Rapid Real-World Validation of DASHclinic: software for outpatient queue optimisation

Summary Report

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Introduction

The NHS is the largest employer in the UK and deals with a complex supply chain to deliver health-related services to over 60 million people annually. This requires a detailed planning process to accommodate a diverse range of demands, whether it be the availability of people, medical material, facilities, equipment or even information. In the year from August 2018 to July 2019, a record 123.4 million outpatient appointments were made[1], a number that had grown annually before seeing an inevitable downturn during the 2020 pandemic. Demand has now grown exponentially, and capacity growth and efficiency are required more than ever before to tackle recovery.

DASHclinic is a software solution that digitises the healthcare clinic queue management system, supporting patients and giving clinicians and managers ease of use and real-time data on clinic flow. DASHclinic displays filtered clinic lists, acknowledges arrivals, and directs patients through pathways. Whilst hospitals organise much of their operational demands via software, currently queue management is an area of practice that has not been prioritised and largely relies on patients and staff moving around paper handoffs. DASHclinic has the potential to enable staff (such as consultants and nurses) to manage patient flow without relying on these paper trails. Staff can visualise flow, orientating every waiting patient. The data generated could be used to create smarter scheduling and generate savings in time and resources, which could in turn lead to improved efficiency and patient and staff wellbeing.

Implementing DASHclinic in a real-world setting

DASHclinic was designed by Jim Gray, Clinical Director Trauma & Orthopaedics at Bedfordshire Hospitals NHS Foundation Trust (BHNFT) as a solution to his own experience of outpatient management systems. Jim received support for a pilot project at BHNFT as part of the Global Digital Exemplar programme (funded jointly by NHS Digital and the host trust). DASHclinic was integrated into a single Trauma and Orthopaedic outpatient clinic at Luton & Dunstable University Hospital and became a working prototype in May 2022.

Eastern AHSN funded a Rapid Real-World Validation (RRWV) of the pilot project and commissioned Cranfield University's Centre for Digital Engineering and Manufacturing to complete the RRWV. The work was led by six MSc students with the support and supervision of academic staff members.

The intention of the pilot and RRWV was to support BHNFT to understand whether DASHclinic has the potential to realise the benefits as anticipated; and help inform future decisions concerning DASHclinic prototype development and

[1] NHS Digital (2019) *Provisional Monthly Hospital Episode Statistics for Admitted Patient Care, Outpatient and Accident and Emergency data April 2019 - July 2019*. Available from https://digital.nhs.uk/data-and-information/publications/statistical/provisional-monthly-hospital-episode-statistics-for-admitted-patient-care-outpatient-and-accident-and-emergency-data/april-2019---july-2019-m04 [accessed 22.02.23].

scaling. This Summary Report draws out the key findings which are documented in full within two MSc dissertations[2].

Anticipated benefits of DASHclinic

DASHclinic aims to enable better operational planning in the short-term to meet stakeholder targets, by:

- minimising medical intervention costs due to unclear handwritten instructions;
- achieving patient satisfaction by improving waiting room throughput of multiple invisible queues with clear visualisation for operational staff;
- improving the wellbeing of staff due to minimising frustration with previous inefficient systems;
- reducing waiting times beyond what is possible with paper-based methods of queue management, enabling forward planning, reducing delays and improving capacity;
- speeding up clinic flow since digitised queuing identifies waiting patients who can be prioritised; and
- reducing staffing resource as paper-based systems required additional overheads.

Over time and with successful implementation of DASHclinic, a range of longer-term benefits are anticipated, such as:

- improved booking and patient flow efficiency within a complex outpatient pathway (with associated time and resource savings and potentially a more efficient use of available staff and physical resources);
- improved patient experience via increased transparency about waiting times;
- improved staff experience including nurses having more time for patient-focused support, reflecting reduced administration associated with the paper-based system.

Rapid Real-World Validation (RRWV) Methodology

The Rapid Real-World Validation set out to answer the following research questions:

1. What is the demand for DASHclinic?
2. What are the barriers to adoption of DASHclinic?
3. Is DASHclinic ready to be used?
4. What needs to be improved for DASHclinic?
5. What are the proposed next steps?

The first phase of the study was undertaken by a cohort of six MSc students between February and April 2022, to support the gathering of evidence and insights into an innovation that may offer a way to improve outpatient queue

[2] Contact j.a.erkoyuncu@Cranfield.ac.uk for more information.

management. Their focus was on collecting baseline data to validate the need for a solution such as DASHclinic (Appendix A highlights some of their key findings).

The second phase of the study (May to September 2022) was led by one MSc student selected by Cranfield University from the cohort of six, to continue gathering data on the feasibility and acceptability of DASHclinic as a solution to outpatient queue management; and to explore whether DASHclinic is transferable to other NHS trusts and clinical pathways that involve a series of component stages (for example, ophthalmology).

The methodology adopted combined qualitative and quantitative research methods to address the five pre-defined research questions outlined above. The work undertaken by the student-centred team focused on the validation and evaluation of the DASHclinic prototype. This included work to identify the impact of the prototype and related insights into its potential for scaling up across other NHS sites. A key objective for the study was to support BHNFT and the clinical innovator to understand if the platform has the potential to realise its anticipated benefits, and the related enabling factors. Raw data was extracted from the DASHclinic back-end systems and cleansed to evaluate the system and draw insights. Data cleansing applied a series of filters, selecting the range of dates applicable for study, completed pathways and coding of stations/pathways from internal identifiers to a human-readable format. Cranfield researchers conducted the analysis based on a set of evaluation metrics detailed in their study.

The RRWV explored how time-savings in clinic operation could be achieved along with key findings and insights related to the implementation of the software solution. To reflect the tight study timeframe and sequence of steps to introduce the DASHclinic prototype to the Trauma & Orthopaedics clinic (including time to onboard staff), the work undertaken by Cranfield University was divided into two phases. Details of the previous clinic state prior to the introduction of DASHclinic were identified in Phase 1 (baseline) and Figure 1 illustrates the layout of the outpatient clinic at Luton and Dunstable Hospital, where the study was conducted.

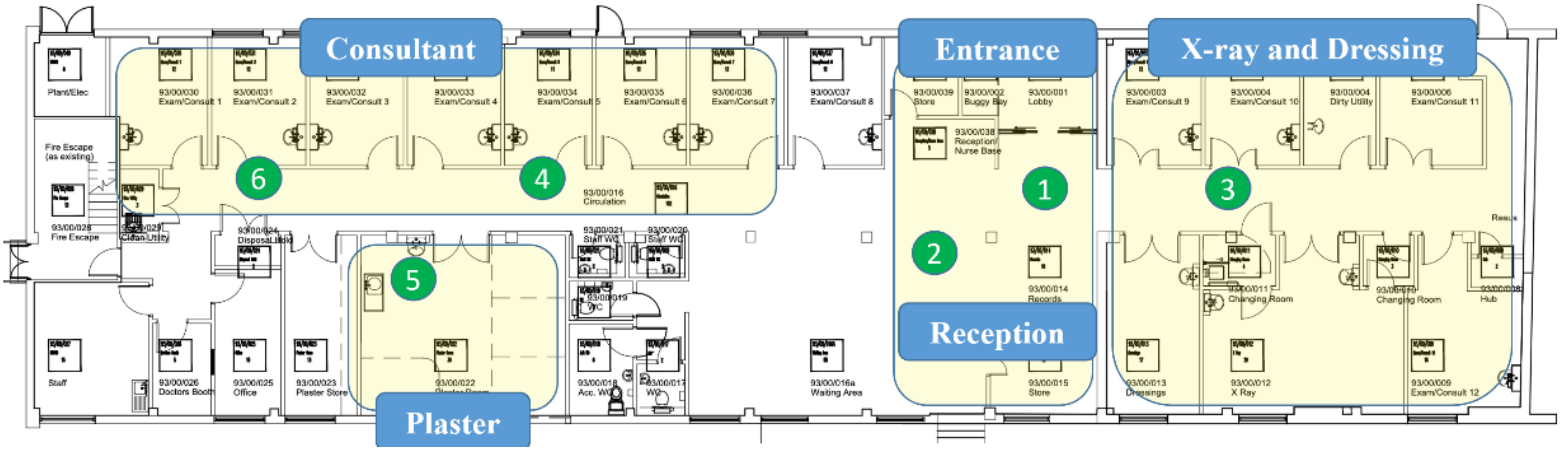

Figure 1. The outpatient clinic where DASHclinic has been piloted. Different clinic stations are marked on the floorplan.

Key findings

This section outlines the findings of the Rapid Real-World Validation. Due to the short-term nature of the pilot, there were constraints to the volume and quality of data generated from the platform's use. Despite this, conclusions and insights have been generated from the study which will help inform the future development and deployment of the DASHclinic prototype.

The demand for DASHclinic

From the data recorded by the DASHclinic software, the clinic sees a significant volume of patients through the outpatient clinic. Once data filtering was completed, there remained a total of over 2,600 patients seen during a 53-day period from 12 May 2022. Analysis of the different pathways between each location in the clinic has identified visits to doctors as the area of highest demand within the clinic – out of 14 different pathways identified, doctors are involved in 12 of these.

The initial findings from the study validated the need for a solution such as DASHclinic. Highlights from this included the clinic pathway where the number of patients visiting clinic pathways who experienced one or more delays of more than 10 minutes were identified as "bottlenecks". The time spent on paper tasks identified various paper-based tasks occupying nurses during a clinic. For actual clinic visits, the demand percentage of patient visits was found for each of the clinic stations: Hospital, Consultant, X-Ray, and Plaster room. The bottlenecks for these are shown in *Table 1* below, with detail on the number of patients visiting each of the various clinics: Spine; Regular Fracture; Consultation; Hips & Knees; Paediatrics. Each clinic has data on the number of patients, the average waiting time per patient; the total waiting time and the corresponding amount of useful time spent by each consultant.

Table 1. Number of patients

Clinic Type	Total No Of Patients	Average of consultant_waitingtime	Sum of consultant_waitingtime	Average of consultant_usefultime
Spine	19	00:50:09	15:53:00	00:13:13
Reg Fracture	175	00:37:31	13:24:00	00:07:00
Consultation	112	00:33:46	15:01:00	00:11:39
Hips & Knees	23	00:21:50	08:22:00	00:08:42
Paedratics	23	00:20:42	07:56:00	00:08:29
Grand Total	**352**	**00:34:53**	**12:36:00**	**00:09:01**

The barriers to adoption of DASHclinic

For some stakeholders, there have been frustrations with the adoption of the DASHclinic software. It has been observed that some doctors in the clinic have a reluctance to use the software more thoroughly, leading to various errors in the use of the system and a reluctance to replace the existing paper-based system. These human factor issues were apparent in the previous paper-based approach and have been replicated in the new digital system. During deployment of the system, enhanced training would have been beneficial to some users who were unfamiliar with using this type of tool. A lack of training led to unfamiliarity with

how existing processes should be adapted to the new system; in particular, 'walk-in' appointments were difficult to manage. The system would benefit from suitable prompts or notifications for missed activities, leading to gaps in data recorded. A key barrier was the parallel running of the digital and paper-based system which undermined impact and tangible time savings that could be generated from the digital system.

Readiness of DASHclinic to be used

During the study, a qualitative survey was conducted to gather end user opinions of the DASHclinic software. From the sample size of 24 clinical staff members, a majority of 95% voted in favour on the ease of use of the system. In terms of the system's primary purpose for queue management, more than 54% rated the software as above average or higher. There are some general infrastructure issues that may currently limit the use of the software; the clinic has poor wireless network connectivity, especially around the radiography department. During the initial trial of the software, paper-based processes continued in parallel to the deployment of DASHclinic, adding to staff workload burden (reflecting in part the early-stage nature of the pilot project).

Potential improvements to DASHclinic

The DASHclinic software is a prototype system, with some shortcomings reflecting its early stage of development and functionality.

- At times, the software experiences a slow response time – either due to processing delays or data retrieval from server systems.
- The software features a note-taking capability, but apparent access to these notes is not readily available for other users in the system. It has however been confirmed that notes can be made and viewed by anyone.
- There are some apparent security issues, with no clear levels of authorisation to control access to restricted data.
- It would be useful if the software allowed the possibility to create a future pathway for a new patient, especially for walk-in appointments. This feature has been planned, but has yet to be deployed.
- There were apparent limitations to managing non-arrivals – either the record is removed from the system too early or can be difficult to reschedule for an actual late-arrival. This has been improved with patients are marked as not arriving and were applicable reallocated to Expected or Arrived.

These insights provide a basis for further development and refinement of the platform, and the work undertaken in Phase 2 of the study outlined a roadmap for its future development.

Proposed next steps to develop DASHclinic

Responses from the qualitive survey have provided useful feedback for deciding on the next steps for the software development. Several respondents have suggested that the prioritisation of different patients to further enhance queue management would be useful. The DASHclinic software would also benefit from closer integration with other NHS systems. A frequent concern was a reduction in the number of apparent software 'time-outs'. The DASHclinic software maybe more successfully implemented once all previous paper-based processes have been abandoned by the NHS Trust (e.g. the complete elimination of paper within the clinic).

Recommendations

The study concluded with a set of key recommendations for further development of the DASHclinic software and support to the potential users of the platform. These are focused on maximising the future scalability and impact.

1. Change management support

The adoption of a change management process would minimise stakeholder reluctance to engage with the system, reducing indifference towards usage. Clarity is needed to articulate the need for change, followed by a plan to implement a sustained change programme. It is vital that key decision makers give their full support to the change management process, ensuring its success. Several additions to the onboarding process to engage various stakeholders exist, for example a clear description of user roles; an explanation of and rationale for correct operational use; as well as sharing the perceived (and evidenced) benefits of effective use of the system.

2. Error reduction in data collection

User interface delays and slowdowns were a frequent user issue, together with missing data with some appointments not recorded in the system. A suitable test and quality assurance program could be adopted for future enhancements to the system. Interoperability was a significant issue during the onboarding process with IT department support and engagement a critical success factor in the replacement of the existing paper-based system with the new digital platform.

3. Outline roadmap to inform future development of DASHclinic

The current DASHclinic prototype can be considered version one and is at an acceptable level of working functionality. The following features are recommended for implementation following a full requirements analysis of the current and future system:

- Scheduling of 'walk-in' appointments
- Transferable notes between clinic locations
- Login roles and levels of authorisation to secure data

4. RTLS integration

Real-Time Location System (RTLS) functionality could give an enhanced level of functionality to the DASHclinic system. Instead of operating a set of virtual queues within DASHclinic, a RTLS would be able to give precise data for all participants within the clinic, identifying throughput, patient flow and any unforeseen bottlenecks within the clinic operational approach. It would allow further automation of the queue management process, reduce the scope for errors and create further improvements and time-saving efficiencies.

Conclusion

Through a mix of qualitative and quantitative data, the Cranfield University research team confirmed the need and value of a digital solution for outpatient workflow management, and that the DASHclinic prototype has the potential to generate improved efficiencies related to patient flow and allocation of staff resources, generating tangible benefits for patients and staff. The study provided an outline route map for further prototype development with insights and recommendations to support staff engagement in the future roll-out of the technology, and the transition from a paper based to digitally enabled queue management system.

While limited data restricted evidence of impact, on completion of this study DASHclinic represents a positive step towards improving working conditions and service quality. However, like many projects, it has not been immune from various implementation challenges common to many digitalisation endeavours. The DASHclinic system offers a wealth of data analytics and insights but would benefit from further refinements in this area to unlock its potential. Identifying trends in non-arrivals, daily activity and recurrent pathways are invaluable for clinic managers. Implementation of the recommendations of this research would make an undoubted contribution to the effective operation of outpatient clinics throughout the NHS.