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Developing a simulation-based learning model for acute medical education during COVID-19 pandemic with Simulation via Instant Messaging – Birmingham Advance (SIMBA)

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ABSTRACT

Simulation-based learning (SBL) is well-established in medical education and has gained popularity, particularly during the COVID-19 pandemic when in-person teaching is infeasible. SBL replicates real-life scenarios and provides a fully immersive yet safe learning environment to develop clinical competency. Simulation via Instant Messaging – Birmingham Advance (SIMBA) is an exemplar of SBL, which we previously showed to be effective in endocrinology and diabetes. Previous studies reported the efficacy of SBL in acute medicine. We studied SIMBA as a learning intervention for healthcare professionals interested in acute medicine and defined our aims using the Kirkpatrick model: (i) develop an SBL tool to improve case management; (ii) evaluate experiences and confidence before and after; and (iii) compare efficacy across training levels.

Three sessions were conducted, each representing a PDSA cycle (Plan-Do-Study-Act), consisting of four cases and advertised to healthcare professionals at our hospital and social media. Moderators facilitated progression through 25 min simulations and adopted patient and clinical roles as appropriate. Consultants chaired discussion sessions using relevant guidelines. Presimulation and postsimulation questionnaires evaluated self-reported confidence, feedback and intended changes to clinical practice.

Improvements were observed in self-reported confidence managing simulated cases across all sessions. Of participants, 93.3% found SIMBA applicable to clinical practice, while 89.3% and 88.0% felt SIMBA aided personal and professional development, respectively. Interestingly, 68.0% preferred SIMBA to traditional teaching methods. Following participant feedback, more challenging cases were included, and we extended the time for simulation and discussion. The transcripts were amended to facilitate more participant-moderator interaction representing clinical practice. In addition, we refined participant recruitment over the three sessions. In cycle 1, we advertised incentives: participation counted

towards teaching requirements, certificates and feedback. To rectify the reduction in participants in cycle 2, we implemented new advertisement methods in cycle 3, including on-site posters, reminder emails and recruitment of the defence deanery cohort.

BACKGROUND

Simulation-based learning (SBL) has been used increasingly within medical education, and its benefits are well-documented in the literature. SBL offers a realistic, immersive and experiential learning environment to develop health professional's knowledge, skills, attitudes and competence while learning in a realistic and safe environment, protecting patients from unnecessary risk.^{1–4} SBL has gained particular prominence and importance during the COVID-19 pandemic when traditional face-to-face teaching activities have been severely limited due to restrictions, such as social distancing requirements. This popularity is likely to continue and increase beyond the COVID-19 pandemic as we observe a paradigm shift in health professions education fuelled by the pandemic.

Simulation via Instant Messaging – Birmingham Advance (SIMBA) is an example of an SBL tool (<https://youtu.be/3bBoa0QmdAg>). SIMBA was initially conceptualised in July 2019 as a minimal-cost simulation-based programme delivered through WhatsApp, which has proved highly effective in improving learners' self-reported confidence in managing endocrinology and diabetes cases.⁵ It has since branched into other specialties, including gastroenterology, hepatology and paediatrics, with plans

to expand further.⁶ With the onset of the COVID-19 pandemic and the unprecedented disruptions to health professions education, we expanded SIMBA on an international scale as our response to the disruption to medical education and training in acute medicine. We aim to further develop SIMBA beyond the pandemic to complement existing traditional teaching methods in specialist training programmes.

Acute medicine is a fast-paced, versatile specialty which can be challenging but also reports high levels of job satisfaction.⁷ It presents as the gateway to General Internal Medicine, providing immediate and early specialist management of adult patients who present to or from within hospitals as urgencies or emergencies. Although most hospitals have developed their acute medical service in response to local clinical need, common characteristics are identifiable in the specialty across hospitals. As a junior doctor, acute medicine jobs can be highly demanding, requiring a broad skillset in a high-pressure environment. Therefore, the ability to work and make robust decisions efficiently is crucial. Literature reports that SBL tools are effective for teaching and learning in acute medicine to test and improve trainees' knowledge and skills.^{8,9} A survey reported that positive attitudes towards interactive learning tools outnumbered negative views.¹⁰

Problem

The University Hospitals Birmingham acute medical unit (AMU) consists of medical trainees at various levels of training, all considered of equal rank during daily clinical practice. However, it is unknown if they are equally capable of handling similar clinical presentations and scenarios. Previously, acute medical teaching at this institution was mostly confined to the lecture theatre with few interactive learning opportunities. The COVID-19 pandemic has further exacerbated these issues as teaching and training activities have been disrupted and service provision prioritised to combat the peaks in COVID-19 infection. This has resulted in a significant disruption to the continuous educational development of trainee doctors.

Aims

We conducted a study of SIMBA as an innovative SBL tool, with the following objectives based on Kirkpatrick's model for training evaluation¹¹:

- ▶ To develop a minimal-cost virtual simulation tool which uses real-life clinical case scenarios to improve the confidence of trainee doctors when managing common acute medical presentations.
- ▶ To evaluate the experiences of trainees and changes in self-reported confidence levels following the SIMBA acute medical sessions.
- ▶ To study the impact of SBL across different grades/levels of training of trainee doctors.

We hypothesise that trainee doctors report increased confidence managing common acute medical presentations after participating in a SIMBA session and that this will be true across different levels of training. In

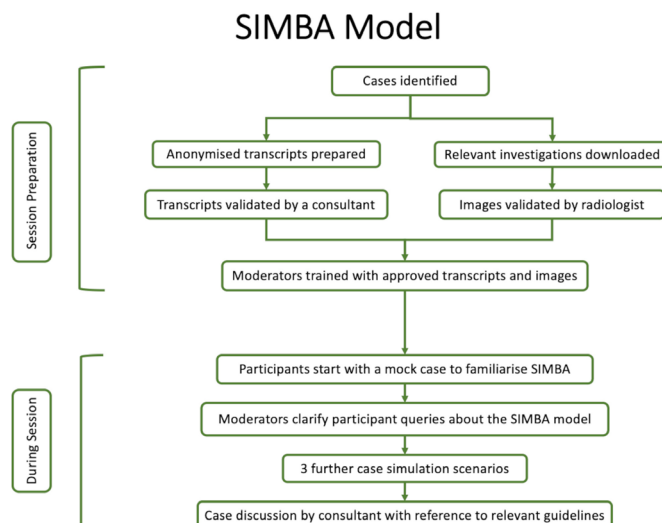


Figure 1 Flowchart illustrating the key stages of the SIMBA simulation model. SIMBA, Simulation via Instant Messaging – Birmingham Advance.

addition, we hypothesise that participating in SIMBA will encourage positive changes to real clinical practice and is a preferable learning approach for trainee doctors over traditional teaching methods.

METHODS

Context

This quality improvement project was conducted between August and November 2020, as an extension of SIMBA, to the acute medical specialty and part of a continuous educational development programme for all clinician trainee doctors in AMU at the Queen Elizabeth Hospital Birmingham (QEHB), Birmingham, United Kingdom (CARMS registration number: CARMS-16233).

Three simulation sessions were carried out during the study period, corresponding to the beginning (week 2), middle (week 8) and end of the acute medicine rotation for junior doctors (week 15). Each session consisted of four clinical case scenarios on acute medical presentations spanning the entirety of the patient journey through secondary care. As part of the SIMBA model (figure 1), real-life cases were selected and approved by acute medicine specialists who chaired the corresponding SIMBA sessions. Anonymised transcripts were created for each case and consisted of presenting symptoms, medical history, examination findings, clinical observations, investigation results (including blood tests and imaging), differential diagnoses, management and follow-up plans (see online supplemental file 1).

Intervention

We adopted the PDSA (Plan-Do-Study-Act) model to address our first objective of creating a minimal-cost simulation programme based on real-life scenarios, to improve trainee confidence in managing common scenarios in acute medicine. The PDSA model is described as follows.

- ▶ Plan: plan the test, intervention or observation, including a plan for collecting data.
- ▶ Do: trial the intervention on a small scale.
- ▶ Study: analyse the data and study the results.
- ▶ Act: refine the change based on what was learnt from the test.

In total, three PDSA cycles were used to achieve our aims. Each PDSA cycle correlated with SIMBA Acute Medicine 1.0, 2.0 and 3.0 sessions, respectively.

Session preparation

Anonymised data for the cases were extracted using the hospital's dedicated patient information systems, Prescription Information and Care Systems, clinical portal and Carestream. This information was then converted into standardised transcripts for use in the SIMBA sessions.

Each session was organised by a team of medical students consisting of a lead and four core members, each assigned to specific tasks necessary for the sessions:

Core member 1: transcript preparation.

Core member 2: moderator training.

Core member 3: creating agenda, advertisement materials, session registration Google Forms, investigations Google Forms for use during simulation, endorsement requests.

Core member 4: mark scheme for rating scale, participant and moderator certificates, presimulation and post-simulation and moderators' surveys via Google Forms.

The core team worked with consultants in acute medicine who were invited as chairs for the sessions and were further assisted by the SIMBA steering committee with the logistics of running the simulation sessions.

A team of moderators, consisting of medical students and junior doctors based internationally, were trained to facilitate participants' progression through the transcripts. Prior to the sessions, moderators familiarised themselves with the transcripts and participated in at least two mock simulation sessions to ensure their proficiency and reduce inter-individual variation. These peer-led sessions, where moderators took turns to act as participants, demonstrates this model's sustainability and low-resource nature. Moderators were also encouraged to attend a teaching session with the acting chair(s), who provided a more in-depth understanding of the cases and their appropriate management. Moderators were also able to clarify any uncertainties regarding the cases.

All three sessions were advertised at QEHB and as stand-alone sessions on social media for interested healthcare professionals internationally (regardless of their level of medical training). A couple of days prior, all registrants received instructions on how to join the session, including a unique anonymous SIMBA ID number and the WhatsApp number of their assigned moderator to interact throughout the session.

During session

Moderators were split into small groups led by one core moderator. All core moderators had previous moderating

experience and guided new moderators to reduce heterogeneity in their responses. Each moderator was assigned a maximum of three participants and were linked via the WhatsApp Web application on their personal computer/laptop. Each session lasted approximately 5 hours, with 25 min dedicated to each case and a 20 min comfort break in between. Each session started with a 15 min opening welcome via Zoom, where the session leads explained the session's timings and logistics to participants. Following this, participants completed the presimulation questionnaire exploring their confidence in managing various acute medical presentations.

The moderators instructed the participants throughout the session and replied to their questions with the relevant information provided in the transcripts. The first case was run as a mock to help participants familiarise themselves with the SIMBA model and address any technical difficulties with their moderator. Moderators offered prompts to participants, if needed, and the mock case was not included in the final performance score received by participants. This was followed by three more cases. Each case was initiated by a set of instructions, sent by each moderator to their participants, informing them of the 20 min timeframe to approach the case as they would in real life. Instructions included the expectation for the participant to elicit the patient history, examination, request relevant investigations, state a clinical diagnosis and propose the appropriate management/follow-up plan. Once participants stated they were 'ready', the simulation began. Moderators provided timely and suitable responses from the transcript to participants via WhatsApp, adopting the roles of patient, senior clinician and multi-disciplinary team as appropriate. If participants requested information not included in the transcript or not relevant to the scenario, such as inappropriate investigations, moderators would provide a generic response that the information was unavailable. Participants requested laboratory tests and imaging investigations via Google Forms, using their SIMBA ID number, to simulate hospital investigation request forms. Once moderators confirmed the submission of these forms, they provided participants with the anonymised results (obtained in the initial data collection and formatted for the session). Following simulation of all cases, an acute medicine consultant chaired a 1 hour interactive discussion of the cases via Zoom video-conferencing webinar. During this debriefing session, the consultant focused on the appropriate approach to the cases with reference to evidence-based guidelines and updated scientific information. The participants also had the opportunity to clarify any areas of the cases where they lacked understanding. Within 2 days following each session, participants received personalised feedback scores using the SIMBA rating scale adapted from the Global Rating Scale which assesses performance across several domains using a Likert-type scale.¹² The rating scale comprised seven components: history, examination, investigations, diagnostic tests, imaging, clinical judgement and management/follow-up plans. The moderator

scored the participants' performance on a 5-point rating scale from unsatisfactory (1) to excellent (5), which was averaged to yield a final score for each category.

PDSA cycle 1

The first PDSA cycle corresponded to SIMBA Acute Medicine 1.0 session. We obtained the hospital email addresses for all new incoming junior doctors to QEHB AMU in August 2020 from the AMU Consultant lead and sent email invitations to join the first SIMBA Acute Medicine session. AMU consultants were also informed and asked to distribute the invitation among junior colleagues. We also advertised the session in the fortnightly junior doctor bulletin. This email included the session details, including a brief description of the SIMBA model, benefits of participating, registration link and session agenda. The listed benefits were attendance included in foundation year doctors' non-core teaching hour requirements, certificate of attendance, and feedback for ePortfolio as proof of commitment to medical education. Registration was opened 16 days before the session and the registration period extended 11 days. In total, 37 participants completed the presimulation and postsimulation questionnaires: 1 consultant, 5 Foundation Year 1 (FY1) doctors, 10 senior house officers (SHOs) and 21 registrars.

PDSA cycle 2

Following feedback from the participants and moderators, we extended the time allocated to each case simulation from 20 min to 25 min per case for SIMBA Acute Medicine 2.0. The length of the discussion of cases was also increased from 50 min to 60 min (10 min chair presentation+5 min Q&A) based on participant and chair feedback. Transcripts were edited to divide larger text into multiple sections to better represent clinical practice and facilitate interaction. Participants were provided with images of laboratory and imaging investigations on request and asked to interpret these, as opposed to only providing laboratory and imaging reports as in SIMBA Acute Medicine 1.0. To increase participation from our hospital junior doctors, we adopted two new strategies. We emailed all trainee doctors on the QEHB acute medical ward, encouraging them to sign up and offered preferential sign-up 1 week prior to opening registration internationally. Noticing most participants in SIMBA Acute Medicine 1.0 were more junior in their training, we aimed to widen our scope to other colleagues for SIMBA Acute Medicine 2.0. Invitations were also emailed to doctors who attended the first session, encouraging them to participate again. We continued our advertisement strategies from the first session, including advertising the session in the junior doctor bulletin and emailing the AMU consultants to disseminate to all AMU consultants and acute medical trainees. However, due to logistics, we reduced the registration period to 11 days, opening this 12 days before the session date. In addition, we used WhatsApp to spread the word among trainee doctors

working at QEHB, including the AMU Junior Doctor WhatsApp group and the Military Foundation Doctor group. The registration form was also adapted to include an additional 'YES/NO' question asking if the participant worked at QEHB to more easily identify QEHB participants for analysis. Two further reminder email and WhatsApp message reminders to register were sent to the aforementioned target groups 2 weeks and 1 week before the session. Unfortunately, despite trialling new techniques to increase the participant number, only 15 participants completed the presimulation and postsimulation questionnaires for SIMBA Acute Medicine 2.0: one medical student, two FY1 doctors, three SHOs and nine registrars.

PDSA cycle 3

For SIMBA Acute Medicine 3.0, transcripts were further edited based on feedback to provide the laboratory and imaging reports following attempt by the participants to interpret these. Large text was again divided into multiple sections and these were further shortened to only include the most relevant information to better address time constraints of the session. We included more challenging presentations of dermatology, infectious disease and toxicology, inviting specialist input for these cases and a dermatologist to co-chair the case discussion. We continued with all the advertisement strategies described in cycles 1 and 2 to encourage junior doctors' participation from QEHB. We chose simulated topics which acute medicine colleagues reported to be more difficult to manage compared with the common presentations in SIMBA Acute Medicine 1.0 and 2.0 and altered our advertisements to detail these topics. We reverted to commencing registration earlier as for Acute Medicine 1.0, opening it 15 days before the session and extending to 12 days. Collaborating with several physicians and colleagues in other units, including the defence deanery, via the postgraduate defence dean, aided the dissemination of the session details, further increasing our participant uptake. We also advertised using printed posters in the AMU staff and locker rooms. Introducing these new techniques increased participation for SIMBA Acute Medicine 3.0, with 23 participants completing the presimulation and postsimulation questionnaires: seven FY1 doctors, one ACP trainee, nine SHOs, one clinical teaching fellow (CTF) and five registrars.

Measurement

Presimulation and postsimulation questionnaires were created to gather quantitative and qualitative data before and after each SIMBA Acute Medicine session. The questionnaires were based on Kirkpatrick's training evaluation model consisting of reaction, learning, behaviour and results. See online supplemental file 2 for example presimulation and post-simulation questionnaires.

Learning was evaluated quantitatively by analysing participants' self-reported confidence in approaching various simulated acute medical presentations measured

using a 7-point Likert scale, ranging from 'strongly agree' to 'strongly disagree'. This focused on the management of 20 common presentations as described by the Joint Royal Colleges of Physicians Training Board's General Internal Medicine curriculum: palpitations, shortness of breath, nausea and vomiting, dizziness, collapse, confusion, chest pain, headache, fever, seizure, falls, abdominal pain, cough, limb swelling, hyperglycaemia, poisoning, haematemesis and melaena, diarrhoea, back pain and lethargy. A fair representation of these presentations was included across the three sessions.

Reaction and behavioural changes were assessed qualitatively using open-ended questions and participant feedback on the simulation experience in the post-simulation questionnaire.

Analysis

Participants who completed both the presimulation and postsimulation questionnaires were included in the analysis. Participants' self-reported confidence levels presimulation and postsimulation were categorised into three outcomes: (i) confident, those who responded 'strongly agree' or 'agree'; (ii) unsure, those who responded 'agree somewhat', 'undecided' and 'disagree somewhat' and (iii) not confident, those who responded 'strongly disagree' and 'disagree'. Frequencies were reported as percentages. The outcomes confident, unsure and undecided were assigned ranks 2, 1 and 0, respectively. Wilcoxon signed-rank test (Stata/SE V.16.0) was used to investigate differences between presimulation and postsimulation confidence levels, with 95% confidence level ($p < 0.05$) considered significant. Higher and more positive ranks was interpreted as an improvement in confidence level managing acute medical presentations. See online supplemental file 3 for an example analysis of one presentation.

Individual and combined analysis of the three SIMBA Acute Medicine sessions was performed and analysis of two subgroups according to grades of training: junior clinicians (SHOs and below) and senior clinicians (registrars and above). The junior clinicians' group included medical students, FY1s, FY1 interim doctors, FY2s, SHOs, internal medicine trainees, ACPs, CTFs and out of programme doctors. The registrar and above group included those in specialty training at any level, general practitioner trainees and consultants.

In addition to managing the cases, participants were also asked for their overall feedback and key learning points of the session (see online supplemental file 2). Responses to open-ended questions were analysed using inductive thematic analysis by generating initial codes and identifying recurring themes.

RESULTS

A total of 75 participants completed both the presimulation and postsimulation questionnaires across all three sessions. Participants comprised mostly of registrars

($n=35/75$, 46.7%), SHOs ($n=22/75$, 29.3%) and FY1 doctors ($n=14/75$, 18.7%). 86.7% of the participants were based in the UK ($n=65/75$), with the remainder from other countries in Asia and Europe.

Improvements in self-reported confidence levels were observed following each SIMBA Acute Medicine session and overall when simulated cases were combined (table 1A). Improved confidence levels were also observed in all individual cases, although only a minority of these improvements were statistically significant.

When categorised by grade, there were significant improvements in the confidence levels of the junior clinician group (SHO and below) following each session when the simulated cases were combined and across all three sessions combined (table 1B). Similar improvements in confidence in the senior clinician group (registrar and above); however, this was only significant following SIMBA Acute Medicine 1.0. Overall, there was a significant improvement in self-reported confidence levels was observed across all sessions and grades of training.

Almost all participants, 93.3% ($n=70/75$), found the simulated topics applicable to their clinical practice. Most, 89.3% ($n=67/75$) and 88.0% ($n=66/75$), found the content impactful on personal and professional levels, respectively. 80.0% ($n=60/75$) strongly agreed/agreed that the sessions accommodated their personal learning styles, with 68.0% ($n=51/75$) reporting that they prefer SIMBA as an alternative learning approach to lecture-based learning. The latter supports our hypothesis that trainees view SIMBA as a preferable learning method over traditional pedagogy. Participants also reported improvements in clinical core competencies following the sessions: patient management ($n=61/75$, 81.3%), practice-based learning ($n=44/75$, 58.7%), system-based practice ($n=40/75$, 53.3%) and patient care ($n=36/75$, 48.0%).

After the SIMBA sessions, many participants expressed intent to make changes to their clinical practice which they believe will positively impact patient care including recognising when to involve senior input and specific clinical knowledge related to the simulated cases (table 2). This supports our hypothesis that participating in SIMBA encourages positive changes to real clinical practice. Participants reported benefit from case simulations of less common presentations and inviting a specialist expert, for example, dermatologist, to discuss this was well received.

LESSONS

The evolution of the SIMBA Acute Medicine sessions was a valuable learning experience for the entire team of medical students and junior doctors involved in both its organisation and evolution. Both SBL and the SIMBA model have yet to become well-established in teaching and training, which presented a major challenge. This was heightened by the challenging circumstances of the COVID-19 pandemic, which saw a surge in demands placed on hospitals, particularly major

Table 1 Changes in participants' confidence levels postsimulation in their approach to simulated cases comparing SIMBA Acute Medicine 1.0, 2.0 and 3.0 (A) and as subgroups defined by the level of training (SHO and below, and registrar and above) (B), shown with p values

(A)						
Session	Simulated acute medical presentation (case number)	Confident (%)	Unsure (%)	Not confident (%)	Significance	
SIMBA AM 1.0 (n=37)	Palpitations (case 1)	18.90	−18.90	0.00	0.0156*	
	Shortness of breath (case 2 and 3)	18.90	−18.90	0.00	0.0156*	
	Nausea and vomiting (case 4)	16.20	−16.20	0.00	0.0312*	
	Combined	+18.00	−18.00	0.00	0.0000*	
SIMBA AM 2.0 (n=15)	Abdominal pain (case 1)	6.70	−6.70	0.00	1.0000	
	Confusion (case 2)	13.30	−13.30	0.00	0.5000	
	Fever (case 3)	6.70	−6.70	0.00	1.0000	
	Diarrhoea (case 3)	33.30	−33.30	0.00	0.0625	
	Lethargy (case 4)	6.70	−6.70	0.00	1.0000	
	Nausea and vomiting (case 4)	20.00	−20.00	0.00	0.2500	
	Combined	14.40	−14.40	0.00	0.0044*	
SIMBA AM 3.0 (n=23)	Collapse (case 1, 2 and 3)	47.80	−47.80	0.00	0.0010*	
	Fever (case 2 and 4)	30.40	−30.40	0.00	0.0156*	
	Combined	39.10	−39.10	0.00	0.0000*	
Overall (n=75)		20.60	−20.60	0.00	p<0.0000*	
(B)						
Group	Session	Simulated cases	Confident (%)	Unsure (%)	Not confident (%)	Significance
SHO and below	SIMBA AM 1.0 (n=15)	Combined	31.10	−31.10	0.00	0.0001*
	SIMBA AM 2.0 (n=6)	Combined	30.60	−30.60	0.00	0.0074*
	SIMBA AM 3.0 (n=18)	Combined	41.70	−41.70	0.00	0.0001*
	Overall (n=39)		34.20	−34.20	0.00	0.0000*
Registrar and above	SIMBA AM 1.0 (n=22)	Combined	9.09	−9.09	0.00	0.0313*
	SIMBA AM 2.0 (n=9)	Combined	3.70	−3.70	0.00	0.6250
	SIMBA AM 3.0 (n=5)	Combined	30.00	−30.00	0.00	0.2500
	Overall (n=36)		8.50	−8.50	0.00	0.0034*

*p<0.05.

AM, acute medicine; SHO, senior house officer.

hospitals such as the QEHB. This saw redeployment of staff and prioritisation to maintain high-quality care to curb the threat of hospitals reaching full capacity.

Almost all participants found 25 min to be sufficient time for each case simulation. Increasing the time for debrief and discussion to 60 min enabled more interactive discussion of the cases. Shorter prompts from moderators and providing real investigation reports better represented real clinical practice which we will incorporate into all transcripts for future sessions.

To encourage participation in these valuable simulation training sessions, we refined our recruitment methods in a targeted approach over the course of the quality improvement project. For SIMBA Acute Medicine 1.0, we managed to recruit the most participants. The session garnered great interest, perhaps in part as the SIMBA model is novel, and the session took place

during a time with low COVID-19 cases, therefore less strain on doctors at QEHB. Unfortunately, the number of participants decreased significantly in SIMBA Acute Medicine 2.0. This may have been due to clinicians having increased clinical commitments with the continuously evolving COVID-19 crisis. To rectify this for SIMBA Acute Medicine 3.0, we implemented new advertisement methods, including more frequent registration reminders and session posters displayed in key staff areas on-site at QEHB such as the AMU Doctors Office and the Doctors Mess. This increased session participant numbers. For future sessions, we would move the registration period earlier and extend this.

LIMITATIONS

There were several confounding factors that were unable to be corrected for across the study period.

Table 2 Thematic tabulation of responses to the open-ended question 'As a result of what I have learnt today, I intend to make the following changes to my practice that I believe will impact my patients' care in a positive way' (n=41/75, 54.7%)

Theme	Examples
Personal professional competence	<p>'Detailed history taking and examination'</p> <p>'Systemic approach'</p> <p>'Holistic approach to patient care ...early involvement of MDT ...'</p> <p>'... Understanding of my limitations and when to involve senior support ...'</p> <p>'... Early involvement of the specialty team if symptoms not improving'</p> <p>'Careful consideration of patients' social histories and any management may affect this'</p>
Specific clinical practice knowledge	<p>'Timing on transfusion, the use of tranexamic acid and PPI infusion in GI bleeding ...'</p> <p>'... management of COVID19'</p> <p>'... diabetic ketoacidosis in patient without compliance to insulin treatment'</p> <p>'... Being more COVID19 vigilant'</p>

First, the small sample size for each session may have impacted on the variability and reliability of the results. The amount and types of other teaching sessions participants received during the acute medicine rotation, increasing familiarity within the department as the rotation progressed and the inter-individual variation in baseline confidence levels, as well as the rate at which different individuals gained confidence were also important. In addition, there was a large geographical variation among participants across the three sessions, which may have affected analysis of differences in self-reported confidence between different grades of doctors. While medical training (both undergraduate and postgraduate level) in the UK is standardised, this may not be the case for other countries.

The sessions were aimed at qualified doctors working or interested in the acute medical specialty. The 'opt-in' method of registration we employed in our SIMBA model may have attracted more motivated and engaged trainee doctors, potentially introducing participation bias. Due to the broad nature of the recruitment process, a small number of allied healthcare professionals, for example, an advanced clinical practitioner, also participated. This may also have impacted our results as their baseline training, learning, and knowledge may differ from physicians. Finally, the outcomes were measured using the Likert scale for self-reported confidence levels; however, there is a tendency for participants to respond towards the middle of the scale, that is, trainees provide answers that they feel they should (observer or Hawthorn effect).¹³

CONCLUSIONS

In summary, we have established SIMBA as an effective teaching model, which improved clinicians' confidence levels in approaching acute medical case scenarios. Participants' self-reported confidence in managing the simulated case presentations were significantly higher postsimulation across various grades, and an overwhelming majority found the simulated topics applicable to their daily clinical practice. The structure and content of the simulation sessions were improved between cycles of the quality improvement project based on feedback received from the participants, moderators and specialist co-chairs. Refining session advertisement and recruitment methods helped to increase participation in the sessions. Interventions included adjustments to the registration form and expanding participant recruitment reach by employing different advertisement strategies over the three sessions.

SIMBA has proved to be a valuable training tool during the pandemic when traditional teaching faced disruption and we anticipate the benefits of SIMBA outlasting this period. Indeed, SIMBA has already been incorporated into specialist training programmes both locally (West Midlands Deanery) and nationally (European Society of Endocrinology and Society of Endocrinology). Ongoing studies are assessing the SIMBA as an on-demand learning platform in the local region. Further studies will explore the long-term impact of SIMBA as a training tool including lasting changes to clinical practice.

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designed and collected the data for presimulation and postsimulation surveys. NE, GM and IA trained the moderators for the sessions. CSCP, GP, ER, JS, AK, MH and DD helped design the transcripts; they also helped with training the moderators. VR-K, JA, GP and EA-T have chaired the SIMBA sessions. MD and EM supervised the design and delivery of the simulation sessions. PK conceptualised and supervised the delivery of all aspects of SIMBA, and is an author responsible for the overall content as the guarantor. The final version has been reviewed and approved by all the named authors. All authors have agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of all parts of the work are appropriately investigated and resolved.

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Ethics approval This study involves human participants and the study was conducted as part of a continuous educational development programme for all clinician trainee doctors in AMU at the Queen Elizabeth Hospital Birmingham (QEH), Birmingham, UK (CARMS registration number: CARMS-16233). Participants gave informed consent to participate in the study before taking part.

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REFERENCES

- Bradley P. The history of simulation in medical education and possible future directions. *Med Educ* 2006;40:254–62.
- So HY, Chen PP, Wong GKC, *et al*. Simulation in medical education. *J R Coll Physicians Edinb* 2019;49:52–7.
- Aggarwal R, Mytton OT, Derbrew M, *et al*. Training and simulation for patient safety. *Qual Saf Health Care* 2010;19 Suppl 2:i34–43.
- Lateef F. Simulation-based learning: just like the real thing. *J Emerg Trauma Shock* 2010;3:348.
- Melson E, Davitadze M, Aftab M, *et al*. Simulation via instant messaging-Birmingham advance (SIMBA) model helped improve clinicians' confidence to manage cases in diabetes and endocrinology. *BMC Med Educ* 2020;20:274.
- Morgan G, Melson E, Davitadze M, *et al*. Utility of simulation via instant messaging – Birmingham advance (SIMBA) in medical education during COVID-19 pandemic. *J R Coll Physicians Edinb* 2021;51:168–72.
- Royal College of physicians. focus on physicians: 2018–19 census (UK consultants and higher specialty trainees) | RCP London. Available: <https://www.rcplondon.ac.uk/projects/outputs/focus-physicians-2018-19-census-uk-consultants-and-higher-specialty-trainees> [Accessed 1 Dec 2021].
- Coolen EHAJ, Draaisma JMT, Hogeveen M, *et al*. Effectiveness of high fidelity video-assisted real-time simulation: a comparison of three training methods for acute pediatric emergencies. *Int J Pediatr* 2012;2012:1–8.
- Khawaja S, Bhalla A, Patel V, *et al*. Collaborative acute medical postgraduate-undergraduate simulation: a new multi-modal transition programme for final-year medical students. *Future Healthc J* 2019;6:135–6.
- Schwarz D, Štourač P, Komenda M, *et al*. Interactive algorithms for teaching and learning acute medicine in the network of medical faculties MEFANET. *J Med Internet Res* 2013;15:e135.
- Kirkpatrick JD, Kirkpatrick WK. Kirkpatrick's Four Levels of Training Evaluation. ATD Press, 2016. Available: https://books.google.co.uk/books?hl=en&lr=&id=mo-DAAAQBAJ&oi=fnd&pg=PT10&dq=Kirkpatrick%E2%80%99s+Four+Levels+of+Training+Evaluation&ots=LNDhUOnjPw&sig=RvmGSxg-odONVTtYD8YUAGv7qZs&redir_esc=y#v=onepage&q=Kirkpatrick%E2%80%99s+Four+Levels+of+Training+Evaluation&f=false [Accessed 25 Apr 2021].
- Ilgen JS, Ma IWY, Hatala R, *et al*. A systematic review of validity evidence for checklists versus global rating scales in simulation-based assessment. *Med Educ* 2015;49:161–73.
- Paradis E, Sutkin G. Beyond a good story: from Hawthorne effect to reactivity in health professions education research. *Med Educ* 2017;51:31–9.