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Are Clinical Decision Support Systems seen as helpful to First Contact Practitioners (FCPs) working in Musculoskeletal Health?

--Manuscript Draft--

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Abstract:	Background There is increasing burden on musculoskeletal (MSK) First Contact Practitioners (FCPs) working in primary care. One possible solution is to use digital technologies such as clinical decision support systems (CDSS). The primary objective of this study was to understand the potential for MSK FCPs to use a CDSS to support their practice in the United Kingdom. Design An explanatory sequential mixed methods design, using a cross sectional survey questionnaire and a subsequent focus group. Following ethical approval responders were recruited via professional networks to complete an online survey. A subsequent focus group enabled an in-depth exploration of survey results. Descriptive statistics were used to summarise survey data and thematic analysis with normalisation process theory used to describe findings. Methods A snowball sampling method was used to invite MSK FCPs to complete the survey, using email, adverts and social media. The questionnaire captured responders' demographic and professional practice characteristics, their knowledge and use of CDSS and their views and experiences regarding CDSS in MSK practice. Results There were 75 responders to the survey and six participants in the focus group. The majority of responders 67% (n=50/75) reported to be in favour of integrating a CDSS into their practice. Three themes were: 1) ensuring CDSS address efficiency concerns, 2) using CDSS to reduce unwarranted variation in practice, and 3) ensuring CDSS sustainability. Conclusions CDSSs have potential value for FCPs working in MSK primary care settings. Eight summary recommendations advise future developments of CDSS for FCPs working in MSK primary care practice.

21st May 2024

Ref: Ms. No. PHYST-23-203: Are Clinical Decision Support Systems seen as helpful to First Contact Practitioners (FCPs) working in Musculoskeletal Health?

Response to Michelle Harms- Editor

Thank you for further consideration of the above manuscript. We hope that the amendments will satisfy both your and the reviewers comments and enable this paper to be suitable for publication in Physiotherapy.

We note your point around non-probability sampling and the issues around self-selection and representativeness. Snowball methods of sampling are becoming an increasingly recognised and largely accepted methodology. Whist there are known limitations, such as those you have highlighted, the advantage of this approach is the potential to engage participants who would not usually participate in research studies because anonymity is assured and accessibility is enhanced. We have added a section in the discussion to highlight the weaknesses of non-probability sampling which we anticipate will enable transparency around this point. Finally, we were hopeful that the non-probability of sampling would be acceptable to your journal as a similar study with very similar methodology was published in Physiotherapy in 2020 (Halls et al. https://doi.org/10.1016/j.physio.2020.04.005)

Responses to Reviewer #1

1. In the background, the authors mention FCP burnout and exhaustion - it is unclear how this links to CDSSs and/or whether there is any evidence that these can mitigate/influence this issue

To address clarity the following has been added to the introduction section: 'It has been recently reported that clinical decision support systems (CDSSs) can reduce clinician burnout'. A further reference has been added to support this statement: Chen, C, Chen, Y, Scholl, J, Yang H & Li Y. (2024)

2. In the background - CDSSs are introduced but not defined (this a consistent feature in relation to this research). It would be useful to define what is meant by a CDSS and also (either within the discussion and or intro) discuss whether (at present) there is any evidence to support their use in msk primary care - this would aid both the rationale and discussion of results

Thank you for highlighting this- it is a good point and one that has been overlooked. A paragraph has been added to the introduction:

'Clinical Decision Support Systems are digital tools that can support clinicians to make safe best practice decisions. Many CDSS are built on algorithmic-evidenced based guidelines such as those used in stratification of back pain [10]. Other CDSS are built on machine learning whereby large data sets can enable a computer to predict which interventions are likely to be best/safest for an individual patient based on their phenotype [11]'

3. In relation to the survey - can the authors please explain how the questions for this survey designed and the constructs to be explored decided- what methods were used to design the survey and what literature informed its development

The design of the survey questions in section two was based around the constructs of value, usability and perceived barriers to implementation. Multiple resources were used to formulate the questions around the use of clinical support tools in clinical practice, including previous literature, online

discussion forums and clinical expertise. This informed the question development which was further refined from using three FCP clinicians as mentioned in the section on 'survey questionnaire' in methods. Further detail has been added to aid clarity:

'The design of the survey questions in section two was based around the constructs of value, usability and perceived barriers to implementation. Multiple resources were used to formulate the questions around the use of clinical support tools in clinical practice, including previous literature, online discussion forums and clinical expertise. This informed the question development which was further refined from using three FCP clinicians who …'

4. The sample size estimation is a little unclear - the authors reference a previous FCP study where 98 were recruited. Was the sampling strategy similar to your study?
   Why is 10% of potential FCPs working in practice deemed a realistic sample?

Yes, the sampling method also used a non-probability method of recruitment and was very similar to our own strategy. We felt that aiming for a number of 80 participants was a realistic number to reach based on what the attainment of this study (Hall et al., 2020) achieved. For clarity, we have added the following sentences to the end of the 'sample size' paragraph: 'Best estimates were based on numbers that had been recruited from a study on FCP where 98 FCPs were recruited to a survey using a non –probability method of recruitment very similar to this study [18]. This study therefore aimed to gain 80 (minimum of 70) survey responses from FCPs based on this being approximately 10% of the total sample, a realistic number to reach, and aligned to what was achieved in the study by Hall et al. (2020).'

5. In the analysis section for the focus groups, codes were identified for Band 7 and Band 8 to look for differences in priorities - it is not clear from the background/rationale and or research aims why this analysis was carried out. Please can the authors clarify?

Thank you for highlighting this. We have added the following to this section: 'Potentially Band 7 FCPs were more likely to have less clinical experience, knowledge and confidence compared to band 8 FCPs. As a CDSS could be considered more useful to the clinicians with less experience, it was decided to analyse the two grades independently.'

6. In the results section - there does not appear to be a clear presentation of the results of the survey tool - these are in table 3 but do not present all survey responses/options

We have included a breakdown of the survey results in an additional appendix- Appendix 2.

7. Can the authors please clarify how participants were selected and recruited to focus group?

The following detail has been added to the text: 'Few of the survey participants (14/41; 34%) who had agreed to be contacted about the focus group responded by saying that they were happy to be involved in the focus group. However, only six participants (6/41; 15%) were able to commit to the day of the group'

8. The results of the mixed methods analysis potentially question FCPs knowledge and understanding of a CDSS - 69% mostly or fully understand what a CDSS is (meaning that 31% report less understanding)
   The majority reported use of CDSSs - 81% using support for self-management (Apps and info leaflets). However, it is arguable whether these are clear examples of a CDSS. Therefore a definition of what a CDSS is and also what is not considered a CDSS would be useful esp. in

relation to discussing these results and whether these is clear coherence in FCPs understanding of what a CDSS is and its potential purposes in primary care msk management

Agreed. We anticipate that by adding the text (from question 2) will address this issue.

9. The authors highlight the sample size and geographic distribution of the sample as a weakness - what impact does this have on the validity of the results?
   There could also be further consideration of the limitations of survey research and potential bias considered

Thank you for highlighting this. In response, we have added the following to the study limitation section in the discussion: 'non-probability sampling and self-selection in particular, are likely to result in sampling bias. When a population of interest is carefully defined, reasonable confidence in its representativeness results. Because the participants were largely self-selecting, there is no knowledge about non-responders and the representativeness cannot be estimated.'

10. The 2nd sentence of methods section is long and difficult to follow - please amend

This has been amended to: 'It was anticipated that combining quantitative and qualitative data, integrating the two, and drawing interpretations would provide a greater understanding of what was needed for CDSSs, rather than using a single method approach.'

11. Please review 1st paragraph for Participant and recruitment for grammar and syntax issues

Thank you – this has been done

12. Please review discussion for grammar and tense issues

Thank you – this has been done

13. Methods The authors state that a methodological expert reviewed the research plan (was this one of the authors?)

No, this was not one of the authors. We have therefore added 'a methodological expert (independent to the research team) reviewed the study plan'.

14. Can the authors please provide a reference for the McGill Mixed methods appraisal tool

This has been added

15. The authors state that in the analysis - limited sample size prohibited further detailed statistical analysis - what further analysis would be required to answer your aims?

Potentially a large response rate could enable a statistical comparison for differences between band 7 FCPs to band 8 FCPs as to the value of having a CDSS to support their practice. As this seems a little redundant, we have eliminated the sentence 'anticipated limited sample size prohibited any further detailed statistical analyses'

16. The authors state that RED flag identification prompted 'emotive responses' - can the authors explain what is meant by this statement

We have added the following for clarity: …'for example, "I live in fear of overlooking something important". The researchers conducting the focus group noted that it was not just what was said, but that it was said with emotion.'

17. In the strengths and weaknesses - the authors state that gender, ethnic groups and disability were 'well represented' - can the authors please clarify which data supports this?

We have added the following detail: 'Females accounted for 54% of the survey cohort. In the UK, females account for 74% of the physiotherapy workforce[26], however it is possible that more male physiotherapists work in musculoskeletal health, which is reflected in osteopathy statistics (which is largely a musculoskeletal specialism) where 51% of the workforce is female[23]. . Nineteen percent of respondents rated themselves to be from an ethnic minority background. This is above national means where it has been reported that 12% of AHPs are from an ethnic minority background [27]. Seven participants (9%) declared themselves to have a disability, which is slightly more than the data available on clinical staff practicing in the UK with a disability (5%) [28].'

Responses to Reviewer #2

1. With the methodology used, this should not be described as an explanatory study. It is exploratory using a small sample descriptive survey and one small focus group. This should be reflected in the abstract and methods. Interestingly, the results and discussion are presented in an exploratory way in this submission, so there is a mismatching how the study is classified and how it was conducted and reported.

This has been amended as advised.

2. The references need to be checked. As examples of reference error, Reference 8 does not include data about exhaustion as this is actually found in reference 10. I haven't checked every reference, but the authors should do so.

All references have been checked and amendments made.

3. Line 146: the majority of survey responders worked in spoke models. There is no mention or discussion of how this compares to FCP practice overall. This information is necessary to understand the representation of the survey responders. Or discussed as a limitation.

There is no published data to identify how many FCPs work in a hub, or spoke, or hybrid model. It was of interest to the authors to find that the majority of survey participants practiced in a spoke model as it was believed that this is a true reflection of the model of current FCP working practice. However, without having any data, this is speculative. For this reason, we have added the following section to the discussion under the 'limitations' section:

'The majority of participants (71%) who responded to the survey practiced as FCPs in a 'spoke' model, where they worked independently to other FCPs (such as working in a GP practice). To the authors' knowledge, no data exists to determine how many FCPs work in a spoke, hub or hybrid model. Therefore, it is unknown how representative this survey sample was for FCPs working in the UK.'

4. The push for patient representation in research is absolutely correct, but it must be meaningful and not a 'tick box' exercise. This study was about FCP views of CDSS and including one patient in the focus group would not have added meaningfully to the study. What would be needed is a more detailed exploration of patient views if CDSS with or without a pre-screening element was moving forward into practice. This exploratory study is fine to focus on FCP views alone.

Thank you - this is a very fair point. We have therefore removed the sentence 'One final but important consideration was that there was no patient representation in this study' and changed it to 'It is important to consider patient representation in clinical studies. In this instance, it was felt that the study was about FCP views of CDSS and therefore including patients in the focus group would not have benefit'

5. Line 242: I would much prefer the word 'limitations' to 'weaknesses'.

This has been changed as suggested

6. Lines 265-266: Overall FCPs may be less sceptical, but the more experienced FCPs were more in line with the GP views, so maybe experience is a key factor here, that is only partly picked up on in the discussion.

An interesting observation- thank you for highlighting this. We have added the following after writing about the GP study in the discussion:

'Trust in the CDSS was highlighted in the FCP study, particularly by the more experienced (Band 8) FCPs, but not as strongly in the study on GPs.'

Minor points.
Typos: lines 65, 141- corrections have been made- thank you.

Title Page (with authors and addresses)

Are Clinical Decision Support Systems seen as helpful to First Contact Practitioners (FCPs) working in Musculoskeletal Health?

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Abstract

Background

There is increasing burden on musculoskeletal (MSK) First Contact Practitioners (FCPs) working in primary care. One possible solution is to use digital technologies such as clinical decision support systems (CDSS). The primary objective of this study was to understand the potential for MSK FCPs to use a CDSS to support their practice in the United Kingdom.

Design

An ~~explanatory~~ exploratory sequential mixed methods design, using a cross sectional survey questionnaire and a subsequent focus group.

Following ethical approval responders were recruited via professional networks to complete an online survey. A subsequent focus group enabled an in-depth exploration of survey results. Descriptive statistics were used to summarise survey data and thematic analysis with normalisation process theory used to describe findings.

Methods

A snowball sampling method was used to invite MSK FCPs to complete the survey, using email, adverts and social media. The questionnaire captured responders' demographic and professional practice characteristics, their knowledge and use of CDSS and their views and experiences regarding CDSS in MSK practice.

Results

There were 75 responders to the survey and six participants in the focus group. The majority of responders 67% (n=50/75) reported to be in favour of integrating a CDSS into their practice. Three themes were: 1) ensuring CDSS address efficiency concerns, 2) using CDSS to reduce unwarranted variation in practice, and 3) ensuring CDSS sustainability.

Conclusions

CDSSs have potential value for FCPs working in MSK primary care settings. Eight summary recommendations advise future developments of CDSS for FCPs working in MSK primary care practice.

Word count for abstract = 250

Contribution of the paper

- This is the first known study evaluating the usefulness of clinical decision support systems (CDSS) for musculoskeletal (MSK) First Contact Practitioners (FCPs)
- CDSS have potential value for MSK FCPs providing they are integrated into existing digital note systems and save clinic consultation time
- Eight recommendations advise future integration of CDSS into MSK FCP practice

Key words

First Contact Practitioner, Clinical Decision Support Systems, Musculoskeletal, Primary Care

Introduction

Musculoskeletal (MSK) conditions, such as low back pain and osteoarthritis, pose a significant burden on the population, affecting 18.8 million people in the United Kingdom (UK) [1]. They are the leading cause of years lived with disability [1], they account for up to one-in-seven General Practitioner (GP) consultations, contribute to 40% of work-related absenteeism, and cost the UK economy £20 billion annually [2].

Most people with MSK conditions are managed in primary care where the demand is substantial and growing. This trend is mirrored internationally, with rising MSK pain attributed to population aging and reducing physical activity levels [3-6]. Physiotherapists skilled in musculoskeletal assessment and management are well placed to provide expertise to deliver intervention as the first point of contact in primary care. First Contact Practitioner (FCP) Physiotherapy roles began in 2014. FCPs are skilled MSK physiotherapists who undertake the first patient consultation, enhancing MSK-patient care and freeing-up GP capacity.

There is an increasing burden on MSK FCP clinicians due to a population with increasingly complex health care needs and comorbidities coupled with constant pressure demand on time and efficiency. FCPs are complaining of burn out due to the high level of stress in working at the top of their professional licence and speed at which they need to complete consultations. It has been reported that 78% of FCP clinicians are exhausted or at risk of exhaustion [7]

In 2022, the Fuller-Stocktake-Report from NHS England, [8] highlighted the strain primary care experiences, with services stretched beyond capacity and signs of public and professional discontent. The report specifically called for innovative solutions to help streamline patient access to care and advice. Digital technologies such as clinical decision support systems (CDSS) are being deployed to address this problem. It was recently reported that CDSSs can reduce clinician burnout [9]

Clinical Decision Support Systems are digital tools that can support clinicians to make safe best practice decisions. Many CDSS are built on algorithmic-evidenced based guidelines such as those used in stratification of back pain [10]. Other CDSS are built on machine learning whereby large data sets can enable a computer to predict which interventions are likely to be best/safest for an individual patient based on their phenotype [11]

A recent systematic review [12] highlighted the need to understand whether CDSS would be a useful adjunct for primary care clinicians.

The aim of this study was to understand if MSK clinicians such as physiotherapists and osteopaths, working as FCPs in primary care would value a CDSS, and if so, for what aspects of care a CDSS would be most valuable. The anticipation is that the results of this study will inform developers of CDSS in MSK care on what aspects would ensure improved implementation, integration and sustainability of a CDSS in FCP clinical practice.

Research Objectives

The overall aim was to understand the potential for MSK FCPs to use a CDSS to support their practice. Objectives included:

- To describe thoughts of FCPs regarding the usefulness of the CDSS in practice, in relation to individual characteristics including digital literacy, and clinical experience levels.
- Understand the areas in which FCPs feel there is greatest need for CDSS (with reasons for this explored)
- To explore facilitators and barriers to using a CDSS to ensure sustainability
- To identify what additional clinical digital adjuncts would be useful to incorporate into a CDSS

Methods

A mixed methods ~~explanatory~~ exploratory sequential design using both quantitative and qualitative approaches was selected to achieve the study objectives. It was anticipated that combining quantitative and qualitative data, integrating the two, and drawing interpretations would provide a greater understanding of what was needed for CDSSs, rather than using a single method approach [13,14]. . ~~The combination of gathering quantitative and qualitative data, integrating the two, and drawing interpretations based on the combined data sets' was considered to provide a greater insight and understanding of what was needed for CDSSs rather than using a single method approach [11,12]. In addition, methods were based around a normalisation process theory.~~ In addition, paradigms of ~~the~~ normalisation process theory was included to identify ~~identifies~~ mechanisms needed for change process and consider~~s~~ important aspects related to how CDSSs could become embedded into everyday practice, thus improving future sustainability [15,16,17].

The sequential study design involved:

1. An online self-completed cross-sectional survey questionnaire amongst MSK FCPs

2. A digital focus group with FCPs

In this design, survey responses informed the subsequent focus group topic guide. The paradigms of normalisation process theory built in were: *Context* (What was seen as a priority for FCPs?), *Coherence* (What FCPs understood a CDSS was?), *Cognitive participation* (Whether the FCPs were engaged and invested in the concepts of CDSSs and who it would be useful for?), *Collectively* (What needed to be done to make CDSSs happen in practice? i.e. how barriers could be overcome?) and *Reflexive monitoring* (What would make a CDSS sustainable for embedding into clinical practice?).

Focus group findings were grouped into themes that facilitated analysis of the survey results. Prior to commencing the study, a methodological expert (independent to the research team) reviewed the study plan. Based on their recommendations, methodological changes to the study included

adding details to the protocol on how themes were identified and how survey responses were analysed.

Participants and recruitment:

Qualified Physiotherapists and Osteopaths who worked ~~were working in~~ as ~~a~~ Musculoskeletal First Contact Practitioners were invited to take part in the survey. A ~~pragmatic strategy used a~~ Non – probability recruitment using a snowball method of recruitment was adopted, whereby existing study responders were ~~would be~~ invited to ~~recruit future participants from amongst their acquaintances by~~ forward ~~passing~~ the electronic survey on to other FCPs in their professional networks. The advantage of this approach was the potential to engage participants who would not usually participate in research studies because anonymity could be assured and accessibility enhanced. Dissemination of the survey included sending emails invitations to professional contacts and the CSP network. The survey was promoted using social media (Twitter and LinkedIn), and at two FCP conferences in the Midlands as well as via clinical interest groups/ Community of practice FCP groups. The survey was advertised in the Physiotherapy professional magazine 'Frontline'.

Survey questionnaire:

The survey comprised of an online questionnaire survey (using Google forms). The introductory section of the survey included a link to a short video to explain CDSSs. The participant information was made accessible via a hyperlink. Following this, questions were asked to confirm that responders had read the participant information sheet and consented to their data being used for research purposes. Eligibility questions established the responders self-identified professional status and that they were working in the UK as a MSK FCP. Section one of the survey asked questions around demographics and clinical experience. Section two focused on the understanding and value (if any) of CDSSs to support MSK FCPs in practice, whether they were using digital support within

their existing practice and how useful this was, and whether they perceived where a CDSS would be most useful. Finally, responders were invited to volunteer to be involved in the focus group. If they chose to do so, they were asked to provide their contact details. The survey was descriptive and exploratory using a mixture of open and closed questions. The questionnaire took approximately 15 minutes to complete and consisted of 35 questions. If the FCPs chose to respond, they would complete the survey anonymously and submit it online.

The design of the survey questions in section two was based around the constructs of value, usability and perceived barriers to implementation. Multiple resources were used to formulate the questions around the use of clinical support tools in clinical practice, including previous literature, online discussion forums and clinical expertise. This informed the question development which was further refined from using three FCP clinicians who 'pre-piloted' the questionnaire and gave feedback leading to some minor modifications.

The analysis used descriptive methods, expressing means, SD and percentages where appropriate. ~~Anticipated limited sample size prohibited any further detailed statistical analysis~~.

Sample size:

The exact number of FCPs working in MSK in the United Kingdom is unknown. There have been estimates of 800 ~~FTE~~ Full-Time-Equivalent FCP physiotherapists, presumably most of whom will be working in MSK [16]. It is unknown how many MSK FCPs are osteopaths. Given the exploratory nature of the study, no formal sample size was calculated for the survey. Best estimates were based on numbers that had been recruited from a study on FCP where 98 FCPs were recruited to a survey using a non –probability method of recruitment very similar to this study [18]. This study therefore aimed to gain 80 (minimum of 70) survey responses from FCPs based on this being approximately

10% of the total sample, ~~and~~ a realistic number to reach, and aligned to what was achieved in the study by Hall et al. (2020).

The focus group aimed to recruit between 6-10 participants. This figure has been recommended to provide meaningful open discussion in a group setting [19]. Only one focus group was feasible due to the limitations of the available funding.

Focus group:

The aims of the digital focus group were to explore survey findings in more depth and provide an opportunity to uncover potential barriers to implement a CDSS. Prior to the focus group a topic guide plan was developed to ensure key aspects relating to the study objectives were discussed (see Appendix 1 for topic guide). The focus group used the Microsoft Teams platform and was recorded. Prior to attending, each participant was sent a participant information leaflet and provided signed consent to their involvement in the focus group. The focus group was led by a facilitator. The video recording was transcribed verbatim and subsequently themes identified as recommended as per Braun and Clarke [20]. Two individuals of the project team independently reviewed the transcripts and identify the 'codes' (highlighted pieces of transcribed text). The same two individuals then collectively used the 'codes' to identify ‘nodes’ (a collection of similar ‘codes’) and then ‘themes’ (a grouping together of similar ‘nodes’). It was noted which codes were identified by Band 7 or Band 8 FCPs to see if there were any differences in priorities between more and less senior FCP practitioners. Potentially Band 7 FCPs were more likely to have less clinical experience, knowledge and confidence compared to band 8 FCPs. As a CDSS could be considered more useful to the clinicians with less experience, it was decided to analyse the two grades independently.

Data Integration:

Quantitative findings (from the survey) were compared with findings from the qualitative data (from the focus group, along with some descriptive feedback from the open questions in the survey)

describing similar content. Analysis and interpretation compared findings to see if they were consistent or inconsistent. The results were brought together using 'joint displays'. Consistency and inconsistency were highlighted in the integration phase (third column on the joint display tables). The joint displays are a frequently used approach to provide a structure from which similarities can be identified in a transparent and meaningful way [14]. Triangulation with previously published similar studies is detailed in the discussion.

Ethical approval and Appraisal:

Ethical approval was obtained from the Health Faculty Ethics Committee at Keele University in November 2022. The McGill Mixed methods Appraisal Tool (MMAT) guided the reporting [21].

Results

The Survey

The survey was launched on 31st January 2023 and closed 6 weeks later on 14th March. A total of 75 responders completed the online survey. This represents approximately 9% of the target population.

Demographic characteristics of the responders are displayed in Table 1. The majority of responders were from England with only one responder from Wales and no responders from Scotland or Northern Ireland. This was despite efforts made via social media and email to engage FCPs from these nations. The mean age of responders (41 years) was similar to the average age of osteopaths and physiotherapists (40 years) [22, 23]. Generally, employment type was equal between the private and public health providers.

Females were under-represented, and ethnic minority groups slightly over-represented compared to the national physiotherapy/Allied Health Profession workforce [24].

[Insert Table 1 here].

Professional and clinical data are displayed in Table 2. 96% of the responders were physiotherapists. The majority of FCPs in post were working at either a Band 7 (B7) or Band 8a (B8) level on the NHS agenda for pay scale. The majority of responders worked in a spoke (GP based) model and had 20 minutes allocated to see their patients. There was variability in how much responders' working time was spent as an FCP (as oppose to working in physiotherapy or osteopathy clinics). On average 70% of the time responders worked in an FCP capacity. All but one of the responders used a digital system for keeping medical records. The large majority used 'EMIS' (42/75; 56%) or 'SystmOne' (22/75; 29%). Some used a combination of 'EMIS' and 'SystmOne' (9/75; 12%). One responder used 'Vision' (a Welsh EMS) and one responder used paper notes. [Insert Table 2 here]. A breakdown of the results of the survey can be found in Appendix 2. Forty-one survey participants volunteered to be contacted for further involvement in the focus group. Twenty-three were practicing at B7 level and 18 were practicing at B8.

The Focus group

Few of the survey participants (14/41; 34%) who agreed to be contacted about the focus group responded by saying that they were happy to be involved in the focus group. However, only six participants (6/41; 15%) were able to commit to the day of the group. The focus group was held on the 9th May 2023 and lasted for 90 minutes. Five were Physiotherapists (5/6; 83%) and the other was an osteopath. All were from England, based across the Midlands and South of the country. One was Asian (n=1; 16%) and the remaining were white, British. There was an equal split between band 7 and band 8 grades (three of each), with four females (66%) and two males represented in the group.

In total, 77 codes were grouped into 13 nodes to make three themes. Some of the nodes fed into more than one theme (Figure 1). Overall, the combined themes were that CDSSs needed to be efficient, reduce unwarranted variation in clinical practice, and be embedded in a sustainable way.

The opening discussion in the focus group broadly explored what the responders considered key barriers and facilitators to their existing role to help establish the context of a CDSS in practice. The main barriers expressed included operational issues such as appointment slot utilisation, appropriateness of patients booked in to see an FCP and time. The key facilitator was the introduction of a pre-screening tool, which the responders believed would help improve operational barrier issues. The 'code' of pre-screening was introduced early in the conversation and was frequently referred to in the remainder of the focus group discussion. It was the most commonly expressed code throughout the focus group discussion.

[Insert Figure 1 here].

Mixed Method Analysis

The majority of survey responders rated themselves to have a good understanding of a CDSS. Most scored either mostly or fully understand (52/75; 69%). Many of the survey users had experience of using a CDSS with most using digital clinical support for patient self-management (57/70; 81%) such as digital apps or on line information leaflets, which are perhaps less advanced forms of CDSS. The focus group participants discussed in detail their understanding of CDSS in terms of use as a clinical aid for assessment and treatment based on algorithmic approaches and AI which some of the participants had experience of using and developing- these being more sophisticated versions of CDSS.

The overall impression of a CDSS was favourable for both the survey responders and focus group participants (Table 3). The majority (two-thirds) of responders in the survey were in favour of

integrating CDSS into their practice (50/75; 67%). 18 of the 75 responders were 'unsure' with many voicing concerns about time versus value. Others needed more evidence that using a CDSS would help them in practice. Few responders were 'not interested' in using a CDSS (7/75; 9%). The responders who were 'not interested' were slightly older (mean age 43 years; SD 6) compared to total survey responders (mean age 41 years; SD 8)) and all but one were B8 level practitioners. There were strong views (particularly with the more senior responders) that cautioned that a CDSS potentially would 'replace' the need for FCPs in the future or deskill the workforce.

There was consistently more interest in using a CDSS for red flag identification than to aid diagnosis or identify best treatment options. Just under half of the survey responders highlighted 'red flag' identification as the greatest need (35/75; 47%). Red flag identification prompted responses that were more emotive, often related to clinical safety, for example, "I live in fear of overlooking something important". The researchers conducting the focus group noted that it was not just what was said, but that it was said with emotion. The discussion in the focus group spent time considering the value of real time prompts to reduce risk and improve diagnosis, however whilst some felt this would help their practice, others who spent more time face to face with their patients and wrote notes retrospectively, did not feel a digital prompt would add value to their consultation.

There was consistency that a CDSS would be most useful for less experienced MSK practitioners such as those working in Band 6 or 7 roles, those new to an FCP role (in the first few years of practice) or those aspiring to be in an FCP role.

There was inconsistency around a CDSS being potentially of more value for FCPs working in more isolated settings e.g. in a spoke (GP based model) rather than a hub model. The participants in the focus group thought that this might be the case but the survey data did not support this.

Time efficiency was something that was highlighted in the survey and discussed in the focus group. Despite the majority of responders in the survey (60/75; 80%) reported that they had sufficient time

to do their role (most of who had 20-minute time slots), issues around time, or lack of it, became more apparent in the qualitative data. Both the lack of time and use of a pre-screen questionnaire to address the lack of time were strong and recurring discussion topics in the focus group across all grades.

All responders completed the survey questions relating to implementation. When asked to rate important factors for implementing a CDSS, the need for the system to be quick and easy was rated as the most important factor, followed by integration into existing electronic notes and finally to be either free or at very low cost. These priorities were echoed in the focus group. In addition, it was acknowledged that to be fully inclusive, considerations should be made for more specialised existing digital tools with particular reference to disabilities, including visual compromise and dyslexia.

[Insert Table 3 here]

Finally, survey responders were asked to rate, which additional factors they would like to see as part of a CDSS (see Figure two). In summary, the most useful adjunct to a CDSS was identified as digital links to a 'shared decision making' tool such as those produced by Versus Arthritis and NHS England in 2022 [25]. The least useful adjunct was 'automated PROMs (Patient Reported Outcome Measures) at set time points' however this was in contrast to the focus group discussion where PROMS and PREMS (Patient Reported Experience Measures) were acknowledged as 'vital, so that we can look back on what we have done and reflect on what we have done well and learn what we need to do better' (B8, Survey participant). [Insert Figure 2 here].

Discussion

This mixed methods study found evidence to support that, in the main, clinical decision support systems would add ~~are of~~ value to musculoskeletal first contact practitioners working in primary care. A CDSS was a priority providing that it addressed a key need around time utilisation.

There was coherence about what FCPs understood a CDSS to be. The FCPs were engaged and invested about using a CDSS and had a high level of agreement regarding ~~as to~~ what a CDSS should be used for (identifying red flags), and who they believed a CDSS would be most useful for~~: 1) identifying red flag signs and 2) being of value to those~~ (practitioners with less experience of musculoskeletal practice and/or new to an FCP role). The main barrier for current working practice was 'time', particularly when assessing patients with complex presentations where practitioners felt already challenged with time constraints ~~seeing presentations that are more complex~~. A potential facilitator identified in the focus group was the use of a pre-screening tool ahead of the FCP consultation. There was a collective agreement that successful implementation and sustainability of a CDSS in practice would need to: 1) be quick and easy to use, 2) fully embed into existing digital systems, and 3) ~~Finally,~~would link to ~~the digital adjunct that a CDSS would most likely need to include was links to~~ shared decision support tools.

Clinical decision support systems ~~is~~ are evolving and have only recently ~~has~~ started to be explored. This study has benefited from using a mixed method approach involving ~~both~~ a survey to gain a wide range of views alongside a focus group to enable a deeper dive to have a more comprehensive understanding of the value of a CDSS.

~~In addition,~~ g Gender, ethnic groups and disability were well represented: Females accounted for 54% of the survey cohort. In the UK, females account for 74% of the physiotherapy workforce[26], however it is possible that more male physiotherapists work in musculoskeletal health, which is reflected in osteopathy statistics (which is largely a musculoskeletal specialism) where 51% of the workforce is female[23]. . Nineteen percent of respondents rated themselves to be from an ethnic minority background. This is above national means where it has been reported that 12% of AHPs are from an ethnic minority background [27]. Seven participants (9%) declared themselves to have a disability, which is slightly more than the data available on clinical staff practicing in the UK with a disability (5%) [28].

Limitations ~~Weaknesses~~ to this study ~~also~~ exist: Non-probability sampling and self-selection in particular, such as used in this study, are likely to result in sampling bias. When a population of interest is carefully defined, reasonable confidence in its representativeness results. Because the participants were largely self-selecting, there is no knowledge about non-responders and the representativeness cannot be estimated.

The target of 80 survey responders was not reached. There was an under representation from Northern Ireland, Scotland and Wales in both the survey and the focus group. In addition, all the participants in the focus group had reported (based on their previous survey responses) that they were in favour of a CDSS. It would have been valuable to have a participant who had not been in favour of a CDSS involved in the group~~. One final but important consideration was that there was no patient representation in this study.~~

The majority of participants (71%) who responded to the survey practiced as FCPs in a 'spoke' model, where they worked independently to other FCPs (such as working in a GP practice). To the authors' knowledge, no data exists to determine how many FCPs work in a spoke, hub or hybrid model. Therefore, it is unknown how representative this survey sample was for FCPs working in the UK.

There was much enthusiasm in the focus group for a pre-screening tool. It is unknown how much of a hindrance or help such a tool would be for patient users or how easy it would be to embed such a tool into a current primary care digital system. Further work is needed to evaluate these aspects.

It is important to consider patient representation in clinical studies. In this instance, it was felt that the study was about FCP views of CDSS and therefore including patients in the focus group would not have benefit.

There have been a number of studies published in recent years to identify~~ing~~ the working practice of MSK FCPs ~~working~~ in primary care. As far as the authors ~~are~~were aware, this study is the first to look

at how digital solutions might help support working practice now and in the future for FCPs specifically. Comparisons ~~can be~~ were made to CDSS in primary care: A recent mixed methods systemic review [12] reported findings around barriers and facilitators for CDSS in primary care internationally. The~~y~~ international study identified three key issues which were classified as human (perceived usefulness), organizational (disruption to usual workflow) and technical (system and user-friendliness). In our study the perceived usefulness ~~has been~~ was explored and supported by the defined user group (in this case MSK FCPs), organisational factors ~~have been~~ were considered in relation to addressing 'time' and 'complexity', and technical issues aligned to digital system integration. Another published study, this time a qualitative study involving interviews of General Practitioners (GPs) in the UK (not included in the systematic review) identified two overarching themes of 'needing trust in CDSS' and 'usability of CDSS in the broader practice' [29]. Both of these themes ~~are~~ were echoed in our FCP study findings particularly relating to sustainability. Trust in the CDSS was highlighted in the FCP study, particularly by the more experienced (Band 8) FCPs, but not as strongly in the study on GPs. This could mean FCPs are less sceptical than their GP colleagues about the introduction of CDSS in clinical practice.

It is encouraging that the majority of FCPs in this study were ~~are~~ open to including CDSS as part of their practice. However, it is important to recognise that whilst recommendations ~~can~~ have been be made from this study (see Figure 3), recognising the emotional side of digital transformation is vital 'Digital transformation is more about people than technology' [30]. Although there was only a minority who were not in favour of moving forward with integrating a CDSS in FCP practice, there was much passion expressed behind the concerns of this group who largely comprised of senior (band 8) clinicians. Senior clinicians have a powerful voice and could be integral to the success or failure of the implementation and sustainability of a CDSS. Therefore, it should be ~~cannot be~~ emphasised ~~enough~~ that all key stakeholders, including senior clinicians need to be fully engaged in the process of CDSS development and integration.

This study has highlighted that further research into CDSSs is warranted. A consideration before moving forward would be to identify how acceptable it would be to patients (particularly if embedding a pre-screening form) and how effective and sustainable a CDSS is in clinical practice. It is important to create, implement, and evaluate such systems to ensure that they harness positives while minimizing negative consequences and perceived threats [31] and support the modern healthcare primary care system.

[Insert Figure 3 here].

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Figures

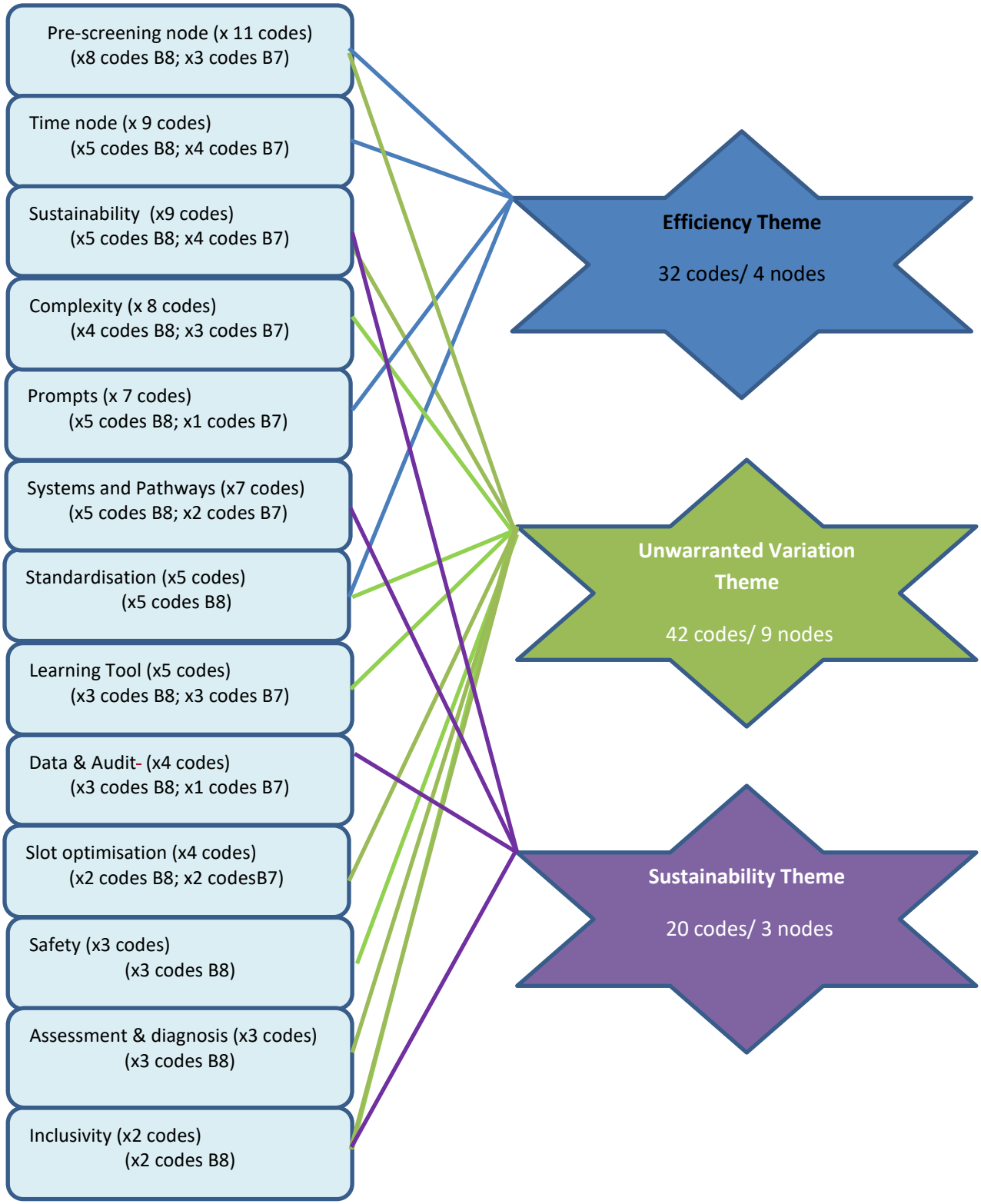

Figure 1: Development of codes to nodes and themes (thematic analysis)

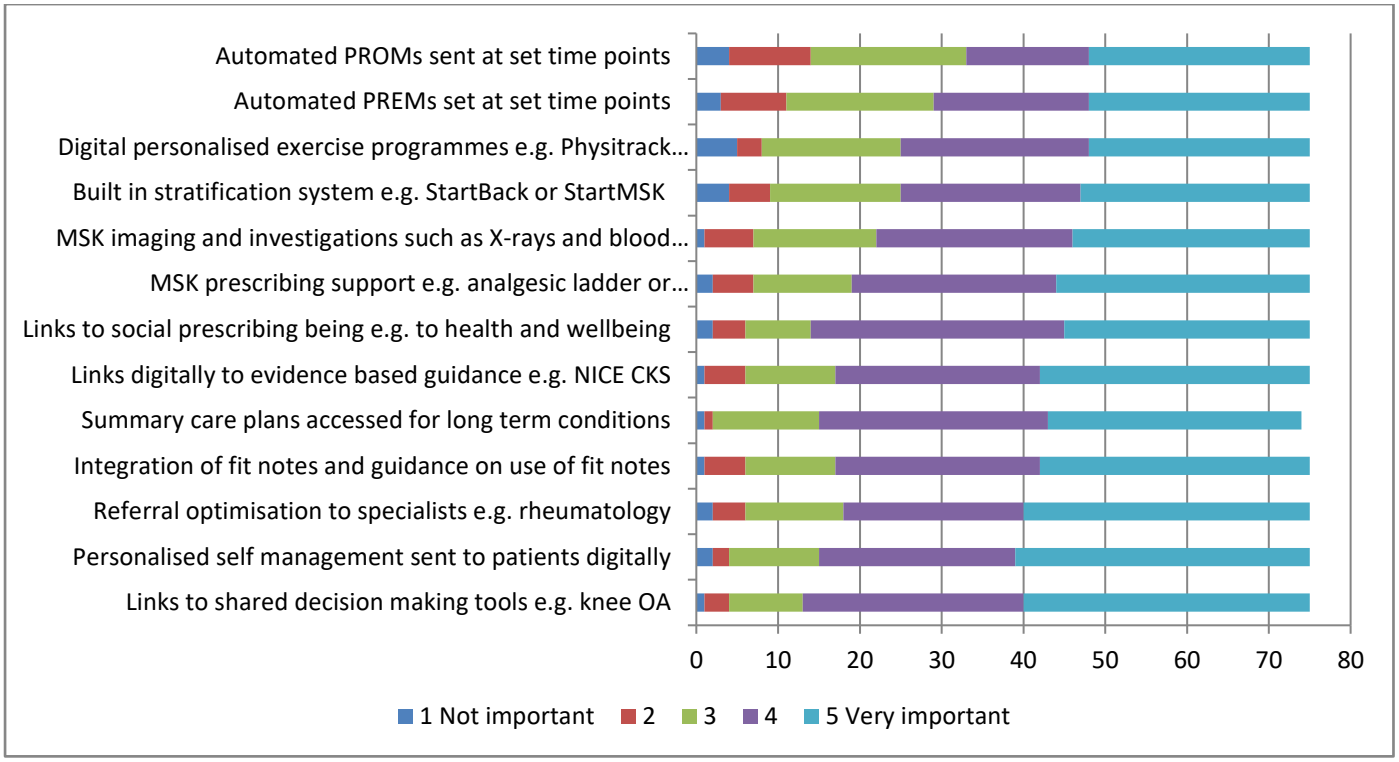

Figure 2: Additional factors MSK FCPs would like to see added to a CDSS

Key: CKS= Clinical Knowledge Summaries; MSK= musculoskeletal; NICE= National Institute for Health and Care Excellence; PREM= Patient Reported Experience Measure; PROM= Patient Reported Outcome Measure

Key Recommendations

1. **Engage all key stakeholders (particularly senior FCP clinicians and patient advisory groups) when developing a CDSS**
2. **Embed safety features into a CDSS particularly around identifying 'red flags'**
3. **Ensure that you have buy in from the target user group – those who have less MSK experience or will be new in FCP roles**
4. **Ensure the CDSS can reduce the burden on time for FCPs**
5. **Identify how a CDSS will be updated and maintained**
6. **Consider how a pre-screen tool could be embedded into a CDSS**
7. **Ensure the CDSS can be embedded into existing digital systems such as EMIS/System One and or digital disability systems**
8. **Consider building in digital systems linked to patient decision support tools**

Figure 3: Key recommendations from the CDSS MSK FCP study

Tables

Table 1 Demographic data (n= 75)

Demographic domain	Mean (SD)	Min, Max
Age (years)	41 (8)	27,59
Gender (Females)	41 (54)	
Ethnicity		
White	60 (81)	
Asian or Asian British	10 (14)	
Mixed or multiple ethnic groups	2 (3)	
Black, African, Caribbean	1 (1)	
Would rather not say	1 (1)	
Disability		
None	66 (88)	
Sight impairment	1 (1)	
Hearing impairment	1 (1)	
physical	1 (1)	
mental	1 (1)	
Other	3 (4)	
Would rather not say	2 (3)	
Area where practicing in the UK		
England	72 (99)	
Ireland (Northern)	0 (0)	
Scotland	0 (0)	
Wales	1 (1)	
Employment type		
NHS acute hospital Trust	21 (28)	
Private provider supporting NHS provision	20 (27)	
NHS community Trust	12 (16)	
Other	4 (5)	
Unsure	1 (1)	

Footnote: Missing data included one response on ethnicity, two responses on area of practice and one response on employment type

Table 2 Professional & Clinical Data

Professional & Clinical domain	n (%)	
Profession		
Physiotherapist	72 (96)	
Osteopath	3 (4)	
NHS pay banding		
8b or higher	5 (7)	
8a	31 (41)	
7	37 (49)	
6	2 (3)	
FCP model		
Spoke (practice without other FCPs around e.g. GP practice)	53 (71)	
Hub & Spoke	15 (20)	
Hub (practice with other FCPs in the same setting e.g. community hospital)	4 (5)	
Other	3 (4)	
Time allocated for each patient		
Up to 30 minutes	17 (23)	
Up to 20 minutes	50 (66)	
Less than 20 minutes	8 (11)	
	Mean(SD)	Min, Max
Years worked as an FCP	3 (2)	1,9
% Clinical time spent as an FCP	70 (29)	10,100

Key: FCP= First Contact Practitioner; GP= General Practitioner; NHS= National Health Service (United Kingdom)

Footnotes:
Band 6, 7 and 8 roles are seen as senior practice level roles in the UK. Band 8 is considered more advanced and band 6 less advanced practitioners.
Missing data included 5 responses on years worked as an FCP and one response on % clinical time spent as an FCP

Table 3: To understand the potential for MSK FCPs to use a CDSS to support their practice: Joint Display with Mixed Method integration		
Quantitative Findings (survey)	**Qualitative Findings (survey and focus group)**	**Mixed method integration**
Overall impression of a CDSS 67% (n=50/75) responders reported to **be in favour** of integrating a CDSS into their practice. 24% (18/75) responders were **unsure**. 9% (7/75) responders were **not interested** in using a CDSS in their practice.	"The NHS has evolved and AI should be part of that evolution" (survey responder, PT B8) "From a standardisation perspective it [a CDSS] is useful when we have varying skill sets across the board" (focus group participant, PT B8- unwarranted variation theme) "It sounds revolutionary, but I would need to be guided by evidence to validate its use" (survey responder (survey responder osteo B8) "Are we clear what we're doing with it [a CDSS]… is AI sensitive enough to pick up on some of the complexity we see" (focus group participant, PT B8- unwarranted variation theme) "It's worrying to see we may be replaced by AI. There is an art to our role, based on science and human interaction. This does not support that." (survey responder, PT B8) "I feel that CDSS tools take away the experience necessary to be a safe practitioner. They allow under qualified staff to perform a role for which they do not have the necessary clinical experience" (survey responder PT B8)	There were consistent findings that whilst the majority of responders are in favour of a CDSS, this was not unanimous. Further work needs to be done to ensure more FCPs understand what a CDSS is and are invested and engaged. Strong views either in favour or against generally came from the more senior responders (B8 FCPs).

What a CDSS would be most useful for 47% (35/75) responders felt a CDSS would be most useful for alerting a clinician to **red flags** 29% (22/75) responders felt a CDSS would be most useful to **aid diagnosis** 24% (18/75) responders felt a CDSS would be most useful to help **identify best treatment** options	"I live in fear of overlooking something important" (survey responder PT, B7) "Patient safety is key in what is often a very unsupported and isolated role" (Focus group participant, PT, B8- unwarranted variation theme) "It would make me more confident in my diagnosis and would improve the patient experience" (survey responder PT, B7) "I think a prompt in terms of differential diagnosis could be useful" (focus group participant, PT B8- efficiency theme) "There are lots of practitioners who wait until the end [of a consultation] before they makes notes, so I don't think I prompt would work for everyone" (focus group participant, B8 PT- efficiency theme)	There was consistently more interest in using a CDSS for red flag identification rather than aid diagnosis or identify best treatment options. The option of 'prompts' were discussed as an option for aiding diagnosis but not considered to be suitable for all
Who is a CDSS most useful for The majority of responders who were not in favour of a CDSS in practice were senior (B8) (6/7; 86%) Responders who had been working longer as an FCP (mean time working as FCP 4.6 years; SD 3.2) were less likely to be in favour of using a CDSS in practice than those who had been working as an FCP for less time (mean time working as FCP 2.5 years; SD 1.4) The majority of responders who were not in favour of a CDSS were working in a spoke model of practice (5/7; 71%)	"It would be useful [as a learning tool] for a band 6 [less experienced/pre-FCP role] looking to go to a band 7 role" (focus group participant, B7 osteo – unwarranted variation theme). " It [a CDSS] could be used to standardise practice when looking at training to be an FCP" (focus group participant, B8 PT – unwarranted variation theme) "I think it's really useful for risk management, especially for when you first step into an FCP role" (focus group participant, B8 PT- unwarranted variation theme) "I think [a CDSS] is more important [from a safety aspect] for those working in isolation" (focus group participant, B8 PT- unwarranted variation theme))	There was consistency that a CDSS would be most useful for less experienced MSK practitioners and/or those new to an FCP role. There was inconsistency around a CDSS being potentially of more value for FCPs working in more isolated settings e.g. in a spoke (GP based model) rather than a hub model.

What is a key consideration for a CDSS (barriers and facilitators) 67% (50/75) had **up to 20 minutes** to see a patient, 23% (17/75) had **up to 30 minutes** and 11% (8/75) had **less than 20 minutes.** 80% (60/75) of responders reported to have **sufficient time** to see patients but 20% (15/75) did not. The responders who reported to have **insufficient time** to see patients were slightly more likely to have a shorter appointment time compared to the main cohort: 20% (3/15) had less than 20 minutes per patient). None of the responders who had insufficient time were against using a CDSS in their practice *(results to be interpreted with caution as numbers are small)*	"FCP appointments are typically around 20 minutes, which means there is a lot to fit into a short period of time. Anything that is integrated into one digital system with evidence based recommendations would be beneficial to speed up this process" (survey responder, B8 PT) " We have 20 minute slots. We have a lot of information in that short period of time" (focus group participant, B7, PT – efficiency theme) " It [a CDSS] would potentially speed up decision making and reduce error in reasoning" (survey responder, B7, PT) "A key driver would be anything that reduces the burden on the time we have with patients" (survey responder, B8, PT) "Some patients have complex histories. The spinal conditions may have many investigations in the past. Reviewing their history itself takes a long time sometimes" (focus group participant, B7 PT- unwarranted variation theme) "If we could think about doing something before the patient arrives, such as a pre-screen tool they can use before the consultation, that would help reduce *time* and improve the quality of the consultation" (focus group participant, B8 PT- efficiency theme)	There was inconsistency around time pressures: the majority of responders in the survey reported to have sufficient time to see patients whereas the qualitative data found a lack of time to be a problem
Implementation & Sustainability Important factors for implementation and sustainability for a CDSS in order of priority were: • Quick and easy (score of 364) • Integrated into existing electronic notes (score of 354) • Free or at very low cost (score of 342)*	"Ultimately the feedback from the user is important to ensure that it is adaptable and fit for purpose" (focus group participant, B7, PT – sustainability theme) "It would be great to have something that you know, you have confidence that it's best practice. But who is then doing the ongoing maintenance…how frequently is it being updated and by whom? How much will that cost?" (focus group participant, B7, Osteo – sustainability theme)	There was consistency that the priority from a clinical viewpoint was that a CDSS should be easy and enjoyable to use for all, and directly embedded into existing clinical systems such as EMIS and System One.

	"I'd need to have confidence that I was maintained and up to date" (focus group participant, B8, PT – sustainability theme) "In the short term it would be a hindrance to be honest. I think it would be a change and I think that is always difficult, but long term I do feel it will work and it's kind of being part of the future. This is where it's all going at the end of the day" (focus group participant, B8, PT – sustainability theme) "We've got to be filled with joy when we see this decision support tool- not something that is clunky and long winded" (focus group participant, B8, PT – sustainability theme) "It needs to be embedded directly into existing systems that are used across primary care so we don't miss or repeat information" (focus group participant, B7 , osteo – sustainability theme) "I worked with a physio who was blind, well nearly blind. She had a system set up to support her. If we start implementing new tools we need to make sure it is inclusive and integrates will *all* digital tools and systems currently used" (focus group participant, B8, PT – sustainability theme)	

Key: AI= Artificial Intelligence; B7= band 7 level clinician; B8= band 8 level clinician; CDSS= Clinical Decision Support System; FCP= First Contact Practitioner; MSK= musculoskeletal; NHS= National Health Service (United Kingdom); Osteo= Osteopath; PT= Physiotherapist

*Likert scales used a 1 to 5 scale where 1 represented 'not important' and 5 represented 'very important'. Total scores were calculated by multiplying the sum of the score with the number of responders who had chosen that score. High scores related to a higher level of importance. Scores could range from 75 to 375. All questions using Likert scales were completed in full by all responders.

Appendix 1

Appendix 2