

Sequential Simulation (SqS) Utilised as a Novel Educational Tool Aimed at Healthcare Managers: A Patient-Centered Approach

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Sequential Simulation (SqS) Utilised as a Novel Educational Tool Aimed at Healthcare Managers: A Patient-Centered Approach

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KEYWORDS

Sequential Simulation (SqS); Healthcare management; Healthcare re-modelling; Care pathway; Patient

Experience

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ABSTRACT

Background: A new challenge for healthcare managers is to improve the patient experience. Simulation is often used for clinical assessment and rarely for those operating outside of direct clinical care. Sequential Simulation (SqS) is a form of simulation that re-creates care pathways, widening its potential use.

Local problem: Numbers, outcome measures and system profiling is used to inform healthcare decisions. However, none of these capture the personal subtleties of a patients' experience.

Intervention: 56 students attended a teaching module using SqS and facilitated workshops as part of their induction week on an MSc International Health Management course. The workshop was voluntary and was offered as an opportunity for the students to gain an insight into the UK health system through the medium of simulation.

Methods: An evaluation survey incorporating quantitative and qualitative student feedback was conducted. Descriptive statistics were generated from the quantitative data, and thematic analysis was undertaken for the qualitative data.

Results: There was strong agreement for the acceptability of the workshop approach in relation to the aims and objectives. Likert scale (1-5) mean total = 4.49. Participants responded enthusiastically (revealed through the qualitative data) with ideas related to perspectives sharing, understanding healthcare management and processes and the consideration of feasibility and practicalities. They also suggested other applications that SqS could be used for.

Conclusion: The SqS approach has demonstrated that simulation has a wider potential than for clinical assessment alone. Further studies are required to determine its potential uses and affordances beyond its current format.

WHAT THIS PAPER ADDS

WHAT IS ALREADY KNOWN ON THIS SUBJECT?

- Managers currently draw on numbers, outcomes measures and system profiling to inform their decisions. However, these measures do not capture new concerns around the patient experience. Therefore, these concerns require a different approach.
- Sequential Simulation is a tool that aims to reveal the complexities of a care pathway bringing together the people who populate it, alongside their expertise, experience, emotions, and needs.

WHAT THIS STUDY ADDS

- Simulation, and in particular, Sequential Simulation, can be applied as a tool to inform, design and operationalize health care decisions, breaking down boundaries and building mutual understanding between stakeholders.
- Further studies of this approach are needed to understand the benefits that SqS can provide in aiding decision making during the management of healthcare provision.

INTRODUCTION

Healthcare managers have a new challenge when redesigning and transforming healthcare services. No longer can healthcare systems be managed from a purely practical perspective, in contrary, the healthcare experience also needs to be considered. However, this is much harder to define, and therefore a different approach is required.

Currently, numbers, outcome measures and system profiling is drawn on to inform healthcare decisions made. However, none of these capture the personal subtleties of a patients' experience, let alone how to manage, and improve their experience amidst the complexities surrounding a clinical pathway^(1,2).

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3 Computer-based simulation is widely used to address healthcare organisational challenges. This
4 approach can range from spread sheet models to discrete event simulation and virtual reality gaming in
5 order to plan and manage a range of healthcare needs and priorities^(3,4). Physical simulation where real
6 clinician's, environments and props are used, are conducted mainly for healthcare professional training
7 and assessment. However, there have been some attempts to widen physical simulations scope, such
8 as through testing new facilities and organisational resilience through in-situ simulations^(5,6).
9

10 Sequential Simulation (SqS) is the physical re-enactment of care pathways, bringing together clinicians,
11 physical environments, actors and simulation tools and scenarios. It is a way of bringing together the
12 complexities of a care pathway and healthcare system, incorporating the people who populate it
13 (clinicians, healthcare personnel, patients, and publics), alongside their expertise, experience,
14 emotions, and needs^(7,8,9).
15

16
17 Previous applications of the SqS tool have included: to engage front-line staff and patients in the design
18 of new models of care⁽¹⁰⁾; to test and evaluate the intervention of a new diagnostic breath test for
19 oesophageal cancer⁽¹¹⁾; to train GP receptionists and pharmacists around integrated care and their role
20 within it^(9,12); to train nurses and healthcare assistants on the deteriorating patient; to train multi-
21 disciplinary teams across an entire hospital on end-of-life care; and as a fundraising tool for a paediatric
22 intensive care unit that revealed the current difficulties faced, to potential donors.
23

24 These applications have engaged a range of stakeholders to consider the entire pathway for a particular
25 objective through the medium of simulation; termed Sequential Simulation (SqS). Thus, the application
26 of simulation has been widened from that of traditional training and assessment to that of strategizing,
27 engaging, testing and evaluating from a broader perspective – that of the care pathway.
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30 In this paper, we explore UK and international students' perspectives on the use of SqS as a novel
31 educational tool for understanding and redesigning complex healthcare systems and clinical pathways
32 and incorporating management-oriented solutions for healthcare delivery. In doing so, we draw upon
33 an *MSC International Health Programme* students' evaluations of SqS as a teaching tool and their
34 perspectives about potential applications for SqS using a pragmatic mixed-method approach.
35

36 INTERVENTION

37 A workshop was used as an intervention to utilise SqS as a tool to engage future healthcare managers
38 with the objectives of a) re-designing a care pathway process, and b) providing an opportunity for
39 participants to use their management skills, with particular consideration given to local initiatives and
40 cost implications.
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43 The aim for the SqS was to generate a care pathway scenario that would provide an opportunity for the
44 students to identify elements of re-design opportunities and apply their management skills. The SqS
45 was therefore designed to replicate a real patient's care pathway, incorporating salient points into the
46 scenario which ensured re-design opportunities.
47

48 A heart attack care pathway was chosen, as in clinical terms, it is highly complex, involving various
49 presenting symptoms and diagnostics. It requires a coordinated, integrated care approach. From the
50 onset of pain to paramedic assessment, the transfer to a Heart Attack Centre (HAC) through to the cath
51 lab for the procedure, and finally, post-procedure considerations. This also includes the consideration
52 of call to balloon times, onset of patient pain to cath-lab times, door to balloon times, and arrival at
53 24hr HAC to cath-lab.
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56 The Heart Attack SqS was designed to involve family support, triage, and patient/clinician
57 communication, to aid the subsequent group discussion. These aspects of the pathway were
58 highlighted due to recent emerging evidence around the lack of psychological support that patients and
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family receive during their care, often leading to increased post care costs (for example, depression, anxiety, and post-traumatic stress syndrome).

UK guidelines recommend person-centred care, where treatment and care should take into account people's needs and preferences, with the opportunity to make informed decisions about their care and treatment, in partnership with healthcare professionals. Good communication between healthcare professionals and the person with chest pain is, therefore, essential, and it should be recognised that the person may be anxious, particularly when the cause of the chest pain is unknown⁽¹³⁾. According to NICE guidelines, options and consequences at every stage of the assessment and investigation process should be clearly explained. Furthermore, guidelines recommend that families and carers should have the opportunity to be involved in decisions about treatment and care: "Families and carers should also be given the information and support they need" p.7⁽¹³⁾.

SqS Design

Heart Attack SqS and Scenario

Students watched the complex care pathway presented through a Sequential Simulation (see figure 1) that was specifically generated to provide an opportunity for students to identify elements for re-design and opportunities for reflection and incorporation of management-orientated solutions aligned with the course objectives.

The heart attack care pathway consisted of Home --> Paramedic/Ambulance Service --> Emergency assessment in a heart attack care centre --> Catheterisation lab --> Ward.

Distributed simulation (portable and affordable simulation backdrops and props) were used to recreate the pathway within a room with capacity for 60 students in an acute London hospital (see Figures 1)⁽¹⁴⁾. Simulated patients were used to portray a wife and husband (heart attack victim). Real clinicians performed the role of paramedics, nurse, and cardiologist. The simulation lasted for 30 minutes, condensing time to highlight the key aspects of the pathway (Table 1).

Table 1 Design of the Heart Attack SqS and Salient Cues for Subsequent Group Discussion

| SqS Scene | SqS Participants | Salient Cues for Subsequent Discussion | Learning objectives |
|--|---|--|---|
| Patient Collapse | Patient, Carer (Trained Actors) | <ul style="list-style-type: none"> • Wife talking to husband about what they will have for lunch (bacon sandwich) | Lifestyle issues |
| Paramedic Arrival & Assessment | Paramedics, Patient, Carer | <ul style="list-style-type: none"> • Paramedics acquire information from patient and wife • Verbal handover via mobile phone from Paramedic to CCU nurse • Wife allowed to travel in the ambulance with them | Identification of Family support, triage approaches and patient-clinician communication |
| Paramedic Transfer of Patient to 24-hour Heart Attack Treatment Centre | Paramedics, Patient, Carer | <ul style="list-style-type: none"> • Technical terminology between paramedics and CCU team (phone call) | Identification of Family support |
| Handover between Paramedics and Clinicians | Paramedic, Patient, Carer, Nurse, Clinician | <ul style="list-style-type: none"> • Cardiologist reliant on paramedic and patient for information and decision making • Limited support for wife • Technical terminology between paramedics and clinicians • Wife increasingly distressed | Identification of Family support, triage approaches |
| Cath-Lab Procedure & | Cath-Lab: Patient, Nurse, Clinician | <ul style="list-style-type: none"> • Communication between clinicians and patient minimal | Identification of Family support, and patient-clinician |

| | | | |
|-------------------|-----------------------|--|---|
| Waiting Room | Waiting Room: Carer | •Wife not updated during this time | communication |
| Ward Consultation | Patient, Nurse, Carer | •Information of who will now be involved in the patient's pathway given •Appropriate referrals made •Support to family not discussed | Identification of Family support, triage approaches and patient-clinician communication |

Workshop design

Following the SqS all students took part in facilitated discussions to identify issues that arose in the cardiac pathway and were subsequently split into three groups of 20-22 to identify potential solutions.

After 90 minutes, students presented their solutions to the wider group, after which a broader group discussion was facilitated by the course leads centred around the management-orientated course objectives such as wider implications for UK and international care pathways; considerations of pathway costs; potential applications for SqS in clinical and management contexts in the UK and international settings.

METHODS

Sample

56 students attended a teaching module involving SqS and facilitated workshops as part of their induction week on an *MSc International Health Management* course. The workshop was voluntary and was offered as an opportunity for the students to gain an insight into the UK health system through the medium of simulation.

Of the 56 students attending, 17 were male, and 39 were female. Three were national students (UK) and the rest international. Professional backgrounds attending the workshop included: accounting & finance, biological and biomedical sciences, bioprocessing, biotechnology, business, dentistry, economics, healthcare, history, management, engineering, nutrition, pharmacology, political sciences and psychology.

Evaluation Tool

An evaluation survey was purposely designed to incorporate quantitative and qualitative student feedback, providing an opportunity for the triangulation of results (Appendix A).

The quantitative component of the survey comprised a 24 item 5-point Likert rating scale (1= Strongly Disagree, 5 = Strongly Agree). The items explored:

- Utility of the SqS for learning and enhancing understanding of UK healthcare systems, clinical pathways, and cardiac pathways
- Utility of SqS for highlighting strengths and weaknesses, and identification of problems and potential solutions for the cardiac pathway
- Utility of SqS as an aid for discussion in the subsequent workshop and group discussions
- Overall utility of SqS as a teaching tool

The qualitative component of the survey allowed students the opportunity to provide more detailed, open-ended perspectives about:

- Implementation of the SqS themes in future studies
- Usefulness of the SqS format and how it could be applied to other contexts
- General feedback

Quantitative analysis

Descriptive statistics (mean and standard deviation) were calculated for each of the Likert scale results.

Qualitative analysis

Thematic analysis of the questionnaires open-ended questions were conducted per question. Main themes and sub-themes were identified and grouped accordingly.

Ethical Considerations

Ethical approval was obtained from the Imperial College Research Ethics Committee (ICREC Reference: 14IC2251). Informed consent was obtained from all participants.

RESULTS

56 students completed the evaluation surveys at the end of the workshop, with a response rate of 100%. Two researcher's (SM-W & TK) checked the data for consistency when uploading and analysing.

Quantitative Findings

Overall, participants slightly to strongly agreed with the statements presented (mean total = 4.49). The strongest agreement was for the '*SqS for learning and enhancing understanding of UK healthcare systems, clinical pathways and cardiac pathways*' (combined question mean of 4.6) and '*SqS as a teaching tool*' (combined question mean of 4.6). The least agreement was for the '*SqS as an aid for discussion in the subsequent workshop and group discussions*' questions (combined question mean of 4.2) (Table 2).

Table 2 Quantitative evaluation results (Mean, SD)

| | Students' Evaluations (n = 56) |
|---|-----------------------------------|
| | Mean (SD) |
| Student's evaluations of SqS for learning and enhancing understanding of UK healthcare systems, clinical pathways and cardiac pathways | |
| The sequential simulation (SqS) was useful for my learning of UK healthcare systems | 4.63 (.62) |
| The SqS was useful for my learning of UK clinical pathways generally | 4.50 (.71) |
| The SqS was useful for my learning of UK cardiac pathway | 4.52 (.69) |
| The case study presented in today's SqS enhanced my understanding of UK cardiac pathways | 4.57 (.68) |
| The SqS approach helped me to visualise how the cardiac pathway might look in practice | 4.71 (.53) |
| From today's SqS I believe my knowledge of the cardiac pathway has improved | 4.41 (.83) |
| Student's evaluations of SqS for highlighting strengths and weaknesses, and identification of problems and potential solutions | |
| The SqS successfully highlighted strengths and weaknesses in the cardiac pathway | 4.27 (.73) |
| The SqS enabled me to identify problems in the cardiac pathway | 4.23 (.81) |
| The SqS enabled me to identify potential solutions to improve the cardiac pathway | 4.23 (.79) |
| Student's evaluations of SqS as an aid for discussion in the subsequent workshop and group discussions | |
| The SqS allowed me to feel confident in my ability to address issues in the subsequent work of the workshop | 4.12 (.85) |
| The SqS helped me to get my points across in the subsequent workshop | 4.39 (.71) |
| Student's evaluations of SqS as a teaching tool | |
| The SqS and workshop facilitated my thinking of the wider implications for healthcare management systems | 4.71 (.50) |
| The SqS and workshop enhanced my understanding of management in applied healthcare contexts | 4.40 (.81) |

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|---|------------|
| Overall, I feel that the Sequential Simulation (SqS) is a useful approach for learning about healthcare systems | 4.73 (.52) |
| The SqS and workshop today will better prepare me for understanding healthcare systems generally | 4.43 (.81) |
| The teaching module today was more useful than attending a didactic lecture | 4.57 (.63) |
| The SqS approach is an appropriate teaching tool for this module | 4.70 (.54) |
| I intend to reflect on the themes of today's SqS and implement them in my future studies | 4.64 (.55) |

(5-point Likert rating scale: 1 = Strongly Disagree, 5 = Strongly Agree)

Qualitative Findings

51 (91%) of respondents left written feedback for the question 'Please describe below how you would implement the themes of today's SqS in your studies'. Five themes were identified by two researcher's (S-M.W & T.K). Table 3 describe the themes identified and illustrate with selected quotes:

Table 3 Themed responses to how students would implement the themes generated from the SqS into their studies

| Theme | Citations |
|---|--|
| By providing different perspectives | <ul style="list-style-type: none"> 'There are a lot of perspectives I never thought of. They helped me to take into account other points of view from clinicians to pharmacists etc.' 'I could put myself in the shoes of a healthcare professional and see how the process can be improved from the management perspective' 'For me it was very important because I always look from a nurse perspective. At the start I was focus [sic] on the nurse role and at the end of the session I was already thinking of costs, implementation, education, awareness etc. So, these themes will help me to think in a more wider and bigger perspective and starting to move out of my "only background" look and approach.' |
| Feasibility/practicalities | <ul style="list-style-type: none"> 'It would enable me to consider when thinking about potential strategies how practical its application is' 'I think the workshop today helped me to tap into an important factor with the delivery of healthcare services - feasibility. The concept would be a key for me to bear in mind at all times during my study with health management' 'When looking at a budget a hospital is provided with, the issues addressed (such as staffing and logistics) in today's SqS would definitely be useful and helpful.' |
| SqS applications | <ul style="list-style-type: none"> 'Use it as an example to illustrate some ideas. Use it as a tool in prevention/training....' 'Future pathway management/production using simulation. Critical analysis' 'Cost effectiveness. Education. Pathway streaming. Physicians having examination' |
| Healthcare management and processes | <ul style="list-style-type: none"> 'The SqS helped me understand the processes regarding the healthcare system in the UK. I would implement it in my studies as a proof that improvements to the system are possible for both time and cost effectiveness' 'As a manager I think it is a powerful tool in training patients and clinicians but more importantly I think it works to designing operating processes that adapt well to a specific layout of hospital. Also, work to train non-clinicians like receptionists and janitors' 'For me it was really useful to think about simulation not only as an educational tool but also as a tool for redesigning processes and innovative interventions' |
| Providing Insight into healthcare processes | <ul style="list-style-type: none"> 'By getting to know the healthcare system, and the pathways and processes, it's a great tool to properly manage a healthcare institution' 'I will use this as an insight of how healthcare practices are done in the UK in comparison to those in my home country. Indonesia' 'It provided fantastic opportunity for students from a wide diversity of subjects to have an understanding on healthcare, especially for me without any expertise on medical or pharmacy. Really useful as a starting point' |

53 (95%) of respondents left written feedback for the question 'Please describe how useful you think the SqS format is and how it could be applied in other contexts'. Five themes were identified and are presented in Table 4.

Table 4 Themed responses to how useful students felt the SqS format is and how it could be applied in other contexts.

| Theme | Citations |
|--|---|
| Education/training | <ul style="list-style-type: none"> 'It is very useful as it is easy to understand, remember and implement the learnings in this format' 'Being able to visualise the process in action makes it easier to understand and see how simulations can be applied in other contexts such as public awareness, i.e. response to emergency situations or for training purposes and reinvention/improvisation of pathways and processes' 'The SqS format is very useful, not only for training staff but also administrative staff who may not be aware of the clinical complexities of different scenarios'. |
| Public health | <ul style="list-style-type: none"> 'Public health: I feel the fear factor of watching a live MI would be a very powerful obesity campaign for example. staffing issues' 'Health education to general population - prevention - faster reaction'. |
| Other clinical contexts | <ul style="list-style-type: none"> It is very useful to give orientation about situations that may have severe impact or be likely to happen, e.g. code blue fire emergency' 'It could be for other types of diseases, like chronic one or even acute (like asthmatic attack)' 'I think it is a very refreshing way to extend the use of simulation beyond clinical assessment'. |
| Patient communities & perspectives/public engagement | <ul style="list-style-type: none"> 'The SqS would be useful for everyone as it provides a general overview of what's happening behind the scenes' 'Is really nice that we can gain contact with clinicians in real field who have experience. Education to public would be possible to apply' 'The idea that this could be used as a product to enhance public knowledge is fascinating. This could be filmed and then become available to clinicians and the public'. |
| Management & optimising pathways | <ul style="list-style-type: none"> 'It's pretty useful for developing soft skills and also for bringing the whole healthcare group in sync. Helps in minimising unwanted worries in the chain of command' 'I think it was extremely useful for exploring everyone's view and important for setting direction in consideration of business concepts. It can be applied in most high stress contexts for management of risk and error' 'The SqS format could be useful to put things together when we are aiming to integrate processes and intervening not only in clinical context but also in management scenarios' However, from a management perspective, the SqS enables me to identify areas where the medical services could be improved on, for example, patient family could be informed better and improved customer services' |

35 (63%) of respondents left written feedback for the question 'Please use the space below to add any other feedback or comments about today's SqS'. Four themes were identified and are presented in Table 5.

Table 5 Themed responses to how useful students felt the SqS format is and how it could be applied in other contexts.

| Theme | Citations |
|------------------------|---|
| Praise | <ul style="list-style-type: none"> 'The SqS is very good. I hope Indonesia will have this kind of module in the future' 'Lovely, beneficial, and iterative. Please continue running this simulation :)' 'The staff, actors, doctors were all super helpful and were able to describe the procedure effectively well to non-UK students' |
| Learning opportunities | <ul style="list-style-type: none"> 'It would be interesting to see how the qualitative insights learned from the simulations can be quantified for decision making at the management level' 'I would like to learn more about management and administrative actions going on in the background rather than clinician in gown' |
| Improvements | <ul style="list-style-type: none"> 'The SqS was definitely very useful. Maybe a bit more time on the workshop. I liked the fact that it's done during induction week as well' 'For a larger audience, the ease of visualising the simulation should be considered in setting of the room (e.g. use of a hall with step ladder sitting)' |
| Different applications | <ul style="list-style-type: none"> 'It could be useful to explore simulation for chronic conditions which are the significant challenge for health systems in a lot of countries. The complexity of chronic conditions could be greatly explained with SqS' 'It has enormous potential in management education. So managers can have a wide perspective of how different scenarios can play out.' |

DISCUSSION

There was high level of agreement on the use of SqS for learning and enhancing understanding of UK healthcare systems, clinical pathways, and cardiac pathways, for highlighting strengths and weaknesses, and identification of problems and potential solutions, as an aid for discussion in the subsequent workshop and group discussions, and as a teaching tool question means scored above four on the Likert scale. The qualitative component of the survey allowed for expansion on why respondents rated the approach so highly.

When respondents were asked how they would implement the themes identified in the SqS into their studies, they responded enthusiastically with ideas related to perspective sharing, understanding healthcare management and processes, and the consideration of feasibility and practicalities, and suggesting other applications.

When asked to describe how useful the SqS format was and whether they thought it could be applied in other contexts, participants responded that it was extremely useful and that they could envision a wide range of applications from education/training and public health to public/patient engagement, management, and the optimisation of care pathways for a range of micro and macro clinical contexts.

The final comments section of the questionnaire revealed a sense of gratitude from by participants towards receiving the workshop. Improvements were only suggested in terms of the physical environment, not the design of the SqS or the workshop itself. Further comments on learning opportunities and different potential applications were made, revealing an appetite for more examples of this kind.

Between the high level of agreement from the quantitative results of the survey to the positive responses related to healthcare management and beyond, the workshop appears to have met its original objectives and has been rated highly in the process. Particular strengths appear to be the perspective-sharing component and the opportunity to optimise a range of care pathways. Adapting and tailoring SqS to different clinical specialities would therefore enable a range of pathways to be considered.

The SqS approach has demonstrated again that simulation has a wider potential than for clinical assessment alone. Further studies are required to determine its potential uses and affordances beyond its current format. A programme of workshops that could be evaluated on a larger scale would be the next step in determining its usefulness alongside testing the other applications suggested.

Limitations

Although this study does not provide generalizable results due to its evaluative nature, it does pave the way forward for a different approach to the use of simulation that is beyond healthcare professionals' needs alone. Due to this study being a pilot and first attempt at using healthcare simulation in this format, it was conducted during the student's induction week. This may have affected the results, as the students hadn't been fully engaged at this point in the programme's management processes content. Further studies should aim to place the intervention at different points in the student's educational programme, aiming to assess its effectiveness and timeliness.

CONCLUSION

In conclusion, this workshop has been a useful exercise that has shown the potential for simulation, its applications and in particular, for sequential simulation to be used in other contexts outside of its traditional setting of the healthcare domain, yet with healthcare remaining at its core. This pilot study

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3 has therefore been successful, and further studies would strengthen its acceptability and applicability
4 in this context.
5

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13
14

15 **Competing Interests Statement**

16 We have read and understood BMJ policy on declaration of interests and declare that we have no
17 competing interests.
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19

20 **Contributorship Statement**

21 SM-W conceived and designed the study, collected, cleaned and analysed the data, drafted and revised
22 the paper. She is guarantor. TK helped design the study, collected, cleaned and analysed the data and
23 revised the draft paper. AE helped design the project, provided clinical guidance and revised the
24 drafted paper. BC initiated the collaborative project, helped design the project, monitored the study
25 and provided guidance and revised the final draft. FB initiated the collaborative project, monitored the
26 study and provided guidance and revised the final draft. RK initiated the collaborative project,
27 monitored the study and provided guidance and revised the final draft.
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18 **Figure 1** Ambulance, Ward and cath lab represented in the form of a SqS

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20 **Figure 2** SqS of heart attack pathway
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Ambulance, Ward and cath lab represented in the form of a SqS
197x108mm (96 x 96 DPI)

For Review Only

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SqS of heart attack pathway

509x88mm (96 x 96 DPI)

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