Shared leadership in tertiary care: Design of a simulation for patient safety decision-making in healthcare management teams

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ABSTRACT

Introduction: Simulation-based training (SBT) on shared leadership (SL) and group decision-making (GDM) can contribute to the safe and efficient functioning of a healthcare system, yet it is rarely incorporated into healthcare management training. The aim of this study was design, develop and validate a robust and evidence-based SBT to explore and train SL and GDM.

Method: Using a 2-stage iterative simulation design approach, 103 clinical and non-clinical managerial students and healthcare professionals took part in an SBT that contained real-world problems and opportunities to improve patient safety set within a fictional context. Self-report data were gathered, and a focus group was conducted to address the simulation's degree of realism, content, relevance, as well as areas for improvement.

Results: Participants experienced the simulation scenario, the material and the role assignment as realistic and representative of real-world tasks and decision contexts, and as a good opportunity to identify and enact relevant tasks, behaviours, and knowledge related to SL and GDM. Areas for improvement were highlighted with regards to involving an actor who challenges SL and GDM; more preparatory time to allow for an enhanced familiarization of the content; and, video debriefs to reflect on relevant behaviours and team processes.

Conclusions: Our simulation was perceived as an effective method to develop SL and GDM within the context of patient safety and healthcare management. Future studies could extend this scenario method to other areas of healthcare service and delivery, and to different sectors that require diverse groups to make complex decisions.

What is already known on this subject

Numerous studies in management psychology suggest that educating teams on shared leadership (SL) leads to enhanced performance and team productivity, creating a group decision-making (GDM) process that is based on a shared understanding, purpose, and participation. However, surprisingly little is known on the value of teaching and learning about SL and GDM in the context of healthcare management and patient safety.

What this paper adds

- The design, development, and evaluation of a simulation-based training (SBT) package to learn about shared leadership and group decision-making in the context of healthcare management and patient safety
- A critical evaluation of how SBT can be used to encourage discussions about the leadership and patient safety culture in the NHS
- Freely available SBT material for anyone (researcher, healthcare manager, practitioner, etc.) who wishes to use it for academic and/or educational, non-commercial purposes

INTRODUCTION

The challenges that arise from the complexities confronting work place and institutions in the 21st century are so unpredictable that it is practically impossible for one person to accomplish the full range of leadership activities by working independently.[1] Thus, there is a view that singular leadership is a no longer adequate,[2] and that the successful management of teams will require shared leadership (SL) and group decision-making (GDM) across different forms expertise and levels of leadership seniority. SL is the collective ability to set direction and build commitment, where team members each have a unique role that is embedded in the context of the group.[3] SL modelling allows for team processes to be dynamic and interactive, and suggests that SL is manifested in joint information gathering and objectives reconciliation and decision-making, all of which are reflected in a series of task and team related behaviours and interactions. Lastly, SL can be executed vertically and horizontally, between team members with different professional backgrounds, as well as between members with varying degrees of seniority.[4]

SL and GDM are particularly important in today's healthcare service and delivery, which demand commitment from both clinical and non-clinical healthcare professions varying in

levels of experience and seniority, in order to develop, provide and maintain holistic and high-quality patient-centred care. Historically, however, shared endeavours between these two groups have been difficult to achieve because of differences in work ethic, training and education, dissimilar styles of solving problems, or contrasting values.[5] Such differences not only affect team satisfaction and the quality of working relationships, but have also the potential to compromise patient safety and efficient healthcare management.[6]

Future leaders and advocates in SL and GDM will be those who develop a learning ability that is continuously expanded through practice and experience.[7] Behavioural simulation-based training (SBT) offers an effective first-person "as-lived" experience that contributes to the development of such future leaders.[8] This method uses discourse, deliberation, and reflection, and enables exploring and examining perspectives, experiences interactions between healthcare professionals and in relation to SL and GDM skills.[9] This is directly opposed to third person learning where there is information transfer from established leaders without the chance to develop these key skills and to 'lead'.

While both SL and GDM are strongly linked with organisational performance and success,[10] developing these skills in healthcare management teams in practice is largely descriptive and anecdotal.[11-13] In the NHS, the 'Windmill' series[14] and the "Lateral Play"[15] were the first to explore SL and GDM in the context of healthcare reforms considering various stakeholders. As part of their simulation design, experts were consulted to identify the main drivers and tensions to be explored in the simulation event, and to provide feedback and performance debriefings to facilitate the learning experience. However, while participants perceived these exercises as beneficial to gain practical experience in cross-functional SL and GDM, the SBT was not examined in terms of teaching and learning.[16] Thus, a rigorously assessed SBT in the context of SL and GDM, and in relation to healthcare management is needed to understand how to model and develop these key skills.

Achieving a scientifically robust SBT requires evaluation of its realism, content, relevance to work and areas for improvement.[17] Areas of interest include the degree to which the simulation teaches what it is intended to; the extent to which the elements of the simulation are relevant and representative of the targeted training purpose; and, the ability for the e.g. a team facilitator to detect distinct areas for improvement for groups of varying experience and expertise.

Context

We designed, developed and validated a simulation scenario to develop SL and GDM for clinical and non-clinical students and healthcare professionals. Specifically, we exposed participants to two hypothetical serious incidents (SIs) as a mean to applying SL and GDM in the context of healthcare management and patient safety.[18] SIs are "… events where the potential for learning is so great, or the consequences […] are so significant that they warrant our particular attention to ensure these incidents are identified correctly, investigated thoroughly and, most importantly, trigger actions that will prevent them from happening again."[19] The quality of experience during the simulation scenario was assessed through subjective self-reports, while areas for improvements and general feedback was collected by means of a focus group (FG). Overall, our aim was to design and develop a realistic and meaningful training package for healthcare management teams, with our overarching research question being the extent to which we achieved this goal.

METHODS

Sample

The sample comprised 103 participants (28 groups of 3-5 participants; *age range* = 24-42; female=55) of (1) academic students from Imperial College London, UK, and London School of Economics and Political Science, UK (n=26); (2) managers working at Public Health England (n=38); and (3) NHS staff (n=39; cf. Table 1).

Table 1. Sample characteristics.

	Academia	Management	NHS staff
Expertise	Medicine Business Health Policy Clinical lecturer	Public Health Health Policy Business Health economy Quality Commission	Nurse Surgical registrar Senior Consultant Head of the Department

The data collection took place through the offices of a UK hospital and the two UK universities. Potential participants were informed about the schedule of events and the time commitment required.

Simulation scenario development

The material and procedure of the simulation scenario were developed based on (1) expert interviews with clinical and non-clinical managerial executives in the NHS healthcare; and (2) existing material from the Lateral Play, a previous simulation exercise developed by one of the co-authors.[15] **All material was developed by the authors and is available in the Supplementary File.**

Expert interviews were conducted with clinical and non-clinical managerial executives in the NHS healthcare in order to identify leadership challenges faced by service line management teams in an NHS institution. This led to the development of hypothetical SIs that were based on reports of the most frequently occurring events within the NHS.[19] The first incident concerned the wrong lens being implanted in a patient's eye; the second incident concerned a retained swab after an emergency operation.[19]

We used material that represented a simulated health system and economy comprising seven providers (acute, community and mental health), two Clinical Commissioning Groups, regulators and a medical school − all members of "the Greendale Partnership".[15] To increase

validity, data packs used for the simulation provided information on the key activities of each trust, including information on, for instance inpatient and out-patient per annum and number of staff.

Guided by scientific recommendations on simulation design, and in addition to the data pack provided by the Lateral Play, we prepared participants for learning about SL and GDM by providing the following items:[20]

(1) Background information on a fictional NHS Trust

The background information provided statistics of the fictional Trust, including patient case activities (e.g. inpatient and out-patient) per annum, number of staff, nurse to bed ratio, the percentage of bed occupancy, and the money spent during one year. Figures informed about the incident reporting rate and trend by divisions (e.g. surgery, pressure ulcer), and tables were used to display data on the number of weeks of delays the incidents were overdue for investigation.

(2) Two serious incident reports

The two SIs entailed the incident description, background and context, as well as human factors and system factors. For our simulation scenario, we used incidents that were reported amongst the most frequently occurring events within the NHS.[19] The first incident discussed surgeons putting the wrong lens in a patient's eye, while the second incident provided details on surgeons who forgot to remove a swab after an operation. As recommended by simulation guidelines, both incidents were developed based on real incident reports.[21]

(3) A news report

Media coverage of events has been shown to stimulate groups into actions and add gravity to the issues that the events represent.[22] The news report entailed a recent SI involving a patient who received a medication overdose, including opinions and perspectives of clinical and non-

clinical managers around patient safety and healthcare management. The aim of the media coverage was to stimulate groups into actions, to critically reflect on the issues that the incidents represent, and to acknowledge the importance of working collaboratively.[22]

(4) A Fishbone diagram

The Fishbone diagram (i.e. Ishikawa Diagram) has become part of the routine manner in which clinicians and healthcare systems deliver care.[23] It enables the analysis of patient-related processes by prompting an examination all possible causes of a quality problem, and by facilitating an understanding of the relationships among them. Well suited for SL and GDM work, participants were encouraged to use it to depict multiple clinical and non-clinical factors affecting patient safety and healthcare management.[24]

(5) A booklet on best practices in SL and GDM in the context of healthcare management

Developed by the authors, and based on relevant research, the booklet was provided to encourage SL- and GDM-related thoughts and behaviours, and to raise awareness of how these processes can be utilised efficiently in a team context.[25] We provided participants advice on how to identify knowledge, skills and attitudes displayed in SL; and to develop effective GDM skills such as how to identify necessary action steps and optimal sequences of actions.[26]

The simulation was trialled and evaluated twice using participants from a target population including a nurse, a senior management consultant, and a cardiovascular surgeon. Each trial was audio and video-recorded and supervised by an expert in leadership training in healthcare management. The results from these trials led to the introduction of a structured timeline and the opportunity for participants to read the background material prior to the simulation.

Simulation – Role

Roles were chosen to represent a cross-functional healthcare management team from different departments in the healthcare system that need to work collaboratively.[27] Each participant was

randomly assigned to one of the following roles: Lead Medical Director, Chief Nurse, Finance Director, Human Resource Manager, and Deputy Medical Director.

Simulation – Task

Participants were asked to read the materials on the fictional Trust, the two SIs, the news item, the Fishbone Diagram, and the booklet. Next, participants, were requested to (1) identify the major problems using the fishbone diagram method to analyse the individual and systemic causes of the incidents; and (2) develop a list of actions to improve healthcare management and patient safety.

Simulation – Procedure

The SBT exercise took place at the offices of the authors' organisations. The entire set of activities lasted approximately two hours. All activities were audio (Olympus WS-853) and video (GoPro4Black) recorded, and were observed by a member of the research team. Before the start of the exercise, participants were given 15 minutes to complete questionnaires on their demographic background and leadership experiences. The simulation exercise was then divided into the three parts: an *individual activity* to give participants time to independently think through actions and potential solutions; a *group activity* which focussed on sharing knowledge, coordinating information and effort, and reaching a group-level agreement regarding prevention of future SIs; [28] followed by a debrief.

During the 30-minute *individual* activity, participants studied the simulation portfolio and developed a list of recommendations to improve healthcare management and patient safety. During the 30-minute *group* activity, participants worked as a team to agree upon a final set of recommendations to be submitted to the researcher at the end of each activity. In both tasks, after 20 minutes, a "10-minute" call was given to ensure that the list was completed on time. The 30-minute *debrief* was designed in accordance with Salas' et al.[29] and Lyon's et al.[30] essential criteria for team feedback, and was carried out by a member of the research team. The

debrief provided feedback addressed SL skills and GDM processes, and participants were encouraged to discuss and reflect on specific events that happened during the simulation.

DATA COLLECTION

Questionnaires

The degree of realism and quality of content were assessed using items based on Kirkpatrick and Kirkpatrick's[31] evaluation questionnaire and rated on a 7-point Likert Scale (1="Not at all" to 7="Very much"). We examined participants' experience of realism during the role-play exercise and the nature of relationships that evolved during the simulation exercise. Second, we asked about attitudes towards the value of the simulation exercise as a method to train SL and GDM in healthcare management (further details are in the results section). We also asked participants to rate their perception (1="Poor" to 7="Excellent") of the role assigned, the quality of the training, and the relevance of the content to their work and needs.

Focus group

The FG was semi-structured and designed to further explore the quality of experience in terms of SL and GDM during the simulation, as well as potential areas for improvement. In particular, and in consideration of the evaluation framework used by Kirkpatrick and Kirkpatrick,[31] we enquired about the quality of the material used, whether participants were able to train and test SL behaviour and GDM, and whether the experience was similar to their workplace.[32] We also asked for information on areas of how to improve the simulation exercise.

DATA PROCESSING

Questionnaires

Data were tested to examine the distributions and the homogeneity of variance using a Shapiro–Wilk and Levene's test before statistical procedures were applied. Because the data were not normally distributed, subjective ratings were then benchmarked against the median of 4 using the One-Sample Wilcoxon signed-rank test, which allows to assess the degree to which

participants' quality ratings of the simulation are below/above the rating's mid-point.[33]

Focus group

The FG, transcribed by an external company for an agreed fee, were processed using NVivo10 (QSR International, Burlington, MA) and analysed using semantic/descriptive thematic analysis.[34] Thematic analysis is a well-established exploratory approach for rich yet complex non-numeric data. It allows for pattern recognition of the content by identifying codes and/or themes that enable for the data to be described and interpreted for meaning. Based on this approach, transcripts were simultaneously coded by two researchers to reach consensus on the coding scheme. Following the development of the coding scheme, the data were grouped and labelled into themes that reflected participants' experiences to further establish the validity of the scenario.[35] Quotes were provided to illustrate each theme, and labelled based on participants' academic (i.e. students), managerial (i.e. Public Health England), or healthcare (i.e. NHS staff) background.

RESULTS

Questionnaires

All items were rated significantly higher than the median of 4, suggesting that the simulation presents a comparable "real-world" experience that is beneficial to train teams in the areas of SL and GDM, and relevant as a training package for their work (cf. Table 2).

Table 2. Ratings for each statement were given from 1="strongly disagree" to 7="strongly agree."

Feature	*Median*
1. This simulation is a realistic representation of a group meeting environment.	5.33
2. The simulation scenario is realistic.	5.50
3. The material used during the simulation was realistic.	5.60
4. The simulation felt like being in a real group meeting.	5.60
5. I would behave in the same way in a real group meeting.	5.25
1. The team dynamic of the group members during the simulation was realistic.	4.8
2. The communication and interaction of the group members during the simulation was realistic.	5
3. The behaviour of the group members during the simulation was realistic.	5.33

4. The simulation offers a good opportunity for training shared leadership skills.	5.60
5. The simulation offers a good opportunity for training group decision-making skills.	5.50
1. The role-play felt realistic.	5
2. I was able to play the role that I was assigned.	4.75
3. I could understand the perspective of the board member whose role I was assigned to.	5.20
1. What is your overall rating of the simulation as a potential training method?	5.80
2. Please evaluate the relevance of the content of today's training to your work.	5.60

Focus group

We identified three overarching themes in the data. Quotes are provided for each theme and sub-themes, and labelled based on participants' background (referred to as "academic", "management" and "NHS staff" in tables 3-5).

The perception of the simulation

The simulation was perceived as a thought-provoking exercise in terms of material and content used; and, as a situation that allowed for reflection on patient safety; and learning about SL and GDM. The scenario was perceived as realistic and comprehensible, and it allowed participants to draw from real-life experiences and learn about healthcare management (cf. Table 3).

Table 3. Codes and sample quotations relating to the theme 'The perception of the simulation.'

Codes	Sample quotations
Thought-provoking exercise in terms of realism, content, relevance, and patient safety	*"I enjoyed this exercise, I thought it was good to just learn what is happening in a hospital and how we can address it and how we can put together a couple of points from my own experience."(Management)*
	"I felt that [the role] really forced you to take a different perspective […] to force you take on a different kind of mind-set, which I thought was really helpful."(NHS staff)
	"This [simulation] is about shared leadership and how do we get people to feel that they are part of a group. That is so important going forward. It is not about "we should audit them" [… it is about] coming and working together."(NHS staff)
Shared leadership and group decision making (shared purpose, social support, increased participation [i.e. voice])	*"We had a lot of encouragement to speak up…which was important in making people feel more comfortable in sharing their own opinions."(Academic)*

	"It was a good way to share different views […] even though we've got different roles, we kind of work on the same goal […] – it was good."(Management)
	"The environment that was created allowed that if someone had something that they hadn't felt had been discussed would have felt comfortable to say, 'Oh hang on, have we thought about that?'"(NHS staff)
	"I think there was some effort to try and understand, to get everyone to give their take on the issue."(Academic)

The scenario as a future training package

Participants acknowledged that the training package could be used as part of an extended workshop activity, with particular focus on SL and GDM, but also to allow discussions around the culture of leading and sharing responsibilities in the healthcare sector. The latter has been a particular challenge for clinical and non-clinical managerial staff, who benefit from efficient communication and collaboration strategies.[5] (cf. Table 4).

Table 4. Codes and example quotes relating to the theme 'The scenario as a future training package.'

Codes	**Sample quotations**
Using the simulation as part of a lager workshop activity to train shared leadership and group decision making	*"This kind of [simulation] highlighted how protocols were followed and it is just like that healthcare culture which is not really a solution because it is difficult to change. One way you could do that is by having these sorts of workshops and simulation exercises which allow you to kind of explore that a bit more."(NHS staff)*
	"And, I'd feel overall, taking the organic approach, I think this is a great first step, assuming that the simulation training isn't an isolated incident, so as a first step, it was a good step."(Management)
Using the simulation to address the culture of leadership in the NHS	*"Trainees don't feel like they can speak out and make contributions […] changing the culture is really important […] such as very early on in your training program trying to*

	instil that kind of culture that you can speak out."(NHS staff)
	"Realistically there might be [difficult] people and I think it is important that we overcome that and that we come to a [shared] solution [using the simulation]."(Academic)
	"We need to own up – and that's the thing, we don't own up to our mistakes. We love to blame. You see it in the media, and you see it around the world – this is blame culture!"(NHS staff)

Areas for improving the simulation experience

Areas for improving the simulation scenario included an actor as an action- provoking source to encourage effective SL and GDM, and more preparation time in terms of role and content. For instance, participants would have appreciated preparatory exercises, such as having to conduct a cost analysis or risk management plan, as well as provisions of videos and more media items to get an overview of the SIs and their impact on the reputation of the hospital. Lastly, participants suggested that the debrief to be supported by video feedback, allowing them to identify behaviours that contributed to, or hindered, the development and enactment of SL and GDM (cf. Table 5).

Table 5. Codes and example quotes relating to the theme 'Areas for improving the simulation experience.'

Codes	**Sample quotations**
Using an actor to increase the learning experience	*"I think it could be interesting to have one of your players being contentious […] to make it a challenge."(Academic)*
	"Having consultants/ actors come in and to specifically try to kind of disturb the culture a little bit is a good way to do that because you kind of learn when you are in the situation by dealing with."(NHS staff)
Preparation time and usage of videos to enhance content comprehension of serious	*"If I have the information beforehand and know what my role is […] if I have a bit of*

incidents	*homework before I come here as to […] do a bit of cost analysis […it] will make me feel like I am having to come invested […] I have to deliver."(Management)*
	"I think depending on who you are asking to read this I wonder if making a little video might not be easier."(NHS staff)
Video debrief	*"It would be interesting also to film an actual meeting and just to see what the interactions are there and see whether you learn anything from there that you can then implement in your simulation."(Academic)*

DISCUSSION

The aim of this study was to establish a simulation scenario that allowed participants to develop and enact SL and GDM for addressing patient safety issues and to set goals for organisational improvement. One hundred and three participants took part in the simulation.

Summary of key findings

Participants experienced the simulation scenario, the material and the role assignment as realistic and representative of real-world tasks and decision contexts, and the group activity as similar to a real meeting environment. They perceived the scenario as a good opportunity for training SL and GDM skills because it enabled them to identify and execute tasks, behaviours, and knowledge in a realistic manner, and encouraged them to think differently about patient safety. Participants suggested that the training package could be embedded within a broader workshop that focuses on leadership culture and sharing responsibilities in healthcare management. Lastly, areas for improvement were highlighted with regards to including an actor who drives and challenges SL and GDM, more preparatory time to allow for greater familiarization with the content, content delivered in form of videos, and a debrief that uses video feedback to improve SL and GDM.

Comparison with previous literature

Establishing a robust SBT is important because it confirms that the exercise enables training groups' ability to execute SL and GDM based on their behaviour.[36] Previous studies have shown that sharing information and sustaining a cooperative relationship between group members are essential enablers of team productivity. These behaviours are commonly referred to a being encouraged to participate (i.e. voice), show mutual support, and have a shared purpose.[10, 37] Thus, a supportive internal team environment not only facilitates greater job satisfaction, but also encourages staff from different disciplines to collectively broaden their knowledge and understanding, and to feel empowered within their healthcare community.[38] In contrast, conflict has the potential to threaten working relationships and productivity.[39] In particular interpersonal conflict is a contributor to higher rates of medical errors and staff burnout, and also leads to greater direct and indirect costs of care.[40] Experienced across healthcare professions, it affects doctors, nurses, co-workers, managers and administrative workers alike, and impacts on team performance and reduces staff satisfaction.[41]

Simulation and analysis of SL and GDM with a focus on patient safety incidents contribute to the safe and efficient functioning of a healthcare system, yet it is rarely incorporated into routine healthcare management training.[42] Our results make a case for the implementation of SBT for clinical and non-clinical managerial healthcare professionals. Healthcare managers benefit from familiarity with the contexts in which patient safety incidents take place because they influence real-life practice and quality of care. Similarly, healthcare professionals who are aware of how health care is delivered and managed are able to make changes in their individual practices to benefit patients.[6]

In summary, our simulation realistically represented a range of roles from different healthcare departments and units, and identified ways to develop SL and GDM such that teams could plan and enact complex processes to reach decisions about how to improve healthcare management and patient safety. Such skills are vital for the NHS leaders of tomorrow.[43] We encourage future

studies that use the simulated scenario and embed it within an experiential learning curriculum that takes place over several days.[44, 45] This will allow for a greater engagement and immersion in the role-play activity and more time for face-to-face and video feedback, as well as reflections on participants' team behaviour that are benchmarked against objective ratings of team efficiency and teamwork quality.

Limitations

Limitations and methodological considerations of our study should be noted:

First, the simulation scenario allowed exploring teamwork processes and behaviour relating to SL and GDM. An additional technique that would shed light on the nature of interactions between team members is the application of direct behavioural measures, assessed in form of observation measures used by a team facilitator to address specific behaviours and social team structures to understand the intensity and density of SL and GDM execution during the simulation exercise.[46]

Second, participants had the required background in healthcare and/or management to take part in this study. However, some healthcare professionals, notably nursing staff, were under-represented. We recommend that future studies implement the simulation exercise as part of student and staff members' educational training and professional development to secure a more homogenous distribution of skills across different professional groups within healthcare and the healthcare management sector.

Third, we have not assessed whether the simulation training resulted in improved healthcare management in response to continuous training. Changes in behaviour typically take habituation and there is little evidence of the long-term influence of SBTs on knowledge, skills and attitudes, or on actual clinical outcomes (e.g. number of adverse events) and economic benefits. Future studies are therefore encouraged to examine the long-term effects of singular

or multiple applications of SBT on SL and GDM skills for healthcare professionals and institutions.

Lastly, we have applied a semantic thematic analysis approach to extract meaningful patterns within the qualitative data from the focus groups. Future studies are explicitly encouraged to apply a purely qualitative data collection method, and embed the data within an analytic narrative that includes an in-depth discussion of the findings within the context of simulation training, SL and healthcare service and delivery.

CONCLUSION

Some health care organisations today still lack effective collaboration across professional boundaries due of differences in expertise, prominence, respect and influence, all of which increase the risk of compromised patient safety.[43] Simulation training on SL and GDM facilitates and encourages communication across clinical disciplines, and advances healthcare management through a culture of informed reporting and learning.[47] For instance, at an individual-level and team-level micro-level, SL and GDM training opportunities may be used to clarify roles and responsibilities during a patient's pathway of care (e.g. surgical treatments); at a regional level, SL and GDM simulations may be of benefit to improve policy making and resource allocations within and between different services of health; and at a national level, exercises on SL and GDM may be used to improve communication and joint decision processes not only to tackle treatment and care but also to establish consistent regulations and quality assurance processes. Today's healthcare organisations are more than ever in need of possessing and leveraging SL skills and GDM. Data from the current study show that our simulation contributes to exploring both skillsets by involving multiple individuals engaging in multiple behavioural interactions to solve complex problems relating to patient safety.

DECLARATIONS

Ethics approval and consent to participate

The research was granted ethical approval by the Imperial College Joint Research Compliance Office (16IC3469), UK, and was conducted according to ethical guidelines of the British Psychology Society. Written informed consent was obtained from all participants, and no payment was given in exchange for participation.

Consent to publish

Not applicable

Availability of data and materials

The data that support the findings of this study are not publicly available. Because of the nature of the informed, written consent and ethical restrictions, data distribution is not permitted. However, the SBT material is freely available for anyone (researcher, healthcare manager, practitioner, etc.) who wishes to use it for academic, non-commercial purposes. The content, including each figure and table in the SBT Supplementary file, was created by the authors and are not based on real-life data. Pictures in the Supplementary file were accessed from websites that are free from copyright restrictions, such as https://www.pexels.com and https://stocksnap.io.

Competing interests

We declare no conflict(s) of interest associated with this research.

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Authors' Contributions

LA, ES, AD and CB conceptualised this research. LA collected and analysed the data. The manuscript was written by LA with contributions from all authors. All authors have read and approved the manuscript.

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REFERENCES

1. Ireland RD, Hitt MA. Achieving and maintaining strategic competitiveness in the 21st century: The role of strategic leadership. *Academy of Management Executive* 2005; 19(4):63-77.
2. Günzel-Jensen F, Jain AK, Kjeldsen AM. Distributed leadership in health care: The role of formal leadership styles and organizational efficacy. *Leadership* 2016; 14(1):110-133.
3. Conger JA, Pearce CL. A landscape of opportunities. Future research on shared leadership. In: Pearce CL, Conger JA, eds. Shared leadership: Reframing the hows and whys of leadership. Thousand Oaks, California: SAGE Publications; 2003:pp. 285-303.
4. D'Innocenzo L, Mathieu JE, Kukenberger MR. A meta-analysis of different forms of shared leadership-team performance relations. *Journal of Management* 2014; 20(10):1-28.
5. Kelly N. Working better together: joint leadership development for doctors and managers. *BMJ Quality Improvement Reports* 2014; 3(1):u204792.w2027.
6. Baker DP, Salas E, Barach P, et al. The relation between teamwork and patient safety. In: Carayon P, ed. Handbook of human factors and ergonomics in health care and patient safety. Mahwah, NJ: Erlbaum; 2007:pp. 259-271.
7. Souba WW. The leadership dilemma. *J Surg Res* 2007; 138(1):1-9.
8. Benishek LE, Lazzara EH, Gaught WL, et al. The template of events for applied and critical healthcare simulation (TEACH Sim). A tool for systematic simualtion scenario design. *Simulation in Healthcare* 2015; 10(1):21-30.
9. Salas E, Wildman J, Piccolo RF. Using simulation-based training to enhance management education. *Academy of Management Learning & Education* 2009; 8(4):559-573.

10. Carson JB, Telsuk PE, Marrone JA. Shared leadership in teams: An investigation of antecedent conditions and performance. *Academy of Management Journal* 2007; 50(5):1217-1234.
11. Souba W. The leadership dilemma. *Journal of Surgical Research* 2007; 138:1-9.
12. Geraghty A, Adamson J, Dhasmana D, et al. O64 Improving teamworking; leadership in mulitidsiciplinary AD-HOC teams. *BMJ Simulation and Technology Enhanced Learning* 2017; 3(Suppl 2):A40.
13. Jabur Z, Lavelle M, Attoe C. Improving decision-making and cognitive bias using innovative approaches to simulated scenario and debrief design. *BMJ Simulation and Technology Enhanced Learning* 2020; 6(1):49.
14. McShane M, Smith R. The NHS in the simulator. *BMJ* 2009; 399:b4868.
15. Darzi A, Parston G. How AHSNs strengthen collaborative working in the NHS. 2013.
16. Moss PA, Brian J. Girard BJ, Haniford LC. Validity in educational assessment. *Review of Research in Education* 2006; 30:109-162.
17. Stefanidis D, Arora S, Parrack DM, et al. Research priorities in surgical simulation for the 21st century. *Am J Surg* 2012; 203(1):49-53.
18. Buchanan DA, Moore C. Never say never again: post-incident change and the investigation trap. *Journal of Change Management* 2015; 16(3):159-183.
19. England N. Serious Incident Framework. Supporting learning to prevent recurrence 2015.
20. Rosen MA, Salas E, Wilson KA, et al. Measuring team performance in simulation-based training: adopting best practices for healthcare. *Simul Healthc* 2008; 3(1):33-41.
21. Munroe B, Buckley T, Curtis K, et al. Designing and implementing full immersion simulation as a research tool. *Australas Emerg Nurs J* 2016; 19(2):90-105.
22. Kepplinger HM, Habermeier J. The Impact of Key Events on the Presentation of Reality. *European Journal of Communication* 2016; 10(3):371-390.
23. Ille G, Ciocoiu CN. Application of fishbone diagram to determine the risk of an event with multiple causes. *Management Reserach and Practice* 2010; 2(1):1-20.
24. Drehobl P, Stover BH, Koo D. On the road to a stronger public health workforce: visual tools to address complex challenges. *Am J Prev Med* 2014; 47(5 Suppl 3):S280-5.
25. Shields C, Newton E. Empowered leadership: Realizing the good news. *Journal of School Leadership* 1994; 4(2):171-196.
26. Siebens H. Facilitating leadership. In: Thomson MJ, Eynikel J, eds. Leading with wisdom. Belgium: Garant Uitgevers N V; 2007:pp. 77-95.
27. Hall P, Weaver L. Interdisciplinary education and teamwork: A long and winding road. *Medical Education* 2001; 35(9):867-875.
28. Wilson JM, Goodman PS, Cronin MA. Group learning. *The Academy of Management Journal* 2007; 32(4):1041-1059.
29. Salas E, DiazGranados D, Weaver SJ, et al. Does team training work? Principles for health care. *Acad Emerg Med* 2008; 15(11):1002-9.

30. Lyons R, Lazzara EH, Benishek LE, et al. Enhancing the effectiveness of team debriefs in medical simulations: More best practices. *The Joint Commission Journal on Quality and Patient Safety* 2015; 41(3):115-125.
31. Kirkpatrick DL, Kirkpatrick JD. Evaluating training programs: The four levels. San Francisco, CA: Berrett-Koehler, 2006.
32. Rabiee F. Focus-group interview and data analysis. *Proceedings of the Nutrition Society* 2004; 63:655-660.
33. Munro BH. Statistical methods for health care research. Philadelphia, US: Lippincott-Raven Publishers, 2001.
34. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology* 2006; 3(2):77-101.
35. Krüger RA, Casey MA. Focus groups. Thousand Oaks, CA: Sage Publications, 2000.
36. McDougall EM, Corica FA, Boker JR, et al. Construct validity testing of a laparoscopic surgical simulator. *J Am Coll Surg* 2006; 202(5):779-87.
37. Aufegger L. Can shared leadership enhance clinical team management? A systematic review. *Leadership in Health Services* 2019; 32(2):309-335.
38. Proenca EJ. Team dynamics and team empowerment in health care organizations. *Health Care Manage Rev* 2007; 32(4):370-378.
39. Hmieleski KM, Cole MS, Baron RA. Shared Authentic Leadership and New Venture Performance. *Journal of Management* 2011; 38(5):1476-1499.
40. Baldwin DC, Jr., Daugherty SR. Interprofessional conflict and medical errors: results of a national multi-specialty survey of hospital residents in the US. *J Interprof Care* 2008; 22(6):573-86.
41. De Dreu CKW, Weingart LR. Task versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology* 2003; 88(4):741-749.
42. Festa M, Sigalet E, Eppich WJ, et al. Simulation education program development. In: Grant VJ, Cheng A, eds. Comprehensive Healthcare Simulation: Pediatrics. Comprehensive Healthcare Simulation. UK: Springer, Cham; 2016:pp. 355-371.
43. Aufegger L, Alabi M, Darzi A, et al. Sharing leadership: Current attitudes, barriers and needs of clinical and non-clinical managers in UK's integrated care system. *BMJ Leader* 2020:leader-2020-000228.
44. Love RL, Zac-Varghese S. Novel simulation-based human factors workshops for nearly qualified doctors. *BMJ Simulation and Technology Enhanced Learning* 2019:bmjstel-2019-000518.
45. Blackmore A, Madaiah S, Purva M. 11 Using in-situ simulation as a tool to improve learning from serious incidents. *BMJ Simulation and Technology Enhanced Learning* 2016; 2(Suppl 1):A25.
46. Hoppe B, Reinelt C. Social network analysis and the evaluation of leadership networks. *The Leadership Quarterly* 2010; 21(4):600-619.
47. Reason J. Managing the risks of organizational accidents. United Kingdom: Ashgate Publishing Limited, 1997.