

Improving safety, efficiency, cost, and satisfaction across a musculoskeletal pathway using the Digital Assessment Routing tool for triage: a quality improvement study.

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Abstract

Background: The increasing prevalence of musculoskeletal conditions results in an increasing financial burden to societies and healthcare systems. Triage patients safely and effectively improves outcomes and reduces costs across the pathway, with digital solutions offering potential advantages over traditional methods.

Objective: We aimed to examine the impact of introducing DART (Digital Assessment Routing Tool) on safety, efficiency, cost and satisfaction across a National Health Service England musculoskeletal service.

Methods: A quality improvement project utilizing a Plan-Do-Study-Act design and Integrated Knowledge Translation model. All musculoskeletal self-referring patients completed an online DART assessment independently, or with administrative telephone support. Quantitative and qualitative methods evaluated the primary outcome of safety, indicated both by agreement between clinician judgement and DART stratification, and safety incident surveillance. Secondary outcomes included efficiency, cost and satisfaction.

Results: Over 4 months 4076 patients self-referred, 93% self-assessing using DART and the remainder via an administrator. Agreement between clinicians and DART was 96%, no safety incidents occurred, and 203 fewer cases required clinical escalation at initial clinician contact compared to the pre-project period. Administrative time to process self-referrals reduced by 83% with a projected £15,312 (US\$20,067)/annum cost-saving. Routing to self-management and an osteoarthritis knee program would reduce costs by £79,590 (US\$104,310)/annum when implemented. Further potential savings of £28,476 (US\$37,320)/annum were demonstrated by DART screening for service eligibility criteria. Patient satisfaction was 90%, with all 14 administrators and 40 clinicians rating the introduction of DART as a positive service improvement.

Conclusions: The introduction of DART demonstrated positive outcomes in all measures presenting opportunities to improve safety and efficiency, reduce cost and improve patient and clinician satisfaction. In addition, the successful delivery of an Integrated Knowledge Translation Approach provides a model for other researchers wishing to test and implement digital health within a musculoskeletal service.

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Original Manuscript

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ABSTRACT

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musculoskeletal service.

Keywords: Triage, Musculoskeletal, Quality, Safety, Effectiveness, Improvement, Outcomes, Cost, Value

INTRODUCTION

Problem description

The study National Health Service (NHS) England musculoskeletal (MSK) service receives an average of 1200 self-referrals per month, with patients booked into the next available physiotherapist or MSK doctor appointment by an administrator, with no clinical validation of urgency or complexity. A waiting list of 6 weeks plus from referral to assessment, presents a safety issue for patients requiring urgent care. With no triage in place, onward referrals consisting of multiple appointments and delays occur, increasing risk of poor outcomes and inefficient utilisation of scarce clinical resource. Operational inefficiencies have also been highlighted. Clinician satisfaction was reported as low, primarily due to unbalanced patient caseloads related to case complexity and physiotherapist level of experience and expertise.

The following Quality Improvement Study has been designed, conducted and reported in accordance with the Standards for Quality Improvement Reporting Excellence Framework [1].

Background knowledge

Musculoskeletal conditions are prevalent and increasing, associated with an aging population and reducing levels of physical activity in Western style economies [2,3]. They pose a financial and societal challenge, with cost to the United Kingdom NHS set to reach £6.3 billion (US\$8.26 billion) in 2022-2023 [4]. "Getting It Right First Time" (GIRFT) by stratifying patients to the correct level of intervention at first point of contact is considered key in improving MSK condition outcomes and efficiency across the MSK pathway, with early identification of patients requiring urgent medical review considered a priority [5,6]. A national rise in MSK case presentation complexity has been noted [4], producing increased demands on clinician resource, particularly less experienced staff.

Remote physiotherapist-led MSK triage is widely utilised to stratify patients to the correct level of care, and has proven effective in reducing waiting times, unwarranted variation in clinical pathways, clinician caseload and cost [6-8]. However, the principal rate-limiting factor to deliver triage is availability of staff [9]. It has been suggested Mobile Health (mHealth) technology could provide a cost-effective alternative for improving healthcare delivery [10,11], with recent advances being made in digital primary care triage applications [12,13]. Using a digital triage tool has potential to

identify patients requiring emergency or urgent care in addition to supporting planned allocation of appointments to better utilise clinician skill-mix and improve clinician satisfaction [14].

DART Overview

The Digital Assessment Routing Tool (DART) is a case-based reasoning digital triage system directing self-assessing MSK patients to the correct level of care, classified as a tier C system by the UK National Institute of Health and Care Excellence (NICE). Routing is configured to match the provider's clinical services. Previous work evaluating safety and effectiveness of DART has been completed with successful results [14,15]. Given the potential for DART to support service delivery across an NHS MSK pathway, we embarked on this quality improvement study. To date, no similar studies evaluating a digital MSK triage system in a real-world context have been published.

Study aim and rationale

DART uses the Same Day Emergency Care (SDEC) principles described by NHS England, routing patients to the most appropriate care – right person, place and time [16]. The specific aim of this project was to examine the impact of introducing DART as a first point of contact digital triage system on the safety, efficiency, cost and satisfaction across the service MSK pathway. In addition to providing outcomes, this report describes the collaborative approach used in delivering the project in a live clinical service.

METHODS

Context

The service is staffed by 39 physiotherapists of varying levels of experience, as defined by Agenda for Change banding [17], including Consultant Physiotherapy Practitioner (CPP) and Advanced Clinical Practitioner Physiotherapists (ACP) who provide clinical support to less experienced band 5-7 physiotherapists. An MSK doctor provides a point of escalation in addition to delivering ultrasound-guided injections, minor surgery, and prescribing medications. The service is supported by 14 administrative staff. From the outset, key principles fundamental to successful delivery of the project within a live clinical environment were acknowledged. These included no introduction of additional clinical risk or barriers to patients accessing care, and no increased burden on emergency services or primary care. Capacity was ensured to meet patients' needs at every stage of the journey and impact on other parts of pathway were considered.

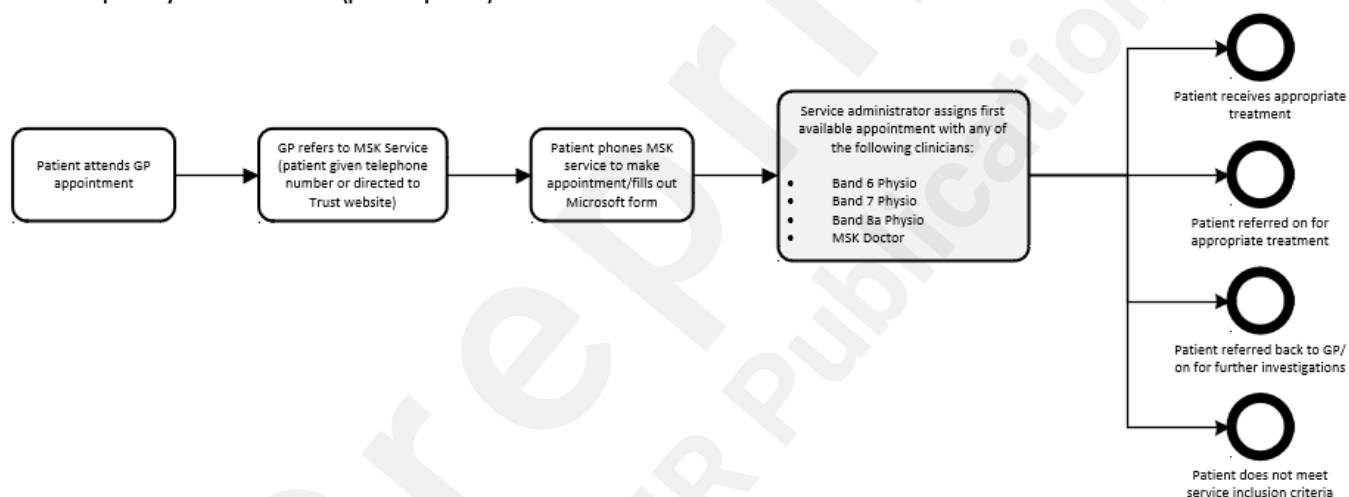
Intervention

All self-referring patients completed a DART assessment, accessed via the NHS service website or

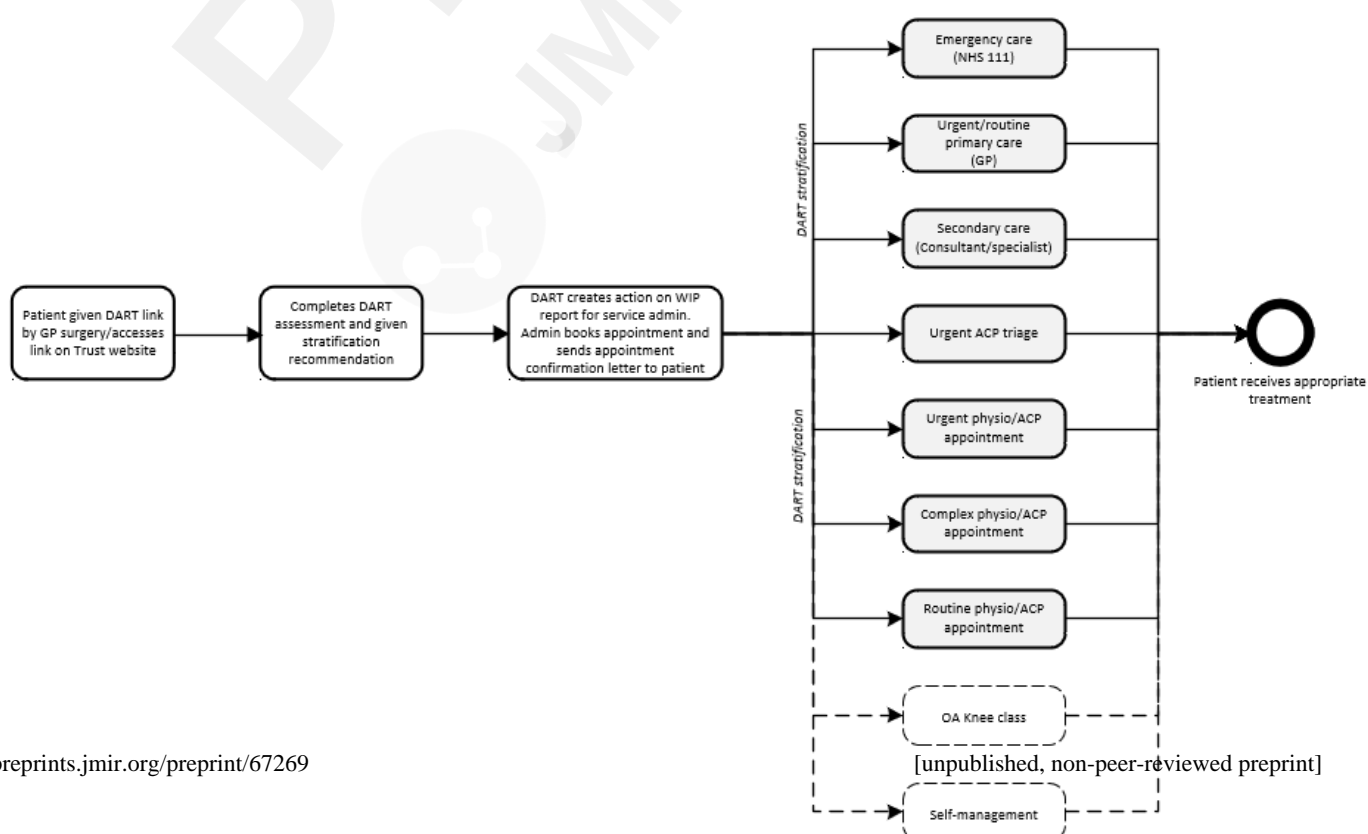
delivered by an administrator over the telephone. The administrator booked an appointment corresponding to the DART stratification recommendation, with new types of appointments created to cater for urgency and complexity. In addition, DART collected data regarding the patient's potential to self-manage their condition to inform future service development. The DART assessment clinical summary was uploaded to the NHS patient record by the administrator, allowing the receiving clinician to review prior to the appointment. Please refer to Figure 1 for existing and intervention processes.

Figure 1. Previous and intervention patient self-referral processes. Outcomes within dotted lines indicate future service options.

Self referral pathway for MSK conditions (previous process)



Self referral pathway for MSK conditions (new process)



Study design

We selected a Plan-Do-Study-Act (PDSA) cycle design, responsive to the process iteration required in a live clinical environment, and an Integrated Knowledge Translation Approach between the NHS clinical team and researchers [18]. This continued throughout the whole 4-month project, not just in planning stages, so ensuring methodology was relevant to a real-world NHS MSK pathway and connecting research to practice [19].

Patient and Public Involvement Statement

To assist with setting research priorities and outcome measures we involved a group of 10 patients recruited at random from the service waiting area. Using semi-structured interviews, we collected opinions on factors important to them within their MSK journey, resulting in reprioritisation of our aim and measures. Throughout the project, qualitative patient feedback was collected within DART, informing iteration, leading to integration of patient suggestions into the subsequent cycle.

Measures

The primary measure was safety, measured by level of clinician-DART-routing agreement for each case, with the receiving clinician indicating their agreement or disagreement with DART using an on-line form. Any disagreements were reviewed by a CPP to validate the result. Results from previous DART studies [14] and published work regarding generic symptom checkers [20] suggested an overall agreement level of 78% would be acceptable, with no safety incidents.

Secondary measures included efficiency, cost savings and satisfaction, with all measures assigned targets jointly agreed between the service lead and the researchers. Performance related to these targets guided decisions to recommend implementation, revision or abandonment of DART's inclusion within the MSK service. All pre-defined targets are presented in the Results section. Table 2.

In addition, referring primary care physicians were invited to provide feedback about the project using an on-line survey, allowing assessment of positive and negative impacts on their practice of DART introduction. Data were provided by DART and the NHS clinical record system. Training was provided to both clinicians and administrators prior to starting data collection in the form of on-site visits, with researchers available for the first two days of data collection to monitor and assist as required.

Data analysis

Data were analysed jointly between researchers and the service lead, the results of which informed the next cycle iteration. Weekly calls were scheduled to discuss project progress, in addition to an open channel of communication between researchers and personnel on-site to address any concerns or comments. Previous self-referral data for the 4 months prior to commencement of the project was used for comparison. As the new DART self-referral process completely replaced the previous process, any changes observed were considered due to the intervention, thus improving validity and reliability of results.

A key consideration was the impact of the patient waiting list on level of agreement between DART and clinician, as during this time a patient's symptoms could have changed. To counter this, clinicians were asked to assess level of agreement in the context of the patient's original presentation.

Ethical considerations

Patients had full access to care, either by completing a DART assessment online or with the assistance of an administrator. The existing e-Referral available to primary care physicians remained unchanged. DART is classified as a "symptom checker" by the UK Medicines and Healthcare Products Regulatory Agency (MHRA), does not qualify as a Medical Device [21] and therefore UK Health Research Authority ethics approval was not required, however approval was sought and granted via the NHS internal governance process.

RESULTS

PDSA Cycles

The first cycle was deliberately short (2 weeks) to allow a quick response to operational issues created by implementation. Cycle 2 (8 weeks) allowed sufficient time to gauge level of routing agreement and highlighted DART algorithm changes required to improve routing to specific service requirements. Cycle 3 (6 weeks) provided data to validate changes made in Cycle 2 and update DART fields to address patient feedback. During the 4-month project period (February – May 2024), the service received 4076 self-referrals, with all patients completing a DART assessment. This compared to 3818 referrals in the 4 months prior to the project, which included the Christmas period. Patient demographics are shown in Table 1.

Table 1. Project patient demographics by age, sex at birth and presenting body site.

| Age | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-----|----------|
| Age | 16-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80+ | Mean age |
| Count | 54 | 204 | 347 | 455 | 868 | 1004 | 799 | 345 | 59 |

| Sex at birth | | |
|--------------|------|--------|
| Sex at birth | Male | Female |
| Count | 1553 | 2523 |
| Percentage | 38% | 62% |

| Body site | | | | | | | | | |
|-----------|---------------|----------------------|-----------------------|----------|-------|----------------|-----|------|----------------|
| Body site | Head and neck | Chest and upper back | Lower back and pelvis | Shoulder | Elbow | Wrist and hand | Hip | Knee | Foot and ankle |
| Count | 243 | 114 | 769 | 620 | 101 | 370 | 519 | 899 | 441 |

The outcomes for all measures are shown below in Table 2, together with their associated pre-defined targets.

Table 2. Primary and secondary measures, pre-defined targets and outcomes.

| | | Measure | Pre-defined target | Outcome | Further information |
|---|--------------|---|---|---|---|
| 1 | Safety | a) Clinician-DART-routing agreement | 78% | 96% | Target based on result of DART RCT pilot study: https://formative.jmir.org/2024/1/e56715/ |
| | | b) Number of safety incidents | 0 | 0 | Defined as when a patient deemed by the clinician as requiring urgent assessment or treatment did not receive the necessary care in the appropriate timescales. |
| 2 | Efficiency | a) Service routing percentages | Consistent with previous real-world data | Percentages within acceptable limits | Less urgent cases due to service exclusion criteria, and more complex cases due to older demographic with more coexisting health conditions |
| | | b) Cases resulting in immediate onward referral at first appointment | Reduction from previous pre-project period | Reduction of 203 cases | a) Routing of most high complexity cases straight to Band 8a physiotherapists |
| | | b) Time taken in minutes for administrators to process self-referrals | 50% reduction | 83% reduction | Longer DART telephone assessment calls [9.5 versus existing process of 4 minutes], but 93% of patients completing self-assessment online |
| 3 | Cost savings | a) Administrative cost to process self-referrals | 50% reduction | Achieved [£15,312/annum] | Reduction in cost related to reduced administrator time required to process self-referrals |
| | | b) Potential cost savings of DART routing to physiotherapist-led remote self-management pathway | 50% per case for self-managing patients | 73% reduction [saving of £84.86/ patient] | Conservative figure of 50% used for cost-modelling pending analysis of self-management outcomes |
| | | c) Potential cost savings of DART routing to a new knee osteoarthritis treatment option | 50% per case for patients routed to this treatment option | 63% reduction [saving £73.45/ patient] | Conservative figure of 50% used for cost-modelling pending analysis of self-management outcomes |
| 4 | Satisfaction | a) Patient satisfaction measured using rating scale and free text option | 84% rating DART as "excellent, very good, good" or "fair" | 90% based on a completion rate of 45.2% | "Good system saves time and enables appointment promptly." – 65-year-old male "I think that it's the way forward...being able to refer yourself is fantastic." – 53year-old female |
| | | b) Clinician satisfaction measured using semi-structured | Overall positive feedback | Overall positive feedback | "[DART summary] helps to shape questioning and can raise points that historically patients forget to divulge as part of a subjective [assessment]". – Band 8a Physiotherapist. |

| | | | | |
|----|--|---|---|---|
| c) | interviews Administrator satisfaction measured using on-line questionnaires | Overall rating of "better" or the "same" as existing process | DART process rated "better" than previous self-referral process | "Overall positive – most patients happy to go away and complete. Only small amount needing to be done over phone." –administrator |
|----|--|---|---|---|

Primary measure - Safety

Across all referrals there was 96 % Clinician-DART agreement, over the pre-defined limit of 78% with no safety incidents reported. Table 2/1a and 1b.

Secondary measures

Efficiency

From previous data obtained from using DART in a real-world occupational health setting, we had established anticipated percentages of referrals routed to each type of disposition if the algorithm was functioning correctly. Effective routing was achieved for 4 out of 6 targets, but all were deemed acceptable. Table 2/2a.

The number of cases requiring immediate onward referral between clinicians was reduced by 203 compared to the previous data period, meaning patients were more likely to see the physiotherapist with the correct knowledge, skills and competences first time. Table 2/2b. Consequently, the amount of support required from Band 8a physiotherapists was reduced, better utilising their time for management of more serious and complex conditions. This was confirmed during the clinician interviews:

"There has been a decreased level of clinical queries around complex pathology presentations from lower banded team members". Band 8a Physiotherapist.

Clinicians also reported more effective use of their allocated assessment time, due to having access to the DART clinical summary prior to the patient appointment.

"It helps with assessment planning as I get more information before I see the patient". – Band 6 Physiotherapist.

Previously, patient access to self-referral was limited to administration team working hours of 7.30am – 7pm, which increased to 24/7 using DART. All administrators answered "yes" when asked if their time was being used more effectively. Table 2/2c:

"Great that the patients are positive about us sending them the email link and they can do it in their own time, and it means that we can get on to the next call so it's quicker to answer the phone to the next caller." – administrator.

Cost savings

The increased administrator time per call to deliver a DART assessment by telephone was offset by 93% of assessments being completed online by patients self-assessing online, meaning an overall

reduction in administrative time equating to a £15,312 (US\$20,067) cost saving per annum. Table 2/3a.

DART identified 15% (611) of all patients being suitable for remote delivery of physiotherapist-led self-management with safety-netting and patient-initiated follow-up (PIFU). Compared to the cost of the existing model of face-to-face assessment and 4 follow-up sessions, this would represent a cost saving of 73% or £84.86(US\$111.22) per patient. Table 2/3b. However, further validation of self-management stratification percentage is recommended to ensure good outcomes are being achieved and patients not re-entering the pathway with the same condition. Pending further data analysis, a more conservative approach was taken of 50% (306) for cost-modelling purposes, providing a potential saving of £82,737(US\$108,435) per annum.

DART identified 105 (21%) patients presenting with a knee problem that had been diagnosed with (or presented with symptoms of) mild to moderate knee osteoarthritis and potentially suitable for a tailored knee programme as an alternative to a standard course of physiotherapy. This would represent a cost saving of 63% or £73.45(US\$96.26) per patient. Again, a conservative value of a 50% saving for this group was used pending validation of successful outcomes, producing potential annual savings of £13,868(US\$18,175). Table 2/3c. If both remote self-management and OA knee treatment package were introduced, this would result in a net saving of £79,590(US\$104,310)/annum.

Overall, cost savings made through implementing DART were estimated to be £123,000(US\$161,203)/annum (excluding DART software licencing), in addition to the other identified indirect benefits.

Satisfaction

Patients (Table 2/4a)

84% of patients rated DART as “excellent, very good, good” or “fair”. Qualitative feedback collected throughout the survey was largely positive, with key themes being quick and easy to use, and a good way to get an appointment. Negative comments were less frequent and mainly concerned difficulty responding to specific questions and the preference to speak to a person about their problem. In response, the option for a patient to speak to an administrator to complete DART was reinforced on the service webpage next to the DART assessment link.

Clinicians (Table 2/b)

No concerns were raised around job security or clinicians being “replaced by technology”, in fact a key theme was the improved balance of urgent and complex presentations in their diaries resulting in better job satisfaction and wellbeing, supporting the NHS service Working Well strategy [22]:

“There has been a significant improvement in team morale with better diary organisation and more structure for less experienced bands”. – MSK Doctor.

Possible disadvantages of DART were mentioned as potential for over-reliance on the DART stratification during a clinical assessment, the quality of the data entered by the patient, lack of detail provided by DART in more complex presentations, and the challenge of catering for multiple body site presentations.

Administrators (Table 2/4c)

Whilst overall job satisfaction levels remained static, administrators rated the DART process higher than the previous self-referral process.

Primary care physicians

Physician practices were invited to provide feedback regarding the new process and served to improve engagement around the MSK service generally, with some practices not being aware patients were able to self-refer. 56% of self-referring patients given a link to DART by their practice, with anecdotal feedback indicating the new self-referral process enabled them to direct patients straight to DART instead of booking a doctor appointment. Additionally, the project supported promotion of service quality improvement initiatives within the service and across the wider NHS region.

Unintended benefits

1) Reinforcement of service eligibility criteria

Annual service funding is calculated by patient activity, with patients subject to exclusion criteria listed on the service website. DART identified 306 patients as ineligible to use the service and redirected them accordingly. This was an unintended outcome but represented a cost saving of £28,476(US\$37,320)/annum to the service based on the cost of one initial assessment per case.

2) Prioritisation of patients off work

Whilst DART identified 43 patients absent from work or on reduced or adjusted duties, there was no appointment urgency associated with this routing outcome. It was suggested by the clinical team we introduce prioritisation of appointments for work absent patients to be

seen within 2 weeks, thereby supporting the NICE early intervention for workplace health guidelines [23] and this change was included within Cycle 3.

3) Supporting patient self-management

For Cycle 3, information was added to all non-urgent DART disposition pages providing a link to Digital Health Therapeutics [24], allowing waiting patients easy access to evidence-based clinical content. This was to potentially reduce waiting lists and support the “Waiting Well” initiative [25].

The project overall

Initial deployment of DART into the MSK pathway was hampered by gaining access to the NHS internet and small operational issues, addressed within the iterative process, with no disruption to the service. No additional costs were incurred outside of budget. Feedback regarding the quality improvement project overall was overwhelmingly positive and supported the collaborative design.

“Being clinically led, it just worked”. Band 7 Physiotherapist.

“It was really well organised and not disruptive to the service”. Band 8a Physiotherapist.

DISCUSSION

The aims of this project were achieved using the principle-based approach of a Quality Improvement Study and an Integrated Knowledge Translation Approach between the NHS clinical team and researchers [18]. Improvements were seen in the primary outcome measure of safety, and all secondary measures of efficiency, cost and satisfaction, demonstrating potential benefits of implementing DART as the first point of contact in the NHS MSK self-referral pathway.

Accessibility is often quoted as a barrier to digital health adoption [26,27], however this project demonstrated that with provision of alternative methods of DART delivery, all patients could complete a DART assessment. Encouraging patients to seek help from family or friends, utilising “surrogate seeking” to complete an assessment is a recognised way for people with lower levels of digital health literacy or non-native English speakers to use an online system [28], a strategy previously reported in our DART usability study [15]. High levels of patient satisfaction, combined with no significant reduction in self-referral rates, led to the conclusion DART was not a barrier to patients accessing care.

The implementation of DART was well-received by less experienced physiotherapists, having a profound effect on their levels of work satisfaction. They told us they previously found the number of complex patients they saw a day challenging, and in some cases, “overwhelming”. Studies have

shown the clinical decision-making skills required to assess complex presentations are acquired with the experience developed over several years post-qualification and associated with more experienced higher Band physiotherapists [29]. Configuration of DART to stratify complex patients to specific bands of physiotherapist, supported a better balance of complex and simple presentations for less experienced clinicians, leading to improved work satisfaction, and additionally may aid retention of scarce clinical resource and reduce associated recruitment costs.

A key strength of the project was the collaborative approach, where all stakeholders remained engaged with data analysis and iteration from beginning to end. In addition, this proved instrumental in successfully embedding DART within the MSK pathway, overcoming the concerns of clinical and administrative teams often associated with deploying digital health technology [30,31]. Variations in NHS MSK services across England include referral routes, service exclusion criteria, clinical interventions available and onward referral options, adding to the complexity of delivering an equitable service to patients. When introducing a digital triage system inevitably there is a trade-off between improving consistency across different NHS regions and matching stratification to the specific needs of the service. This can only be achieved by collaborative working between system developers and clinical service providers and this approach certainly supported the successful delivery of this project.

Relationship to existing work

Whilst primary care digital triage systems (also referred to as symptom checkers) are increasingly suggested as an alternative to clinician-led triage, there remains scant evidence of their safety and effectiveness. Between 2019 and 2023 alone there have been 6 literature or scoping reviews evaluating published studies of their performance [20,32–36], with the same conclusions being drawn that there remains no confirmation of their assumed potential benefits. Significant ontological, epistemological and methodological limitations have been consistently identified, affecting the quality of most digital triage studies [37]. A tendency for developer bias is also well documented, likely linked to the cost and time to evaluate a system in a fast-paced competitive digital health market [33]. This has led to calls for a more rigorous independent evaluation process and greater market regulation [38]. In their scoping review published in 2019, Aboueid et al went as far as to say that a prominent knowledge gap exists in this field, with further reviews having limited value until more high-quality research is available [32]. Our quality improvement study was the culmination of a programme of work to design robust study protocols and deliver the standard of

research required to give reassurance to clinical service managers and commissioners. In achieving this aim, we suggest we have provided a blueprint for other digital health system evaluation, leading to an increase in much needed high-quality studies in this important emerging sector.

Limitations

This project was conducted at one site and NHS England MSK services are not homogenous, with geographical factors and patient demographics being key variables [33]. Therefore, when evaluating and implementing digital technology, local variances between patient characteristics and service structure should be considered. Analysis and insight into the NHS service was challenged by availability and accuracy of data from the NHS electronic record system, due to lack of key metric fields and user input error associated with complexity of data field format. This is an important consideration when developing future quality improvement projects within a service.

Bias

To minimise bias, all data except for semi-structured interviews were collected within the DART or NHS electronic record system, and all data analysed in conjunction with the NHS service lead. Academic oversight and review were provided by Queen Mary University London. Review of cases to assess safety and level of Clinician-DART agreement was completed by the NHS clinical team, with no input from researchers. The NHS service did not receive any remuneration for participating in the project. Patients were not offered any financial reward to participate in the study.

CONCLUSIONS

This project demonstrated the introduction of DART produced positive outcomes in all measures, presenting opportunities to improve safety, efficiency, cost and satisfaction across the NHS MSK service. This evidence could support commissioning discussions and potential adoption of DART as the first point of contact for self-referring patients across other NHS sites. In addition, the successful delivery of a quality improvement project utilising an Integrated Knowledge Translation Approach provides a model for other researchers wishing to test and implement digital health within clinical services.

Acknowledgments

This study was funded by Optima Health. Support for this study has been provided by Mersey & West Lancashire Teaching Hospitals NHS Trust.

Data Availability

The raw data sets generated during the study are stored on the DART system and so are not publicly

available, however the data sheets used for analysis are available from the corresponding author on reasonable request.

Conflict of Interest

Optima Health has developed the DART system and is the owner of the associated intellectual property. The principal investigator (CL) is an employee of Optima Health and a PhD Research Student at Queen Mary University of London.

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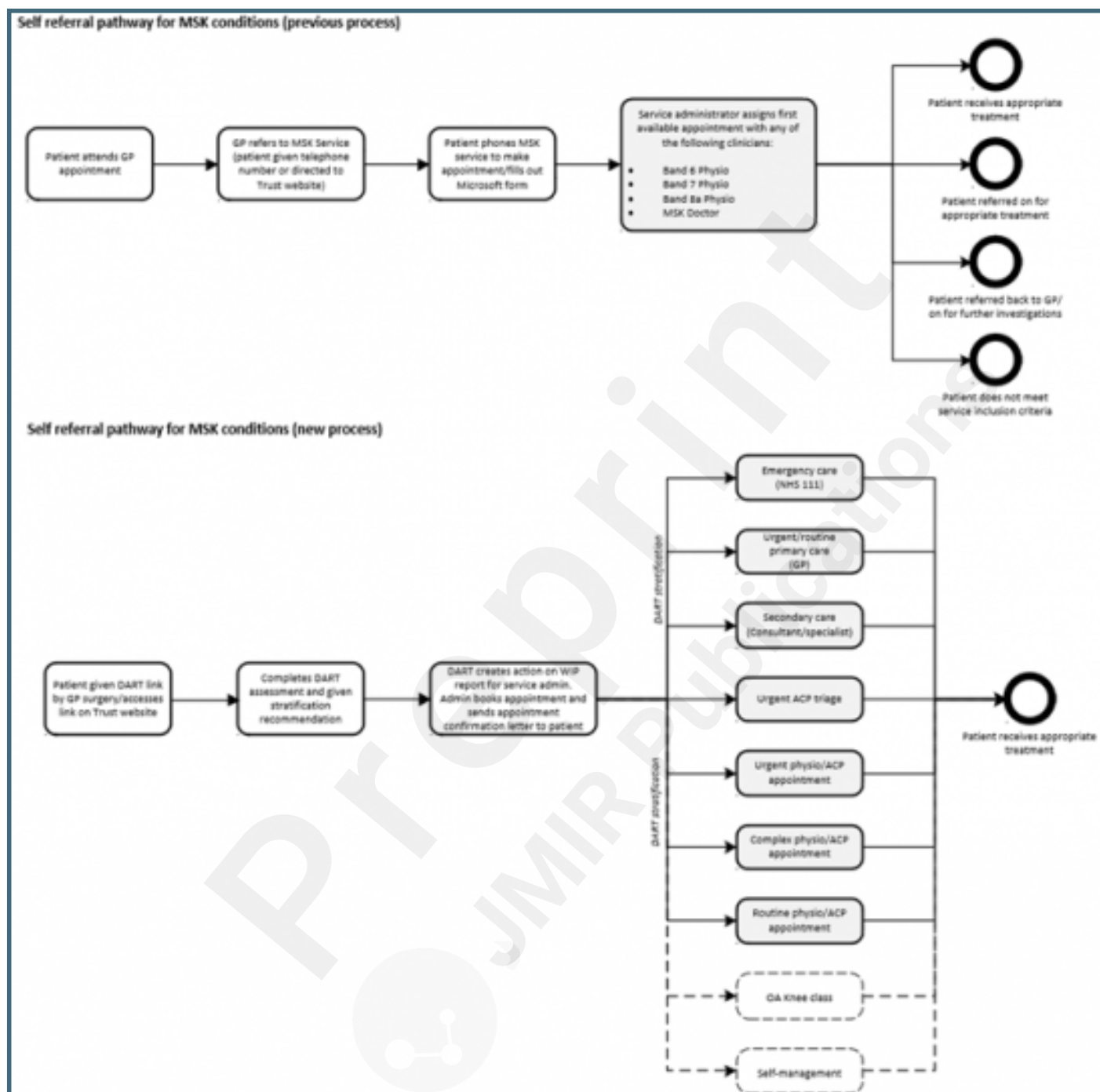
Abbreviations

ACP – Advanced Clinical Physiotherapist Practitioner
CPP – Consultant Physiotherapist Practitioner
DART – Digital Assessment Routing Tool
GIRFT – Get It Right First Time
MRHA – Medicines & Healthcare Products Regulatory Authority
MSK – musculoskeletal
NHS – National Health Service
NICE – National Institute for Health & Care Excellence
PDSA – Plan-Do-Study-Act
PIFU – patient-initiated follow-up
SDEC – Same day Emergency Care

Supplementary Files

Figures

Previous and intervention patient self-referral processes. Outcomes within dotted lines indicate future service options.



CONSORT (or other) checklists

SQUIRE reporting guidelines V 2.0.

URL: <http://asset.jmir.pub/assets/1bf6c67cf4621c6ee88361cac4cefeab.pdf>

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TOC/Feature image for homepages

DART mHealth system.

