**Comparison of healthcare utilisation, costs and health-related quality of life across the subgroups defined by the Keele STarT MSK Tool**

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**Abstract**

**Objectives:** The aim of this study was to describe and compare health economic outcomes (healthcare utilisation, costs, work outcomes and health-related quality of life (EQ-5D-5L)) in patients classified into different risk subgroups by the Keele STarT MSK Tool.

**Methods:** Data on healthcare utilisation, costs and EQ-5D-5L were collected from a healthcare perspective within a primary care prospective observational cohort study. Patients presenting with one (or more) of the five most common musculoskeletal pain presentations were included: back, neck, shoulder, knee or multi-site pain. Participants at low, medium and high risk of persistent disabling pain were compared in relation to mean healthcare utilisation, costs, health-related quality of life and employment status. Regression analysis was used to estimate costs.

**Results:** Over 6 months, the mean (SD) total healthcare (NHS and private) costs associated with the low, medium and high risk subgroups were £132.92 (167.88), £279.32 (462.98) and £476.07 (716.44) respectively. Mean health-related quality of life over the 6 month period was lower and more people changed their employment status in the high risk subgroup compared to the medium and low risk subgroups.

**Conclusion:** This study demonstrates that subgroups of people with different risk of poor musculoskeletal pain outcomes also have different levels of healthcare utilization, healthcare costs, health-related quality of life and work outcomes. The findings show that the STarT MSK tool not only identifies those at risk of a poorer outcome, but also those who will have more healthcare visits and incur higher costs.

**Keywords:** Costs, Musculoskeletal pain, Stratified care, EQ-5D

**Rheumatology Key messages**:

* The Keele STarT MSK Tool was developed to stratify patients with musculoskeletal pain into subgroups.
* Patients identified as high risk incur greater healthcare costs compared to those in other subgroups.
* Patients in the high risk subgroup were associated with lower health related quality of life.

**Introduction**

Musculoskeletal pain is common, the prevalence of persistent musculoskeletal pain is high (25%-32%) and it affects all sites of the body; most commonly the back, neck, shoulder, knee, as well as multiple sites [1]. The burden of musculoskeletal pain is reflected in high healthcare use, with approximately 20% of a typical primary care population consulting about musculoskeletal pain annually [2]. Conditions such as low back pain are among the leading causes of years lived with disability, representing a significant global burden [3-4]. It has been noted that musculoskeletal pain is one of the key drivers of the costs associated with work absence, and estimates have shown that musculoskeletal conditions account for 20% of sickness certificates in primary care [5].

Most patients with musculoskeletal pain are managed within primary care [6-7], and an approach that subgroups patients based on their risk of persistent disabling pain and matches each subgroup to different treatments, known as STarT Back stratified care [8-9], has previously been shown to be effective and cost-effective for low back pain in the UK NHS setting [10-11]. Several systematic reviews have shown that the prognostic factors that predict poor outcome in low back pain are similar to those that predict outcome across a range of common musculoskeletal pain presentations (back, neck, knee, shoulder and multi-site pain) [12-13]. The Keele STarT MSK Tool was developed and validated to stratify patients into three subgroups (low risk, medium risk and high risk) in those who consult with one or more of the five most common musculoskeletal pain presentations in primary care [14,15]. The validation study showed that the Keele STarT MSK tool predicts persistent pain and disability at 2 and 6 months follow-up [14]. In addition to the validation study, it is also important to establish the health economic costs and outcomes associated with each of the subgroups. This provides useful information for decision makers on the expected healthcare resources required by these patients, and also establishes baseline information for intervention studies.

The aim of this study was to describe health economic outcomes (healthcare utilisation, costs, work outcomes and health-related quality of life) associated with patients classified into risk subgroups based on the Keele STarT MSK tool.

**Methods**

The economic analysis was carried out alongside a prospective primary care cohort study called the Keele Aches and Pains Study (KAPS) [15], and adopted a healthcare perspective (NHS and private costs). In the KAPS study, participants aged 18 years and above presenting with one (or more) of the five most common musculoskeletal pain presentations: back, neck, shoulder, knee or multi-site pain were recruited from 12 general practices in Staffordshire and West Midlands between July 2014 and February 2015. Full details of the eligibility criteria, methods of identification, invitation, consent and data collection, are published elsewhere [14]. The Keele STarT MSK tool was included in patient questionnaires (at baseline, 2 months and 6 months follow-up points). This was used to stratify participants into three risk subgroups (low, medium and high risk of persistent disabling pain) using cut-points based on predictive values, likelihood ratios, sensitivity and specificity for predicting pain intensity and self-reported physical health [14]. The protocol for this study has been published previously [15]. The economic analysis was based on the 1890 participants who consented to participate and returned the baseline postal questionnaires.

 ***Healthcare utilisation data***

Healthcare utilisation data were collected from self-complete questionnaires for each participant and medical record review for those who consented to this.Information on healthcare utilisation relating to the participant’s musculoskeletal pain was collected from their 6 month follow-up questionnaire. NHS healthcare utilisation for musculoskeletal pain included primary and secondary care contacts and treatments, tests and investigations, and contacts with other healthcare professionals such as physiotherapists, rheumatologists and orthopaedic surgeons. Healthcare utilisation associated with participant’s personal expenditure focused on private healthcare use such as osteopathy and over-the-counter treatments such as medication. In addition to the healthcare utilisation data obtained from the patient questionnaires, data on prescribed medication related to the musculoskeletal pain problem were collected from medical records for those who consented to this. Data from the time period approximating to when the patient presented at their general practice about their musculoskeletal pain, up to a period of 6 months after this date, were used for analysis.

***Work outcomes***

Data on employment status were collected from the 6 month follow-up questionnaire, where participants provided information on their current employment status (employed: yes/no), whether their usual employment duties had changed due to pain, and employment satisfaction. Descriptive statistics were used to summarise employment status.

***Unit costs***

Unit costs associated with items of healthcare utilisation were obtained primarily from standard national sources such as the British National Formulary (BNF) for prescribed medication, NHS Reference costs for investigations and PSSRU publication on Unit Costs of Health and Social Care for items such as visits to healthcare professionals [16-18]. Participants also self-reported information on out-of-pocket costs related to the use of over-the-counter medications including costs paid for medication. In cases where participants did not provide costs for their medication(s), we used unit costs obtained from the BNF. Due to a lack of data on unit costs associated with private healthcare, the NHS equivalent was used to cost private healthcare use. 2015/2016 costs were inflated to 2019 prices using the consumer price index.

***Health-related quality of life***

Health-related quality of life was assessed using the 5-level version of the EuroQoL-5D (EQ-5D-5L) questionnaire [19] in baseline, 2 month and 6 month questionnaires. This measure comprises a descriptive system with five dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression). Each dimension is sub-divided into five levels (no problems, slight problems, moderate problems, severe problems and extreme problems), resulting in the definition of 3125 separate states [19]. EQ-5D-5L index scores were generated using the cross-walk tariff as recommended by the National Institute for Health and Care Excellence (NICE) in the UK [20]. As a sensitivity analysis, EQ-5D-5L scores were also obtained with the UK value set [21-22].

***Statistical analysis***

Descriptive statistics were used to summarise the main health economic outcomes (healthcare utilisation, costs and health-related quality of life). The initial description of healthcare utilisation and costs was limited to complete cases. To ensure all eligible participants were included in the analysis and to overcome potential biased reporting due to missing data, missing EQ-5D-5L scores and costs were imputed using multiple imputation methodology [23]. A total cost-per-patient over a period of 6 months was estimated by summing up the costs associated with each healthcare utilisation item. Mean total costs associated with each patient risk subgroup were obtained and bootstrapping (1000 replications) was used to estimate bias-corrected confidence intervals around differences in mean costs and quality of life. Comparisons between risk subgroups used the low risk subgroup as the reference category. Regression analysis was used to estimate costs in the patient risk subgroups and investigate the relationship between the actual scores on the Keele STarT MSK tool and costs. Mean costs by risk subgroup and by pain site were also estimated.

The study was approved by the South East Scotland Research Ethics Committee (14/SS/0083). All participants gave informed consent to take part.

**Results**

Out of the 1890 participants, 193 (10.2%) participants did not have any risk subgroup classification due to missing items on the Keele STarT MSK tool and as a consequence were not included in the analysis by risk subgroup. Overall (including participants without risk subgroup classification), most (51.5%) reported they had multi-site pain compared with pain in only one site (back 21.6%, knee 18.5%, shoulder 5.4%, neck 3.0%) (Table 1). A total of 1,253 participants had complete resource use and health-related quality of life data at 6 months and, of these, 114 (9.1%) participants did not have a risk subgroup classification.

***Healthcare utilisation and costs***

Healthcare utilisation for complete cases is presented in Table 2 and Supplementary Table 1. The most common primary care visit was to the GP (mean 1.44 visits per participant over 6 months). Across the subgroups, a higher proportion of participants in the high risk subgroup (mean 2.22) reported GP consultations compared to those in the low risk subgroup (mean 0.66). A similar trend was seen with secondary care consultations. The only exception was with respect to consultations to private acupuncturists and private physiotherapists, where slightly more of these types of consultations were reported by participants at medium risk than high risk of persistent disabling pain (Table 2).

The results also showed that 36.9% of participants classified at high risk of persistent disabling pain reported treatments/investigations such as x-rays (NHS or private) over the 6 month follow-up period compared to 29.5% and 14.5% in the medium and low risk subgroups, respectively (Table 2). The self-reported use of over-the-counter (OTC) medication ranged from an average of 40.7% in the low risk subgroup to 52.4% and 51.6% in the medium and high risk subgroups, respectively. Regarding type of prescribed medication, 23.9% and 15.1% of prescriptions in the low risk subgroup were for NSAIDS and topical analgesics compared to 10.7% and 7.8% in the high risk subgroup. In contrast, only 8.4% of the prescriptions reported by participants in the low risk subgroup were opioid medications compared with 32.2% in the high risk subgroup (Table 2).

Data on healthcare costs (complete cases and imputed analysis) are presented in Table 3 and Supplementary Figures 1 and 2. Overall, the mean total healthcare (NHS and private) cost (SD) per participant recorded over the 6 months follow-up period was £306.17 (523.77). Total mean costs (SD) per participant over 6 months were £132.92 (167.88), £279.32 (462.98) and £476.07 (716.44) in the low, medium and high risk subgroups, respectively, with total costs in both the medium and high risk subgroups higher than those in the low risk subgroup. The regression analysis gave similar results (Table 3), and a similar pattern was seen across the five musculoskeletal pain sites. For example, for those presenting with back pain, total mean cost (SD) in the low, medium and high risk subgroups were £115.35 (136.22), £242.38 (291.21) and £389.66 (580.29) respectively. Similarly, for those presenting with multi-site pain, total mean cost (SD) in the low, medium and high risk subgroups were £143.22 (173.16), £267.83 (352.95) and £503.38 (699.07). The results for the other pain sites are presented in supplementary Table 2. Results from the regression analysis showed that there was no significant relationship between any cost items and the actual scores on the Keele STarT MSK tool (Supplementary Table 3).

***Health-related quality of life (EQ-5D-5L)***

Data on health-related quality of life are presented in Table 4 and Supplementary Figure 2. Overall, mean EQ-5D-5L scores increased over the 6 month follow-up, indicating improvement in general health-related quality of life. EQ-5D-5L scores in the high risk subgroup were lower than those recorded in the low risk subgroup at all time-points, with a mean score of 0.332 at baseline compared to 0.621 and 0.778 in the medium risk subgroup and low risk subgroups. At 6 months, mean EQ-5D-5L scores were 0.801, 0.655 and 0.420 in the low, medium and high risk subgroups respectively. A similar pattern was observed with EQ-5D-5L scores that were obtained from the UK tariff (Table 4).

***Work related outcomes***

Work related outcomes are presented in Table 2 and the results show that more participants in the high risk subgroup (10.0%) had changed their usual employment due to pain at 6 months compared to those in the medium (5.7%) and low risk (0.3%) subgroups, respectively. Job satisfaction was highest in the low risk subgroup, with 18.2% reporting they were very satisfied with their jobs compared to 11.5% and 6.6% in the medium and high risk subgroups.

**Discussion**

***Summary of the main findings***

This study describes and compare healthcare utilisation, costs, work outcomes and health- related quality of life in patients with musculoskeletal pain, classified into different risk subgroups defined by the Keele STarT MSK Tool. The results showed that patients identified as being at high risk of persistent disabling musculoskeletal pain have more primary and secondary care consultations for their pain, and incur greater healthcare costs over 6 months, compared to those in medium and low risk subgroups. The mean total healthcare (NHS and private) cost for all patients over 6 months was £306.17. By risk subgroup, the mean costs were £132.92 for low risk, £279.32 for medium risk and £476.07 for the high risk subgroup. Patients in the medium and high risk subgroups had lower quality of life scores compared with those in the low risk subgroup, and EQ-5D-5L scores at 6 months were 0.801, 0.655 and 0.420 in the low, medium and high risk subgroups respectively. The results also show that more patients classified at high risk changed their employment status over 6 months compared to the medium and low risk groups.

Stratified care studies such as the STarT Back trial have shown similar results, with healthcare utilisation generally higher in the high risk subgroup compared to the medium and low risk subgroups, and EQ-5D scores lower in the high risk subgroup [24]. Furthermore, baseline EQ-5D scores in the low risk group in the STarT Back trial were twice as high as those in the high risk subgroup, in line with the results of this study.

***Strengths and limitations***

Strengths include the way in which we have provided a comprehensive health economics assessment (healthcare utilisation, costs, work outcomes and health-related quality of life) of the Keele STarT MSK tool within a large prospective cohort of adults consulting with musculoskeletal pain in UK primary care. The design and methods for the cohort study and health economic analyses were published in full previously in a protocol [15]. A limitation was that we could not compute the STarT MSK risk subgroup classification for some patients due to missing items. However, this was only 10.2% of the sample. In addition, the sample was limited to 1890 of the 4720 patients who were invited. This could lead to bias if participants were systematically different to the whole group that were invited to participate. Lastly, data on number of days off work were not collected and as a result it was not possible to estimate productivity costs and time off work.

***Implications for research and practice***

This study describes the patterns of healthcare utilisation, costs, work outcomes and health-related quality of life in people presenting with musculoskeletal pain, across the five most common musculoskeletal pain presentations. The study also describes these outcomes in different subgroups of risk of persistent disabling pain, defined by the Keele STarT MSK tool. The results show that healthcare utilisation and costs appear to be higher in those in the high risk subgroup compared with the low and medium risk groups, and high risk patients also experience lower health-related quality of life. The findings add to our previous paper [14] that showed the STarT MSK tool identifies those at risk of a poorer outcome, by also now showing that the tool also identified those who will use more healthcare and incur higher costs. The study also presents valuable information about this patient group with which to make comparison in intervention studies in the future. Furthermore, the findings provide an insight into the potential resource use and cost implications associated with each risk subgroup, which is potentially important information for healthcare decision makers when considering the impact of treatment options.

***Conclusion***

This study provides a clear description and comparison of the health economic outcomes (healthcare utilisation, costs, work outcomes and health-related quality of life) in different risk subgroups of primary care patients with musculoskeletal pain, defined classified by the Keele STarT MSK Tool. The results provide useful information on the potential cost implications of successful interventions within each group.

**Conflicts of Interest:** None to declare

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**Data availability statement:** The datasets analysed during the current study are available from the corresponding author on reasonable request.

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