) 1-5**		**N=17 Depends (47%) D-3**	
Clinical Check of Discharge prescription	100		**P=76%**		**N=21 5(38%) 2-17**		**N=21 1 (100%)**	
Talking to patient about their medicines	95		**P&MMT=81%**		**N=17 5 (47%) 1-15**		**N=17 1 (40%) D-2**	
Making interventions on patient care	100		**P=33% Discharge =67%**		**N=16 5 (56%) 1-10**		**N=19 Depends (57%) D-Daily**	

Direct patient care activities completed for each patient admission	A Agreement with task necessity		B Staff group required to deliver task	
	% Participants' agreement N=21	Your Site Data	% Participants' response/ Category N=	Your Site Data
In patient Booking on to tracker system	67		**(N=9) ATO 100%**	
In patient Dispensing	100		**ATO=29% ATO&TECH=48 % Not reported= 19%**	
In patient Checking	100		**ACT=38% P&ACT=43%**	
Discharge booking onto tracker system	76		**(N=13) ATO 100%**	
Discharge Dispensing	100		**ATO=14% ATO&TECH=57 5% NR=19%**	
Discharge Checking	76		**P&MMT=64% MMT/ACT=29%**	

Data Review

If you wish to amend your data set please make changes to the relevant category using the example answer below

Tasks: **Direct patient care activities completed for each patient admission**	**A** **Identify if you think this task should be completed by your Pharmacy Team for each patient**	**B** **Identify staff group required to perform this task** Pharmacist (P) MMT ATO Technician (T) ACT	**C** **How long do you think this activity should take to complete on average (per prescription in mins)?** NB This data can be: 1. Existing local data (ELD) 2. Data collected specifically in response to questionnaire (DC) 3. Best Guess (BG) 4. Not Known (NK)	**D** **Please estimate number of occasions the task should be completed per admission.** Please identify if this is dictated by personal practice (PP) or by departmental SOP (SOP)
Sample Answer: **Medicines Reconciliation (pharmacy completed and signed off by pharmacist**	√	**P and MMT**	**ELD 10**	**SOP 1**

Key for abbreviations: **MMT** – Medicine Management Technician, **ATO** – Assistant Technical Officer, **ACT** – Accredited Checking Technician

Revised Data Set – please use this section to amend your site's data in the light of the results above.

Direct patient care activities completed for each patient admission	A Identify if you think this activity should be completed by your Pharmacy Team for each patient	B Identify staff group required to perform this task	C How long do you think this activity should take on average (per prescription in mins)?	D Please estimate number of occasions you think the activity should place per admission.	Comments
Medicines Reconciliation					
Check of Patients Own Drugs (PODs)					
Clinical Review of Notes					
Review of Blood results					
Initial review of Drug Chart					
Initial endorsing of Drug Chart					
Subsequent review of Drug Chart					
Subsequent endorsing of Drug Chart					
Completion of Paperwork					
Ordering of Non Stocks					
Clinical Check of Discharge prescription					
Talking to patient about their medicines					
Making interventions on patient care					
DISPENSING ACTIVITY					
In-patient Medicine Supply (whether that as non-stock or as one stop dispensing)					
Booking on to tracker system					
Dispensing					
Checking					
Discharge Prescription (ward or dispensary based)					
Booking onto tracker system					
Triage (Clinical Check)					
Dispensing					
Checking					

Thank you for your support and contribution to this study. You will be sent a copy of the Executive Summary when it is prepared at the end of the research.

Please consider in particular data set D. If you answered 'depends on the patient' for this category in the previous round of data collection or have changed your response to 'depends on the patient' in this round. Please describe below the patient characteristics which would result in you reviewing this patient more frequently.

If these characteristics exist how often would you review the patient?

Does your service delivery model include different levels of clinical review? **YES** **NO**
For example
Level 1 – chart review only, basic safety review doses, interactions, allergies, formulary
Level 2 - above and in addition review of medical notes, blood results, fluids etc

Using the example below to guide you please identify when during the course of a patient stay you would expect to complete certain clinical tasks for a 'typical' patient in each category below.

Key: MR – medicines reconciliation, L1-Level 1 review, L2 – level 2 review, TTO – clinical check, PODs- POD check

Patient type	**Admission day**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Example patient	MR & L2 & POD	L2		L1 & TTO	POD					
Respiratory patient with CAP										
Elective 'gynae' surgical patient										
Longer stay elderly patient										
Short stay medical patient										
Vascular surgical patient										

During the initial questionnaire, some of your colleagues identified additional tasks, which they believed should be routinely delivered in pharmaceutical care. Please complete the following grid with your consideration of these tasks

Additional activities routinely performed but not listed above				
Direct patient care activities completed for each patient admission	**Identify if you think this activity should be completed by your Pharmacy Team for each patient Y=yes N=no**	**Identify staff group required to perform activity at your Trust**	**How long do you think this activity should take on average (per prescription in mins)?**	**Please estimate number of occasions activity should take place per admission.**

Appendix 9: Main study Part 2: Operator evaluation

Royal Stoke Pharmacy Workforce Calculator – Operator Evaluation

Thank you for returning your workforce questionnaire. Attached to this email is a copy of the RSPWC tool with instructions for use. Following the instructions provided please calculate the workforce required for the following scenarios and then cut and paste the bottom section of the tool with your answers in each section. For the purposes of the study, please do not alter the percentages of the different types of prescription items – these answer s are intended only to confirm the transferability of the tool between different operators. It is accepted that these numbers may differ between sites and patient groups ie

REQUIRED STAFF GROUP	GRADE REQUIRED (According to speciality needs)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (mins)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY	MID POINT OF GRADE (+22% oncost)	COST
ATO	2	#DIV/0!	#DIV/0!	#DIV/0!	19338	#DIV/0!
TECHNICIAN	4	#DIV/0!	#DIV/0!	#DIV/0!	25178	#DIV/0!
MMT/PHARMACIST	5	#DIV/0!	#DIV/0!	#DIV/0!	29066	#DIV/0!
PHARMACIST	7	#DIV/0!	#DIV/0!	#DIV/0!	43354	#DIV/0!
				CLINICAL STAFF TOTAL		#DIV/0!

1. A new general medical ward is planned to open. This will have 28 beds and an average length of stay of 5 days. The average number of items on an in-patient prescription is 8. You have to identify the pharmacy staff (WTE) required to deliver your standard ward based service.

2. An existing 28 bed general medical ward with average length of stay of 4 days (average items 8) is being converted to a short stay (48 hour) unit. What impact will this have on your pharmacy service and what if any additional staff would you request?

3. Finally, you are approached by a directorate manager about to submit a business case for 200 new Bariatric Surgical patients. No new beds will be opened, these cases will go through and existing 28 bed surgical ward with a length of stay of 3 days. These patients have an average of 6 items on their prescription. He asks what resource implications this will have for you and what he should include in the business case

Now use the RSPWC for your own purposes and apply it to situations that arise in your setting. When you have familiarised yourself with the tool , please answer the following questions

1. Do you think the RSPWC generates the workforce resource required to deliver pharmaceutical care in your setting?

   Yes **No**

   If 'No' please explain:

2. How did the value generated compare with what you would have requested without using it? (please circle)

   More **The same** **Less**

3. Were the instructions easy to understand? (please circle)

   Yes **No** **Other (please explain)**

4. How long did it take you to use the RSPWC to calculate the answers? (please circle)

   <10 minutes **10-20 minutes** **21-30 minutes** **>30 minutes**

5. Would you be willing to participate in a semi-structured telephone interview about the application of the RSPWC in practice? (please circle) *NB you will be contacted by email in the first instance to arrange a convenient time/date.*

   Yes **No thanks**

   Name:

   email:

Thank you for taking the time to complete this questionnaire. You are now free to use the RSPWC in your practice. Regardless of your answer to question 5, we would be interested in hearing about your experience of using it. Please email r.bednall@nhs.net with any other feedback as you use this tool in practice.

Please note that a final, fully validated version will be issued at the end of the evaluation project. For this reason we ask therefore that this version is not further shared but retained for your department's use. Please direct any interested parties to the researcher.

Appendix 10: Main Study Participant Information Sheet

Study title: Pharmacy workforce - validation of a staff resource calculation tool.

Invitation. You are being invited to take part in a research study. You do not have to take part but before you decide, it is important for you to understand why the research study is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. My name is Ruth Bednall, I am Doctorate in Pharmacy student at Keele University and I am doing this research study as part of this degree. Take time to decide whether or not you wish to take part.

What is the purpose of the study? The Royal Stoke Pharmacy Workforce Calculator (RSPWC) was developed by the Pharmacy Department at the Royal Stoke University Hospital. Locally this tool has proved an effective method of identifying the pharmacy resource required to deliver pharmaceutical care. This study seeks to assess its reliability and usability when applied to the ward pharmacy services of other hospital sites.

Why have I been chosen? You are being invited to take part in this research study either because you responded to the invitation issued through a professional forum, or to a personal invitation to participate and expressed an interest to be part of the study.

Do I have to take part? It is up to you to decide whether or not to take part. If you choose to take part you will first be asked to confirm your consent and you can still withdraw at any time. You do not have to give a reason.

What do I have to do to take part? If you decide to take part you will be invited to contribute in 4 parts.

Part 1: This is a questionnaire that you will be required to complete and return by email. It identifies tasks that are performed by your staff in the course of their provision of pharmaceutical care, what resource you currently request to deliver specific services, 'down time' in an average working week and demographic information about your hospital The time required to complete this questionnaire will be dependent on the availability of data at your site. To fully complete some local data collection may be required, but this is not compulsory and incomplete data sets are acceptable where local data for specific criteria are not easily available. You may need to complete aspects of this questionnaire during working hours. Your Chief Pharmacist should be aware and approve of your participation in this study.

Part 2: On return of your response to the first questionnaire you will be sent a copy of the RSPWC and asked to use it to calculate the pharmacy resource that would be required to deliver services in 3 different scenarios and complete a feedback form. This should be emailed to the investigator and you are then free to continue using the RSPWC for your own purposes

Part 3:.Results from the first questionnaire will be returned to you. You will be only be able to identify your data in the tables provided, other data will be anonymised. The second questionnaire will ask you to confirm or amend your responses in the light of the information presented. You will be required to return this questionnaire by email.

Part 4: On receipt of your calculations, if you have identified an interest in continued participation, you may be contacted by the investigator to participate in a semi-structured telephone interview to appraise your views of the use of the RSPWC and its perceived or actual benefits/disadvantages to your department.

What are the possible disadvantages and risks of taking part? We are not aware of any disadvantages or risks to you in taking part in the study.

What are the possible benefits of taking part? You will have access to the RSPWC tool to use for your own workforce planning purposes.

Can I withdraw from the study? Yes, any participant can choose to withdraw their data from the study with no explanation required up to the point when the data collection for Part 2 is complete and the results compiled. If a participant chooses to withdraw, their data will be destroyed and not included in the report. Withdrawal rate of participants will be included in the degree report but this will be anonymous.

W**hat if there is a problem or something goes wrong?** You can contact me (r.bednall@nhs.net) if you wish to complain, or have any concerns about any aspect about any way you have been approached or treated during the course of this study. I will consider such reports promptly and take appropriate action immediately. If you feel that your complaint has not been handled to your satisfaction you can contact my supervisor (Dr Simon White]) at (s.j.white@keele.ac.uk). Alternatively, you may contact the Head of the School of Pharmacy (Professor Nigel Ratcliffe n.ratcliffe@keele.ac.uk). If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way in which you have been approached or tyreated during the course of the study please write to Nicola Leighton, who is the University contact for complaints regarding research at Research & Enterprise Services, Keele University, ST5 5BG n.leighton@keele.ac.uk telephone 01782 733306.

Who will have access to information about me or my department? All the information that we collect about you during the course of the research will be kept strictly confidential and no one outside the project will be allowed access to it. Electronic data containing personally identifiable information about you will only be stored on password-protected media that only I and my supervisor (Dr Simon White) have access to. Hardcopies of data and other documentation containing personally identifiable information about you will be kept secure in a locked cupboard that only my supervisor and I have access to. At the end of the study all data and documents containing personally identifiable information about you will be destroyed. You will not be able to be identified in any reports or publications. You will have access to your data benchmarked against other participant sites.

How will information about me be used? The results (including anonymised short direct quotes with your consent) will be included in a research report as part of my doctoral degree in pharmacy at Keele University, and may subsequently be published as research papers in academic journals and presented at conferences. The participating Trust names will be listed within the degree report and may be included in any publication to demonstrate the population within which consensus has been achieved. It will not be possible to associate any data with any individual in any direct quotes, reports, papers, presentations or summaries.

Who is organising and funding the research? The study is being organised and funded by the School of Pharmacy at Keele University and the University Hospitals of North Midlands (UHNM) NHS Trust.

Who has reviewed the study? The research study has been approved by Keele University Ethical Review Panel and has received NHS Management permission (R&D approval).

Further Information and Contact Details If you have any questions or require any further information, either now or at any time during the study, please contact me (Ruth Bednall) at r.bednall@nhs.net. Alternatively, you can contact me in writing at the Pharmacy Department, Royal Stoke University Hospital, Newcastle Road, Stoke on Trent, ST4 6QG

Thank you for taking time to read this information.

Appendix 11: Main Study Consent Form

Consent Form

Title of Project: Pharmacy workforce - validation of a staff resource calculation tool.
Name of Principal Investigator: Ruth Bednall
Please tick box

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions ☐

I have informed the relevant authority within my Trust that I am submitting data to this project (eg Chief Pharmacist) and they are happy with the content of that submission ☐

I agree to take part in this study and I understand that my participation is voluntary and that I am free to withdraw at any time up to the conclusion of Part 2 of the study. ☐

I understand that data collected about me during this study will be anonymised before it is submitted for publication, this includes anonymised short direct quotes if I participate in Part 4 ☐

Name of participant _____

Signature _____

Date _____

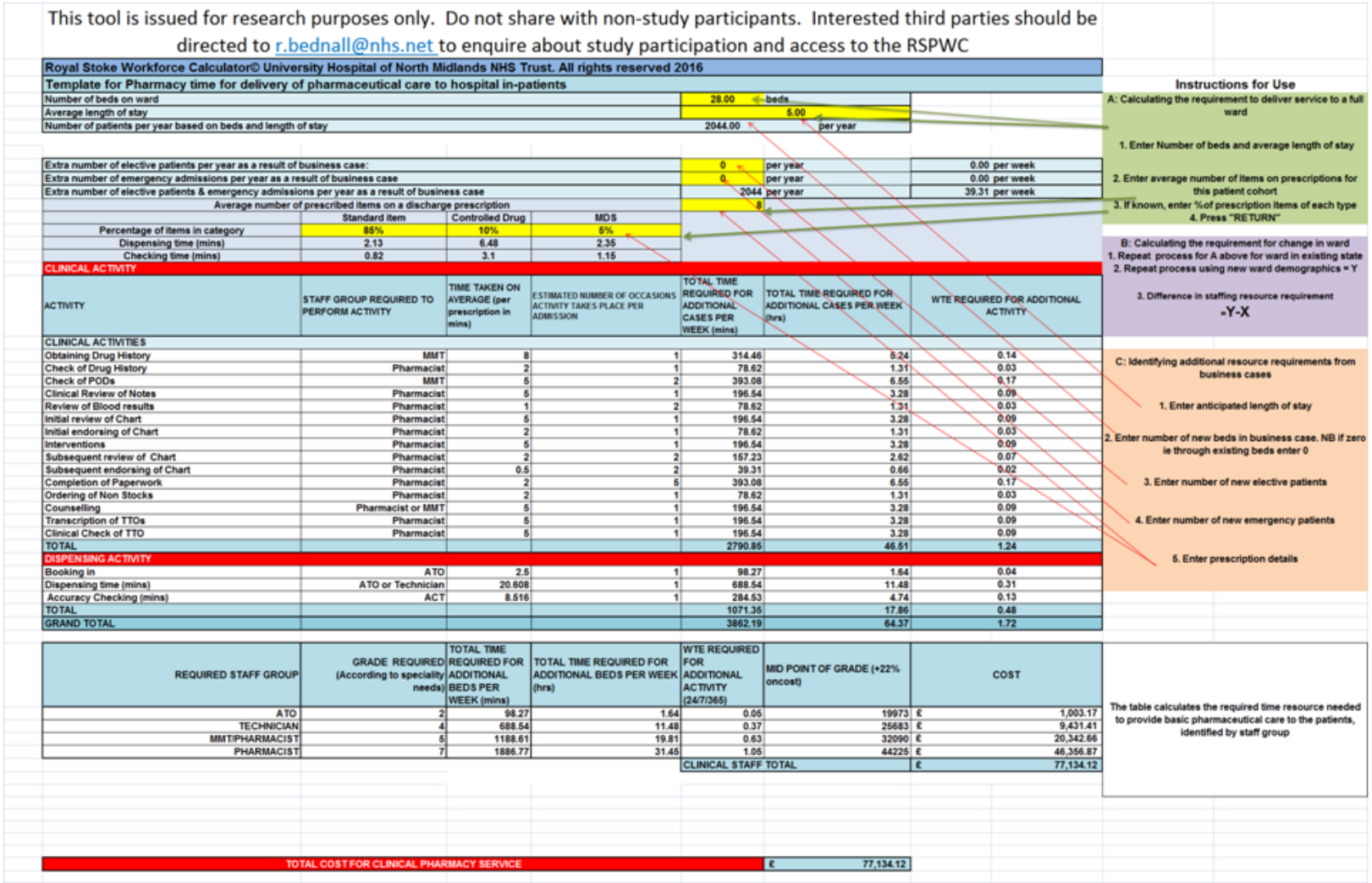
Researcher Ruth Bednall

Signature Ruth M Bednall

Date 27/2/15

1 copy for participant, 1 copy for researcher

Appendix 12: Study Prototype RSPWC with instructions for use



This tool is issued for research purposes only. Do not share with non-study participants. Interested third parties should be directed to r.bednall@nhs.net to enquire about study participation and access to the RSPWC

Royal Stoke Workforce Calculator© University Hospital of North Midlands NHS Trust. All rights reserved 2016

Template for Pharmacy time for delivery of pharmaceutical care to hospital in-patients

Number of beds on ward	28.00	beds
Average length of stay	5.00	
Number of patients per year based on beds and length of stay	2044.00	per year

Extra number of elective patients per year as a result of business case:	0	per year	0.00 per week
Extra number of emergency admissions per year as a result of business case	0	per year	0.00 per week
Extra number of elective patients & emergency admissions per year as a result of business case	2044	per year	39.31 per week
Average number of prescribed items on a discharge prescription	8		

	Standard item	Controlled Drug	MDS
Percentage of items in category	85%	10%	5%
Dispensing time (mins)	2.13	6.48	2.35
Checking time (mins)	0.82	3.1	1.15

CLINICAL ACTIVITY

ACTIVITY	STAFF GROUP REQUIRED TO PERFORM ACTIVITY	TIME TAKEN ON AVERAGE (per prescription in mins)	ESTIMATED NUMBER OF OCCASIONS ACTIVITY TAKES PLACE PER ADMISSION	TOTAL TIME REQUIRED FOR ADDITIONAL CASES PER WEEK (mins)	TOTAL TIME REQUIRED FOR ADDITIONAL CASES PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY
CLINICAL ACTIVITIES						
Obtaining Drug History	MMT	8	1	314.46	5.24	0.14
Check of Drug History	Pharmacist	2	1	78.62	1.31	0.03
Check of PODs	MMT	5	2	393.08	6.55	0.17
Clinical Review of Notes	Pharmacist	5	1	196.54	3.28	0.09
Review of Blood results	Pharmacist	1	2	78.62	1.31	0.03
Initial review of Chart	Pharmacist	5	1	196.54	3.28	0.09
Initial endorsing of Chart	Pharmacist	2	1	78.62	1.31	0.03
Interventions	Pharmacist	5	1	196.54	3.28	0.09
Subsequent review of Chart	Pharmacist	2	2	157.23	2.62	0.07
Subsequent endorsing of Chart	Pharmacist	0.5	2	39.31	0.66	0.02
Completion of Paperwork	Pharmacist	2	5	393.08	6.55	0.17
Ordering of Non Stocks	Pharmacist	2	1	78.62	1.31	0.03
Counselling	Pharmacist or MMT	5	1	196.54	3.28	0.09
Transcription of TTOs	Pharmacist	5	1	196.54	3.28	0.09
Clinical Check of TTO	Pharmacist	5	1	196.54	3.28	0.09
TOTAL				2790.85	46.51	1.24
DISPENSING ACTIVITY						
Booking in	ATO	2.5	1	98.27	1.64	0.04
Dispensing time (mins)	ATO or Technician	20.608	1	688.54	11.48	0.31
Accuracy Checking (mins)	ACT	8.516	1	284.53	4.74	0.13
TOTAL				1071.35	17.86	0.48
GRAND TOTAL				3862.19	64.37	1.72

REQUIRED STAFF GROUP	GRADE REQUIRED (According to speciality needs)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (mins)	TOTAL TIME REQUIRED FOR ADDITIONAL BEDS PER WEEK (hrs)	WTE REQUIRED FOR ADDITIONAL ACTIVITY (24/7/365)	MID POINT OF GRADE (+22% oncost)		COST
ATO	2	98.27	1.64	0.05	19973	£	1,003.17
TECHNICIAN	4	688.54	11.48	0.37	25683	£	9,431.41
MMT/PHARMACIST	5	1188.61	19.81	0.63	32090	£	20,342.66
PHARMACIST	7	1886.77	31.45	1.05	44225	£	46,356.87
				CLINICAL STAFF TOTAL		£	77,134.12

TOTAL COST FOR CLINICAL PHARMACY SERVICE	£	77,134.12

Instructions for Use

A: Calculating the requirement to deliver service to a full ward

1. Enter Number of beds and average length of stay
2. Enter average number of items on prescriptions for this patient cohort
3. If known, enter %of prescription items of each type
4. Press "RETURN"

B: Calculating the requirement for change in ward

1. Repeat process for A above for ward in existing state
2. Repeat process using new ward demographics = Y
3. Difference in staffing resource requirement

-Y-X

C: Identifying additional resource requirements from business cases

1. Enter anticipated length of stay
2. Enter number of new beds in business case. NB if zero ie through existing beds enter 0
3. Enter number of new elective patients
4. Enter number of new emergency patients
5. Enter prescription details

The table calculates the required time resource needed to provide basic pharmaceutical care to the patients, identified by staff group

Appendix 13: Main Study Part 3: Interview Guide

Introduction:
Thank you for agreeing to have this conversation with me today. I anticipate that it will take no longer than 30 minutes. I am digitally recording our discussions so that it can be accurately transcribed for analysis purposes. The data generated will remain confidential and reported anonymously, no comments will be directly attributed to you in any report or paper produced. You are able to stop the conversation at any point today and withdraw your data from the analysis within the next 4 weeks.

If you are happy then we can start?

I'd like to first understand a little about your site and the service you deliver.

Perhaps you could start by describing for me the trust in which you work in terms of status, beds, and specialities?

Can you describe how your pharmacy department is structured and the way in which your ward based clinical pharmacy service is delivered?

What are the challenges that face you currently in terms pharmacy staffing?

Prompts: recruitment, retention, CIP, productivity

Having used the RSPWC what do you think might be its application if any in your practice?

What do you think might be the benefits or disadvantages of this tool?

What are the limitations of its application?

During the course of the study it has become apparent that the consensus on how often a task has to be done is that 'it depends on the patient'. What do you think would be patient characteristics that would require additional or priority input and how do you manage this at your Trust?

Appendix 14: Main Study Part 3: Participant Information Sheet

Study title:
Pharmacy workforce - validation of a staff resource calculation tool.

Invitation: You are being invited to take part in a research study. You do not have to take part but before you decide, it is important for you to understand why the research study is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. My name is Ruth Bednall, I am Doctorate in Pharmacy student at Keele University and I am doing this research study as part of this degree. Take time to decide whether or not you wish to take part.

What is the purpose of the study? The Royal Stoke Pharmacy Workforce Calculator (RSPWC) was developed by the Pharmacy Department at the Royal Stoke University Hospital. Locally this tool has proved an effective method of identifying the pharmacy resource required to deliver pharmaceutical care. This study seeks to assess its reliability and usability when applied to the ward pharmacy services of other hospital sites.

Why have I been chosen? You are being invited to take part in this research study because you responded to an invitation issued through a professional forum or a direct personal invitation and expressed an interest to be part of the study and have already completed the first 3 parts of the research.

Do I have to take part? It is up to you to decide whether or not to take part. If you choose to take part you will first be asked to confirm your consent and you can still withdraw at any time. You do not have to give a reason.

What do I have to do to take part? If you decide to take part you will be contacted to participate in a conversation about pharmacy staffing requirements generally and your views of the RSPWC in particular and its perceived or actual benefits/disadvantages to your department. This conversation is not expected to take more than 30 minutes and will be digitally recorded to ensure accurate transcription of the conversation for analysis purposes. The timing of this interview will be arranged for your convenience and it may/may not be during your working hours. Your Chief Pharmacist should be aware and approve of your participation in this study.

What are the possible disadvantages and risks of taking part? We are not aware of any disadvantages or risks to you in taking part in the study.

What are the possible benefits of taking part? You will have opportunity to express your views and opinions on the potential applications of the RSPWC and influence the future development of this tool.

Can I withdraw from the study? Yes, any participant can choose to withdraw their data from the study with no explanation required up to the point when all the conversations have been completed and the results compiled. If a participant chooses to withdraw, their data will be destroyed and not included in the report. Withdrawal rate of participants will be included in the degree report but this will be anonymous.

What if there is a problem or something goes wrong? You can contact me (r.bednall@nhs.net) if you wish to complain, or have any concerns about any aspect about any way you have been approached or treated during the course of this study. I will consider

such reports promptly and take appropriate action immediately. If you feel that your complaint has not been handled to your satisfaction you can contact my supervisor (Dr Simon White]) at (s.j.white@keele.ac.uk). Alternatively, you may contact the Head of the School of Pharmacy(Professor Nigel Ratcliffe n.ratcliffe@keele.ac.uk). If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way in which you have been approached or tyreated during the course of the study please write to Nicola Leighton, who is the University contact for complaints regarding research at Research & Enterprise Services, Keele University, ST5 5BG n.leighton@keele.ac.uk telephone 01782 733306.

Who will have access to information about me or my department? All the information that we collect about you during the course of the research will be kept strictly confidential and no one outside the project will be allowed access to it. Electronic data containing personally identifiable information about you will only be stored on password-protected media that only I and my supervisor (Dr Simon White) have access to. Hardcopies of data and other documentation containing personally identifiable information about you will be kept secure in a locked cupboard that only my supervisor and I have access to. At the end of the study all data and documents containing personally identifiable information about you will be destroyed. You will not be able to be identified in any reports or publications.

How will information about me be used? The results (including anonymised short direct quotes with your consent) will be included in a research report as part of my doctoral degree in pharmacy at Keele University, and may subsequently be published as research papers in academic journals and presented at conferences. The participating Trust names will be listed within the degree report and may be included in any publication to demonstrate the population within which consensus has been achieved. It will not be possible to associate any data with any individual in any direct quotes, reports, papers, presentations or summaries.

Who is organising and funding the research? The study is being organised and funded by the School of Pharmacy at Keele University and the University Hospitals of North Midlands (UHNM) NHS Trust.

Who has reviewed the study? The research study has been approved by Keele University Ethical Review Panel and has received NHS management permission (R&D approval).

Further Information and Contact Details If you have any questions or require any further information, either now or at any time during the study, please contact me (Ruth Bednall) at r.bednall@nhs.net. Alternatively, you can contact me in writing at the Pharmacy Department, Royal Stoke University Hospital, Newcastle Road, Stoke on Trent, ST4 6QG

Thank you for taking time to read this information.

Appendix 15: Main Study Part 3: Consent form

Consent Form

Title of Project: Pharmacy workforce - validation of a staff resource calculation tool.

Name of Principal Investigator: Ruth Bednall

Please tick box

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

I have informed the relevant authority within my Trust that I am submitting data to this project (eg Chief Pharmacist) and they are happy with the content of that submission. ☐

I agree to take part in this study and I understand that my participation is voluntary and that I am free to withdraw at any time up to the conclusion of Part 2 of the study. ☐

I understand that data collected about me during this study will be anonymised before it is submitted for publication ☐

I am willing for anonymised direct quotes to be included in a reports produced relating to this study ☐

_____	_____	_____
Name of participant	Date	Signature
Ruth Bednall	27/2/15	Ruth M Bednall
Researcher	Date	Signature

1 copy for participant, 1 copy for researcher

Appendix 16: List of participant sites

The following sites submitted data as part of this nationwide consensus study.

Bradford Teaching Hospitals NHS Foundation Trust

County Durham and Darlington NHS Foundation Trust

Dudley Group NHS Foundation Trust

East Kent University Hospitals NHS Foundation Trust

Guys' & St. Thomas' NHS Foundation Trust

Hutt Valley District Health Board, NZ

Morriston Hospital, Abertawe Bro Morgannwg University Health Board

Neville Hall Hospital, Aneurin Bevan University Health Board

Newcastle upon Tyne Hospitals NHS Foundation Trust

NHS Fife

North Bristol NHS Trust

North Cumbria University Hospitals NHS Trust

Northampton General Hospital NHS Trust

Northumbria Healthcare NHS Foundation Trust

Nottingham University Hospitals NHS Trust

Nottinghamshire Healthcare NHS Foundation Trust

Royal Gwent Hospital, Aneurin Bevan University Health Board

South Tees Hospitals NHS Foundation Trust

Tee, Esk and Wear Valleys NHS Foundation Trust

The Leeds Teaching Hospitals NHS Trust

The Robert Jones and Agnes Hunt Orthopaedic Hospital NHS Foundation Trust

University Hospitals Coventry and Warwickshire NHS Trust

University Hospitals of Leicester NHS Trust

University Hospitals of North Midlands NHS Trust