

# Whole Consultation Simulation in Undergraduate Surgical Education: a Breast Clinic Case Study

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## Research Article

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# Abstract

**Background:** Safe and effective clinical outcomes (SECO) clinics enable medical students to integrate clinical knowledge and skills within simulated environments. This realistic format may better prepare students for clinical practice. We aimed to evaluate how simulated surgical clinics based on the SECO framework aligned with students' educational priorities in comparison with didactic tutorials.

**Methods:** We delivered two breast surgery SECO-based simulated clinics to Year 3 students during their surgical attachments at a London teaching hospital. All students attended a didactic breast surgery tutorial the previous week. Pre- and post-session surveys and post-session debriefs were used to explore learning gain, processes, preferences and impacts on motivation to learn. Data were analysed using inductive thematic analysis to categorise student views into themes.

**Results:** 17 students enrolled in the simulated clinics and debriefs. Students expressed that passing examinations was a key extrinsic motivating factor, although the SECO-based format appeared to shift their motivation for learning towards aspiring to be clinically competent. Self-reported confidence in clinical skills such as history taking and examination improved significantly. Active learning methods were valued. Students expressed a preference for simulated clinics to complement, but not replace, tutorial-based learning.

**Conclusion:** The SECO-based simulated clinic promoted a shift towards intrinsic motivation for learning by allowing students to recognise the importance of preparing for clinical practice in addition to passing examinations. Integration of surgical simulated clinics into the undergraduate curriculum could facilitate acquisition of clinical skills through active learning, a method highly valued by students.

## Introduction

The General Medical Council (GMC) sets out 'outcomes for graduates' which stipulate that medical graduates must show competency in safely diagnosing, investigating and managing clinical presentations across both community and secondary care settings, including surgery [1]. Most newly qualified foundation doctors rotate through surgical specialties [2] making preparedness for practice a key outcome for undergraduate surgical education.

Despite significant variation in undergraduate curricular design and recent innovations to improve practical clinical learning, a large proportion of newly qualified doctors continue to feel unprepared when transitioning to clinical practice [3–6]. Unpreparedness is related to a lack of meaningful clinical experience as an undergraduate [7]. In surgery, this is exacerbated by increasing curricular emphasis on generalism and community-based teaching which has reduced exposure [8]. Newly graduating doctors also describe a lack of clinical responsibility during their undergraduate years, affording them limited opportunities to develop skills in clinical diagnosis or the management of patients' problems [9]. Undergraduate surgical education typically involves core knowledge in anatomy, physiology and pathology, supplemented by clinical attachments and clinical skills training. There are calls for medical

educators to create more integrated learning experiences rather than separating clinical knowledge, skills, professionalism and communication [10]. Surgical placements, although highly influential in modulating career intentions in surgery [11], have multiple barriers which limit their capacity and effectiveness as an undergraduate learning environment [8, 12]. There is a pressing need for innovative ways to support students in experiential surgical learning: a central component in the integration of knowledge and skills, and the journey towards preparedness for practice [13–15].

## Methods

### Design

In this evaluative case study, we present our teaching materials and processes, alongside a qualitative analysis of the simulation debrief which explored participants sense-making about learning processes, preferences and motivations. This was supplemented by pre- and post-teaching confidence scales across different domains of learning.

### The intervention

Whole consultation simulations that emphasise patient-centred outcomes within authentic clinical contexts and resources were pioneered by Williamson et al. as Safe and Effective Clinical Outcomes (SECO) clinics. SECO clinics address learning objectives that are clearly aligned with future clinical practice in a safe and supervised environment [16, 17]. Through this framework, students are encouraged to take clinical responsibility for patients by combining their knowledge and clinical reasoning skills to make decisions, including seeking appropriate advice in order to achieve safe, effective outcomes. SECO clinics have been evaluated as both engaging and effective for learning around patient-centred clinical practice in primary care [17, 18], but have yet to be evaluated in surgical education.

We based our simulated clinic on the SECO design [17] with pragmatic modifications. We divided the students into pairs or trios. Student groups rotated through four simulated consultations over approximately an hour (Fig. 1). Students alternated between the roles of a simulated patient and doctor, whilst being observed by a tutor (AL, DA, MF). We designed the session to feel as realistic as possible, with the provision of the usual resources available to doctors in clinics such as clerking proformas, investigation reports and management guidelines. We encouraged students to discuss any uncertainties with a 'senior' (role played by the tutor) as would be expected in clinical practice. We encouraged students to remain in role as a doctor throughout the simulated clinical encounter to promote awareness of their professional boundaries and capabilities.

We chose a 'triple assessment' breast cancer clinic for our pilot as this requires students to demonstrate a wide range of patient-centred skills. Triple assessment clinics involve taking a focussed history, performing an examination (on a breast examination model worn by another student), and selecting the correct choice of imaging and histology. Students were required to order the correct tests based on their history and examination, interpret the results, and communicate their findings and plan. Participants had

all participated in an hour-long classroom-based breast tutorial, facilitated by OB, the previous week. The learning outcomes were taken from the year 3 curriculum at Imperial College London (Table 1).

Table 1  
Learning outcomes for the Virtual Breast clinic (based on the Imperial College London curriculum).

Learning outcomes
1. Explain the aetiology/risk factors for breast cancer
2. Summarise the epidemiology of breast cancer
3. Recognise the presenting symptoms of breast cancer
4. Recognise the signs of breast cancer on physical examination
5. Identify appropriate investigations for breast cancer and interpret the results

We provided feedback to students in two formats (as per the original SECO design) per station: i) achievement of clinical outcomes and ii) achievement of patient-centred outcomes, assessed by the tutor and simulated patient, respectively. Examples of station materials and feedback forms can be found in the **supplementary material**.

## Research aims

Our primary aim was to explore and categorise factors influencing medical students' motivation to learn, and how these were modulated by their experiences during the simulated clinic. Our secondary aim was to explore students' perceptions of simulated clinics in comparison to classroom-based surgical education.

## Research team

OB and RM are hospital-based clinical teaching fellows, whilst AL, MF and DA are hospital-based junior doctors. KLG is a full-time medical education researcher. OB, RM and KLG have post-graduate qualifications in education and designed the project.

## Participants and setting

Students (n = 17) were in their third year of a six-year medical degree. This was their first year of clinical placements and their first general surgical placement. We delivered these sessions at a North West London teaching hospital in November 2019 and January 2020 with eight students in the first session and nine students in the second session. All students were invited to participate and 17 gave written consent for their data to be used for evaluative purposes.

## Data generation

Immediately after the session, students participated in a 20–30 minute debrief. This was recorded with informed written consent. OB and RM led the debrief sessions which followed a semi-structured format of open-ended questions, exploring experiences, preferences and impacts on motivation to learn. The topic guide was designed by OB and RM and informed by the literature on SECO clinics. We collected quantitative feedback using pre- and post-session online questionnaires. Students were asked to grade their confidence performing various clinical skills relevant to breast surgery using 5-point Likert scales (ranging from strongly disagree to strongly agree). The questionnaire and topic guide are shown in Table 2.

Table 2

Statements and questions used in the pre- and post- session online survey and debrief sessions. The survey used a 5-point Likert scale (from strongly disagree to strongly agree).

Likert-scale questionnaire	Debrief sessions
1. I feel confident taking a history of a patient with a breast lump	1. How did it feel to learn in a simulated clinic environment?
2. I feel confident documenting a history of a patient with a breast lump in clinical notes	2. The simulated clinic was based on the same learning outcomes as the breast tutorial last week. How did you feel that each session addressed these outcomes?
3. I know the risk factors for breast cancer and how to ask these in a history	3. Do you prefer to learn in a simulated clinic environment or a classroom-based tutorial on the same subject matter?
4. I know the presenting symptoms of breast cancer and how to ask these in a history	4. Students are presented with two statements: <i>“The top priority in my education should be to prepare me to pass my final exams. The top priority in my education should be to prepare me to become a competent junior doctor”</i> . Discuss to what extent you agree or disagree with those statements and why.
5. I feel confident examining a patient with a breast lump and documenting this in the clinical notes	5. How do you feel simulated clinic sessions and classroom-based tutorials prepare you for these educational priorities (passing examinations vs. junior doctor competencies)?
6. I know how to recognise the examination findings of breast cancer exam	
7. I would feel confident ordering appropriate investigations for a patient presenting with a breast lump	
8. I would feel confident interpreting appropriate investigations for a patient presenting with a breast lump	

## Data analysis

The post-session debrief was transcribed verbatim and anonymised prior to analysis. We used an inductive thematic approach [19] facilitated by Dedoose online software. AL, DA and MF independently coded the debrief transcripts line-by-line with the generation of themes and sub-themes through a

collaborative iterative process, the methodology of which has been described in the literature previously [19]. This involved merging duplicate codes and themes through group consensus and resolving any differences in interpretation through discussion. We then further refined these themes and sub-themes into broad categories relating to impacts on learner motivation, insights into learning processes, and comparisons between classroom-based and simulation-based learning. Pre- and post-session confidence ratings from the online Likert scale questionnaire were compared using Fishers exact test (Microsoft Excel [V16.32]).

## **Ethics approval and consent to participate**

We discussed this evaluation with the Medical Education Ethics Committee of Imperial College London on 24th October 2019. It was classified as exempt as all data were generated in the normal course of teaching. Participants were informed that they could participate without their data being used in the evaluation or participation in the debrief without reason or penalty. In accordance with best practice, we obtained informed written consent to analyse their debrief and feedback on the sessions for research purposes. This evaluation was conducted in accordance with the Declaration of Helsinki.

## **Results And Interpretation**

For the first session (November 2019), 8 students completed the pre-course questionnaire and 7 students completed the post-course questionnaire. For the second session (January 2020), 9 students completed both the pre- and post-course questionnaire. Students reported significant improvements in their confidence across all domains. Students were initially least confident in their confidence in documenting the history and examination of a patient with a breast lump and were most confident in their ability to take a focused history from patients, and to determine symptoms and signs of breast cancer on history-taking and clinical examination respectively. The most statistically significant improvements in confidence score related to confidence in asking patients about their risk factors for breast cancer, confidence in performing a breast exam and documenting this in the notes, and confidence in ordering the correct investigations in the triple-assessment clinic (all  $P < 0.0001$ ; Fig. 2).

For the debriefs, 17 students participated and consented to their recorded comments being used for evaluative purposes. Two debriefs ran simultaneously for each session allowing for smaller group sizes; therefore a total of four debriefs were recorded. Eight themes were identified from the sessions and these were broadly categorised into two subgroups: motivation for learning, and preferences for learning. (Table 3). We do, however, acknowledge that overlap exists between these two groups.

Table 3

Student motivation and preferences to learning. The first four themes relate to student motivations to learning and the latter four themes relate to student preferences to learning.

Theme	Sub-theme	Code(s)	Example Excerpts
Fear of existing systems		Avoidance of failure	Ex. 1: "I felt more confident to ask questions and get things wrong because obviously it wasn't a real patient [...] this is the place to make mistakes rather than on the wards"
		Avoiding mistakes on placement	Ex. 2: "But then if you do get it wrong in this ["simulated clinic"] setting then you've got a smaller group where you're not disturbing too many people if you get it wrong"
Becoming clinically competent	Practical skills	Becoming competent at practical skills	Ex. 3: "The breast clinic session is useful because we need to know the practical elements."
		Practicing practical skills	Ex. 4: "They ["simulated clinic tutors"] also made us do stuff like examinations too. For me this helps me remember stuff a bit more."
		Understanding / practicing practical aspects of clinical practice	

\* - Denotes code that was felt to be part of multiple themes

☒ - The authors acknowledge that examinations also act as a fear

Note: most excerpts were tagged with multiple codes, and where it was deemed pertinent, some excerpts have been used as example excerpts more than once.

Theme	Sub-theme	Code(s)	Example Excerpts
	Communication & professionalism	Practicing communication skills	Ex. 5: "A lot of it is skills based like being able to speak to your patient properly and then understand what they're saying."
		Developing professional skills	Ex. 6: "Just knowing the principles of history taking doesn't actually help you that much when you come to taking a history because if you can't make a patient feel comfortable, they won't open up to you or talk to you."
		Knowing when to escalate and ask for help	Ex. 7: "The point of the session as well was when to ask for help and like how to do that. [...] There's no other way really to learn about it in a textbook."
		Generating good habits	
		Temporal changes in motivation	Ex. 8: "This [simulated clinic] builds your practical skills a lot better, and I feel like it gives you better information for like the history taking part."  Ex. 9: "I feel like when you get to sixth year [...] finals are approaching but then you're also like oh a couple months after that I'm going to be the F1 and I'm going to be doing nights and covering all the wards. [...] It's different pressures at different stages."
	Application of clinical knowledge	Clinical reasoning	Ex. 10: "In textbooks [...] they'll have like a billion investigations, so you don't necessarily know which one is the one that you'll use first in the hospital. Whereas by doing simulated clinics you'll see [...] this is the first line, this is what you progress to because its got better specificity."
		Real-life practices vs textbook	
		Having confidence in applying clinical knowledge*	Ex. 11: "It's one thing to know what the symptoms are supposed to be and another thing to recognise them on a patient, even a simulated one."  Ex. 12: "Learning things like differentials, you probably get more of that in the tutorial but recognising them is an entirely different scenario."

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Note: most excerpts were tagged with multiple codes, and where it was deemed pertinent, some excerpts have been used as example excerpts more than once.

Theme	Sub-theme	Code(s)	Example Excerpts
Acquisition of core medical knowledge		Covering the medical curriculum Acquisition of medical knowledge Learning facts	<p>Ex. 13: "The history taking part [of the simulated clinic session] was amazing, like I personally thought that the history taking part was so useful, but actually knowing specifically about the disease and all the different investigations and symptoms and everything that can come with it can only really be well taught in a classroom environment."</p> <p>Ex. 14: "We got roughly the same information out of each session (tutorials and clinic) but it was just a different way of doing it."</p> <p>Ex. 15: "I wouldn't teach about disease this [simulated clinic] way but as far as examination goes it probably makes sense to teach it this way."</p>
Passing examinations☒		Passing examinations Passing non-written exams Passing written exams Temporal changes in motivation*	<p>Ex. 16: "The tutorials are more like more for exams and the tutorials are more for OSCEs"</p> <p>Ex. 17: "I think simulated clinic sessions make use a lot more competent as a junior doctor, rather than focus on helping us pass exams."</p> <p>Ex. 18: "To be honest prioritising my exams is probably my priority at the moment."</p> <p>Ex. 19: "The simulated sessions are useful for both competencies as a doctor as well as practical things like passing our OSCE."</p> <p>Ex. 20: "If all our teaching was done in a simulated environment then I don't think we'd feel as prepared to pass our exams."</p> <p>Ex. 21: "I think at this stage, our main priority if we're being realistic about it is to pass our exams. We can be the most competitive junior doctor, but if we haven't passed our exams, then you know..."</p>

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Note: most excerpts were tagged with multiple codes, and where it was deemed pertinent, some excerpts have been used as example excerpts more than once.

Theme	Sub-theme	Code(s)	Example Excerpts
Active learning techniques	Maintaining active interest during teaching exercise	Interactive teaching	Ex. 22: "In a big group you're less likely to put your hand up to answer a question."
		Active discussion	Ex. 23: "It's good to be put on the spot as well, because I think just a tutorial is quite passive and so you could be like 'I could do that, I can do all these things' but then when you actually go to do it in a simulated environment you're like 'oh wait hang on a minute.'"
		Active recall / learning	
		Assessment throughout teaching / factual recall	Ex. 24: "I think having a tutorial like a week ago not knowing what the topic is today, is probably the best thing because you learn some stuff in the tutorial, you forget about it, and then you have to use active recall to remember the info."
		Interactivity of the teaching session	
		Engagement with teaching exercise	Ex. 25: "I learn more from practical sessions. In lunchtime tutorials there is just a lot of information so sometimes it just feels too much and it is hard to remember stuff until you actually put it to use and do it."
	Aiding long-term memory recall	Consolidation of knowledge	Ex. 26: "I think having a tutorial like a week ago not knowing what the topic is today, is probably the best thing because you learn some stuff in the tutorial, you forget about it, and then you have to use active recall to remember the info."
Forming long-lasting learning memories			
Memorable teaching frameworks		Ex. 27: "We already had that [tutorial] session then afterwards we came and consolidated that session a few days later with this [simulated clinic]."	
Application of knowledge		Ex. 28: "I think they [tutorial and simulated clinic] were both very good because i feel like the first one was more like our actual learning outcomes like our conditions that we need to know and to have a clear image of what the differentials could be and then the second one was like how would you use all this knowledge in practice."	
Feeling prepared for the teaching session			

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Theme	Sub-theme	Code(s)	Example Excerpts
Teaching environment		Safety of learning environment	Ex. 29: "I feel more at ease [...] in this environment than doing it on the ward."
		Small group learning	Ex. 30: "I think the simulated clinic, it's pretty much what they do in the breast clinic, so its like very much what we'll have to do as a doctor, so I feel like in terms of that respect, this is more useful than a normal tutorial."
		Suitability of learning technique	Ex. 31: "I felt like both [the tutorial and the simulated clinic] were useful in their own way, and in fact I felt doing this after the tutorial was actually better because it consolidated all of the stuff that we did in the tutorial so I think they both kind of go hand in hand which is kind of a good thing, but maybe just look at it as an adjuvant rather than one or the other."
		Realism of clinical setting	
		Being able to ask questions	
		Having confidence in applying clinical knowledge*	
	Learning through mistakes*		

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Theme	Sub-theme	Code(s)	Example Excerpts
Learning through simulation		Exposure to rare learning experiences	Ex. 32: "I don't think well have the chance to sit in on all the clinics so this would be the place to do it to learn about things that we haven't been able to see."
		Simulated learning environment	Ex. 33: "I guess it's also [...] more time for us to go through it because it's very rare that you see a patient from presentation to future investigations and maybe we wouldn't have had the chance to do that on the ward."
		Simulation of real-life scenario	
		Learning through mistakes*	Ex. 34: "I feel like they are making us do the stuff, like it identifies what we actually do know and what we've retained and what we don't."
		Recognising clinical presentations	Ex. 35: "I feel it kind of does prepare us for the exams, but also kind of [sic] tests our professionalism and maturity."
		Pure enjoyment / interactivity of the session	Ex. 36: "[...] understanding your patient manner as well, and with sensitive things like breast cancer to learn how you'd approach it because you have to be more sensitive."
Supervised and feedback-driven learning event		Working on weaknesses*	
		Human factors	
		Feedback-led session	Ex. 37: "I think because we're in small groups in this session it makes it easier to get quick feedback compared to in a larger tutorial."
		Having time and exposure to learning experiences	Ex. 38: "I guess it's also [...] more time for us to go through it because its very rare that you see a patient from presentation to future investigations and maybe we wouldn't have had the chance to do that on the ward."
		Quality of tutors	Ex. 39: "It's more intimate, you can talk to people better and voice your concerns."
		Supervision during learning events	Ex. 40: "I feel like they are making us do the stuff, like it identifies what we actually do know and what we've retained and what we don't."
	Identify weaknesses		
	Working on weaknesses		

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Note: most excerpts were tagged with multiple codes, and where it was deemed pertinent, some excerpts have been used as example excerpts more than once.

Theme	Sub-theme	Code(s)	Example Excerpts
		Integration of SECO with existing experiences	<p>Ex. 41: "I think having a tutorial is a good pre-session for this [simulated Clinic]."</p> <p>Ex. 42: "I think having a tutorial like a week ago not knowing what the topic is today, is probably the best thing because you learn some stuff in the tutorial, you forget about it, and then you have to use active recall to remember the info."</p> <p>Ex. 43: "I think we would definitely still want some tutorials, like a balance is useful rather than all of one."</p> <p>Ex. 44: "I would want both, but if I could only have one I'd select this because the book stuff you can just look it up on your own time whereas you can't recreate this by yourself."</p> <p>Ex. 45: "A nice idea would be to have two sessions a week, the first as classroom based and then later on that week would be simulated clinical environment to consolidate that."</p>
* - Denotes code that was felt to be part of multiple themes			
☒ - The authors acknowledge that examinations also act as a fear			
Note: most excerpts were tagged with multiple codes, and where it was deemed pertinent, some excerpts have been used as example excerpts more than once.			

## Impact on motivation for learning

Student motivations for engaging in learning were classified into four broad themes; fear of existing systems, becoming clinically competent, acquisition of core medical knowledge and passing examinations (Table 3).

Some students prioritised the acquisition of core, examinable medical knowledge, which they saw as a crucial step in passing their examinations.

Excerpt 14: "We got roughly the same information out of each session (tutorials and clinic) but it was just a different way of doing it." Excerpt 18: "To be honest prioritising my exams is probably my priority at the moment."

This was attributed to their stage in training. They felt that preparedness for practice would become a greater priority as they progressed through medical school.

Ex. 21: "I think at this stage, our main priority if we're being realistic about it is to pass our exams. We can be the most competitive [sic] junior doctor, but if we haven't passed our exams, then you know..."

Others discussed the importance of balancing codifiable knowledge and facts with more applied communication and clinical skills.

Ex. 6: "Just knowing the principles of history taking doesn't actually help you that much when you come to taking a history because if you can't make a patient feel comfortable, they won't open up to you or talk to you."

Ex. 11: "It's one thing to know what the symptoms are supposed to be and another thing to recognise them on a patient, even a simulated one."

Some felt the simulated clinic had reframed their academic motivation away from passing examinations and towards preparedness for practice.

Ex. 17: "I think simulated clinic sessions make us a lot more competent as a junior doctor, rather than focus on helping us pass exams."

## **Impact on student preferences for learning**

Students sense-making on the processes of learning were classified into four themes; active learning techniques, teaching environment, learning through simulation, and supervised and feedback-driven learning events (Table 3).

Students welcomed the opportunity to apply their knowledge during the simulated clinic and felt that this aided their overall development of clinical competence. Active recall was valued, and this was seen by students as aiding them in consolidating their knowledge and preventing passive engagement in learning activities.

Ex. 23: "It's good to be put on the spot as well, because I think just a tutorial is quite passive and so you could be like 'I could do that, I can do all these things' but then when you actually go to do it in a simulated environment you're like 'oh wait hang on a minute.'"

Students felt the simulated learning environment helped them to feel more comfortable trying new approaches, making mistakes, and asking questions. This enabled them to identify gaps in their learning. Students felt classroom-based learning and real surgical learning promoted passive engagement and a fear of error, whereas the simulated clinics embraced errors as an essential part of the learning process.

Ex. 1: "I felt more confident to ask questions and get things wrong because obviously it wasn't a real patient [...] this is the place to make mistakes rather than on the wards"

Ex. 22: "In a big group you're less likely to put your hand up to answer a question."

Ex. 40: "I feel like they are making us do the stuff, like it identifies what we actually do know and what we've retained and what we don't."

Comparisons were drawn between the simulated clinic and the tutorial they received on the same topic a week prior to the clinic (Table 4). Students felt the simulated clinics provided a good environment to practice practical skills but lacked the structure required to acquire more in-depth medical content. Students remarked that they felt that they would be less prepared for written exams if they only learned through simulation. They still wanted tutorials to cover the "specifics of each disease" and to ensure that "baseline knowledge" had been fully covered.

Ex. 13: "The history taking part [of the simulated clinic session] was amazing, like I personally thought that the history taking part was so useful, but actually knowing specifically about the disease and all the different investigations and symptoms and everything that can come with it can only really be well taught in a classroom environment."

Table 4

Advantages and disadvantages of traditional didactic learning compared with simulated clinic learning identified by the medical students.

Traditional Didactic Learning			Simulated clinic learning		
Theme	Code	Example Excerpt(s)	Theme	Code	Example Excerpt(s)
Acquisition of core medical knowledge	Covering the medical curriculum  Acquisition of medical knowledge  Learning facts	Ex. 13: "The history taking part [of the simulated clinic session] was amazing, like I personally thought that the history taking part was so useful, but actually knowing specifically about the disease and all the different investigations and symptoms and everything that can come with it can only really be well taught in a classroom environment."  Ex. 46: "Learning presentations and risk factors and baseline knowledge is better in a classroom."  Ex. 47: "In terms of learning things like risk factors I think the first session where there are slides is more useful as we get to see stuff."	Passing examinations	Passing non-written exams	Ex. 19: "The simulated sessions are useful for both competencies as a doctor as well as practical things like passing our OSCE."

Traditional Didactic Learning			Simulated clinic learning		
Passing examinations	Passing written exams	Ex. 20: "If all our teaching was done in a simulated environment then I don't think we'd feel as prepared to pass our exams."	Being a competent doctor	Practical skills	Ex. 3: "The breast clinic session is useful because we need to know the practical elements."
				Communication & professionalism	Ex. 5: "A lot of it is skills based like being able to speak to your patient properly and then understand what they're saying."

Traditional Didactic Learning	Simulated clinic learning	
	Application of clinical knowledge	<p>Ex. 10: "In textbooks [...] they'll have like a billion investigations, so you don't necessarily know which one is the one that you'll use first in the hospital. Whereas by doing simulated clinics you'll see [...] this is the first line, this is what you progress to because its got better specificity."</p> <p>Ex. 12: "Learning things like differentials, you probably get more of that in the tutorial but recognising them is an entirely different scenario."</p>

Traditional Didactic Learning	Simulated clinic learning		
	Active learning techniques	Maintaining active interest during teaching exercise	<p>Ex. 22: "In a big group you're less likely to put your hand up to answer a question."</p> <p>Ex. 23: "It's good to be put on the spot as well, because I think just a tutorial is quite passive and so you could be like 'I could do that, I can do all these things' but then when you actually go to do it in a simulated environment you're like 'oh wait hang on a minute.'"</p>
	Learning through simulation	Simulation of real-life scenario	<p>Ex. 30: "I think the simulated clinic, it's pretty much what they do in the breast clinic, so its like very much what we'll have to do as a doctor, so I feel like in terms of that respect, this is more useful than a normal tutorial."</p>

Traditional Didactic Learning	Simulated clinic learning	
	Working on weaknesses	Ex. 40: "I feel like they are making us do the stuff, like it identifies what we actually do know and what we've retained and what we don't."
	Feedback-led session	Ex. 37: "I think because we're in small groups in this session it makes it easier to get quick feedback compared to in a larger tutorial."

## Integration of SECO with existing learning experiences

Students' evaluations of the simulated clinic format were overall extremely positive, and many recognised the uniqueness of simulated learning events, which are a rare opportunity in their curriculum.

Ex. 44: "I would want both, but if I could only have one I'd select this [the simulated clinic] because the book stuff you can just look it up on your own time whereas you can't recreate this by yourself."

They did however feel that simulated clinics may not work as the sole form of delivering their surgical curriculum, but rather it should supplement their existing teaching to consolidate classroom-based learning.

Ex. 20: "If all our teaching was done in a simulated environment then I don't think we'd feel as prepared to pass our exams."

Ex. 45: "A nice idea would be to have two sessions a week, the first as classroom based and then later on that week would be simulated clinical environment to consolidate that."

## Discussion

The medical students in this study felt significantly more confident after the simulated clinic in their ability to safely and effectively assess breast lumps, with greatest confidence gains in awareness of how

to ask patients about their risk factors of breast cancer, performing and documenting a breast examination, and confidence in ordering the correct investigations in the triple-assessment clinic. Domains where there were significant improvements in confidence but to a lesser degree included the ability to take a focused history, the ability to recognise presenting symptoms of breast cancer, and how to interpret investigation results. These former domains, which saw the greatest gains in confidence, require the application of knowledge assimilated from textbooks or classroom-based teaching to clinical practice, and these seemed to improve most from the simulated clinic sessions. Simulated clinics may therefore help to bridge the gap between acquiring knowledge during medical school and applying this knowledge in clinical practice.

Inductive thematic analysis revealed four key themes related to student motivations for learning. These consisted of fear of existing systems, the need to pass examinations, the desire to acquire core medical knowledge and to become clinically competent. Furthermore, four key themes relating to student reflections on the processes of learning were identified including; active learning techniques, learning through simulation, learning through feedback and appropriateness of teaching environments. Students felt that simulated surgical clinics would be a welcome addition to the surgical curriculum, allowing practical application and consolidation of knowledge. However, they suggested that simulated clinics should not replace classroom-based teaching, which they felt was more appropriate for the delivery of high-volume semantic knowledge. In a discrete choice situation, they felt the simulated clinics were more valuable as this type of learning was not possible through self-study.

The themes surrounding learner motivation and preferences presented in this study align with previously published characteristics of adult learning in undergraduate surgical curricula [20]. These characteristics include the need for learning to be perceived as relevant, experiential, participatory, problem-based, applicable to practice and based on active, high quality feedback [20].

Research has shown that engagement in educational processes is strongly linked to learner motivation [21]. Motivation can be categorized according to self-determination theory as either intrinsic or extrinsic [22]. Intrinsic motivation is driven by inherent enjoyment and satisfaction in the task, whereas extrinsic motivation usually involves external or introjected regulatory factors [23]. Examples of extrinsic motivators identified in this study include the need to pass examinations and fear of failure at work or on placement. Concern about examination performance has previously been identified as a strong motivator for learning [24]. Enjoyment of the session and interest in medicine was identified by the students as an intrinsic motivator, in accordance with previous research [24].

Cook and Artino proposed five contemporary theories for motivations to learn in medical education, including self-determination, goal orientation, social-cognitive, attribution and expectancy-value [25]. Goal orientation was an important motivator in this study, with students highlighting the desire to become clinically competent, knowledgeable and adept at practical skills, both in the context of performing well as junior doctors (performance approach goal) and avoiding mistakes in examinations and on placement (performance avoidance goal). Social-cognitive theory describes reciprocal interactions between learners

and their environment. In this study, students consistently praised the ability to learn through simulation, which provided an opportunity to communicate with mock patients in a realistic setting, observe their peers' performance, and practice 'soft skills' such as asking for senior advice. Students placed higher task value on the simulated clinics after having had a preparatory didactic session the week before, which made them feel more confident that they could achieve their learning goals (expectancy-value theory).

During the debrief sessions, the students' responses suggested that the simulated clinics impacted their motivation, with a shift towards intrinsic motivation. Simulation-based teaching has been reported to improve intrinsic motivation in medical students [26, 27]. Whilst passing examinations was still highly prioritized, students had a greater consideration that passing medical school examinations was only one aspect of becoming a clinically competent doctor. Use of techniques to drive intrinsic motivation is important, having been associated with improved learning outcomes, quality of care, doctor-patient relationships and reduced physician burnout and job dissatisfaction [24, 28, 29].

The students' preference for active learning in a small-group, simulated environment is supported in the literature and has been shown to improve skill acquisition in comparison to traditional clinical education [30–32]. Previous research has also shown that medical students value the ability to learn through realistic clinical scenarios in a 'safe' environment [33]. In recent decades, a greater emphasis has been placed on active learning in small groups, with the uptake of problem-based learning (PBL) in most UK medical schools [34]. Moreover, simulation-based learning is becoming more commonplace in postgraduate medical education and is promoted by Health Education England for Core Medical Trainees [35]. Whilst the medical students in this study supported the integration of simulated clinics within the undergraduate curriculum, they did not feel they could replace didactic teaching entirely. This was mostly related to concerns regarding the inability of simulated clinics to deliver large volumes of knowledge required to pass examinations. However, the students noted that this could be overcome with a prior didactic session, and that the two teaching modalities complimented one another.

## Strengths and limitations

The findings of this study should be interpreted in the context of its strengths and limitations. The sample size was small ( $n = 17$ ) and participants were recruited from one teaching hospital, limiting generalisability. Furthermore, whilst we asked the students to directly compare the classroom-based teaching session with the simulation session, the former session was always held before the latter, due to timetabling constraints. This may have confounded student opinion and comparisons between the sessions. However, despite the small sample, the rich qualitative data collected provided a valid substrate for thematic analysis performed using rigorous published methodology by three independent coders. Moreover, the transcripts reached a point of data saturation with respect to code generation, suggesting adequate exploration of these students' views.

## Conclusion

This evaluative case study of surgical simulation clinics, based on a SECO clinic design, has demonstrated important motivations and preferences for learning amongst clinical medical students. In particular, the simulated clinics promoted a shift towards intrinsic academic motivation by allowing students to recognise the importance of preparing for clinical practice as opposed to focusing on written examinations. Surgical simulation clinics were received by the students as a positive addition to the undergraduate curriculum. Integration of surgical simulated clinics into the undergraduate curriculum could facilitate acquisition of clinical skills through active learning, a method highly valued by students. Further research is required to validate these findings in larger cohorts and other surgical and non-surgical teaching settings, and to examine the impact of this teaching on preparing medical students for the transition from medical student to clinician.

## **Abbreviations**

SECO: Safe and Effective Clinical Outcomes

## **Declarations**

### **Ethics approval and consent to participate**

We discussed this evaluation with the Medical Education Ethics Committee of Imperial College London on 24<sup>th</sup> October 2019. It was classified as exempt as all data were generated in the normal course of teaching. Participants were informed that they could participate without their data being used in the evaluation or participation in the debrief without reason or penalty. In accordance with best practice, we obtained informed written consent to analyse their debrief and feedback on the sessions for research purposes. This evaluation was conducted in accordance with the Declaration of Helsinki.

### **Consent for publication**

All student participants provided informed written consent for their anonymous quotes to be used for publication.

### **Availability of data and materials**

Anonymised raw questionnaire data and transcripts are available as supplementary information files.

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### **Competing interests**

The authors declare that they have no competing interests.

### **Author contributions**

OB prepared and delivered the preparatory classroom-based session. AL, MF and DA developed the teaching plan and materials for the simulated clinic, facilitated the simulated surgical clinics and analysed the data in collaboration with OB and RM. OB and RM facilitated the debrief. All were involved in writing and reviewing the manuscript.

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## References

1. GMC: Outcomes for Medical Graduates. Outcomes for Medical Graduates. 2018.
2. UK Foundation Programme Rough Guide. 2019.
3. Miles S, Kellett J, Leinster SJ. Medical graduates' preparedness to practice: a comparison of undergraduate medical school training. *BMC Med Educ.* 2017;17:1–9.
4. Kellett J, Papageorgiou A, Cavenagh P, Salter C, Miles S, Leinster SJ. The preparedness of newly qualified doctors - Views of Foundation doctors and supervisors. *Med Teach.* 2015;37:949–54.
5. Monrouxe L V., Bullock A, Gormley G, Kaufhold K, Kelly N, Roberts CE, et al. New graduate doctors' preparedness for practice: A multistakeholder, multicentre narrative study. *BMJ Open.* 2018;8:e023146.
6. Van Hamel C, Jenner LE. Prepared for practice? A national survey of UK foundation doctors and their supervisors. *Med Teach.* 2015;37:181–8.
7. Burford B, Whittle V, Vance GHS. The relationship between medical student learning opportunities and preparedness for practice: A questionnaire study. *BMC Med Educ.* 2014;14:223.
8. Agha RA, Papanikitas A, Baum M, Benjamin IS. The teaching of surgery in the undergraduate curriculum - Reforms and results. *International Journal of Surgery.* 2005;3:87–92.
9. Burrige S, Shanmugalingam T, Nawrozzadeh F, Leedham-Green K, Sharif A. A qualitative analysis of junior doctors' journeys to preparedness in acute care. *BMC Med Educ.* 2020;20:12.
10. Quintero GA, Vergel J, Arredondo M, Ariza M-C, Gómez P, Pinzon-Barrios A-M. Integrated Medical Curriculum: Advantages and Disadvantages. *J Med Educ Curric Dev.* 2016;3:JMECD.S18920.
11. Sutton PA, Mason J, Vimalachandran D, McNally S. Attitudes, motivators, and barriers to a career in surgery: A national study of uk undergraduate medical students. *J Surg Educ.* 2014;71:662–7.
12. Agha RA, Papanikitas A, Baum M, Benjamin IS. The teaching of surgery in the undergraduate curriculum. Part II - Importance and recommendations for change. *International Journal of Surgery.* 2005;3:151–7.
13. Kolb DA. *Experiential Learning: Experience As The Source Of Learning And Development How You Learn Is How You Live* View project. 1984.
14. Kolb AY, Kolb DA. *Experiential learning theory: A dynamic, holistic approach to management learning, education and development.* SAGE Handb Manag Learn Educ Dev. 2009;;42–68.

15. Hay A, Smithson S, Mann K, Dornan T. Medical students' reactions to an experience-based learning model of clinical education. *Perspect Med Educ*. 2013;2:58–71.
16. Young JE, Williamson M I, Egan T G. Students' reflections on the relationships between safe learning environments, learning challenge and positive experiences of learning in a simulated GP clinic. *Adv Heal Sci Educ*. 2016;21:63–77.
17. Williamson M, Walker T, Egan T, Storr E, Ross J, Kenrick K. Teaching and Learning in Medicine An International Journal The Safe and Effective Clinical Outcomes (SECO) Clinic: Learning Responsibility for Patient Care Through Simulation) The Safe and Effective Clinical Outcomes (SECO) Clinic: Learning Responsibility. 2013.
18. Bartlett M, Gay SP, Kinston R, McKinley R. Taking on the doctor role in whole-task simulation. *Clin Teach*. 2018;15:236–9.
19. Kiger ME, Varpio L. Thematic analysis of qualitative data: AMEE Guide No. 131. *Med Teach*. 2020;42.
20. Hamdorf JM, Hall JC. The Development of Undergraduate curricula in surgery: II. Generic Surgery. *ANZ J Surg*. 2001;71:108–13.
21. Kusurkar RA, Ten Cate TJ, van Asperen M, Croiset G. Motivation as an independent and a dependent variable in medical education: A review of the literature. *Med Teach*. 2011;33:e242–62.
22. Ryan RM, Deci EL. Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemp Educ Psychol*. 2000;25:54–67.
23. Kunanithaworn N, Wongpakaran T, Wongpakaran N, Paiboonsithiwong S, Songtrijuck N, Kuntawong P, et al. Factors associated with motivation in medical education: A path analysis. *BMC Med Educ*. 2018;18.
24. Liang J-C, Chen Y-Y, Hsu H-Y, Chu T-S, Tsai C-C. The relationships between the medical learners' motivations and strategies to learning medicine and learning outcomes. *Med Educ Online*. 2018;23:1497373.
25. Cook DA, Artino AR. Motivation to learn: an overview of contemporary theories. *Med Educ*. 2016;50:997–1014.
26. Escher C, Creutzfeldt J, Meurling L, Hedman L, Kjellin A, Felländer-Tsai L. Medical students' situational motivation to participate in simulation based team training is predicted by attitudes to patient safety. *BMC Med Educ*. 2017;17:37.
27. Younan H-C. Simulation-based medical education to improve intrinsic motivation in medical students. *Adv Med Educ Pract*. 2016;Volume 8:31–2.
28. Nantha YS. Intrinsic motivation: How can it play a pivotal role in changing clinician behaviour? *Journal of Health, Organisation and Management*. 2013;27:266–72.
29. Tung YC, Chou YY, Chang YH, Chung KP. Association of intrinsic and extrinsic motivating factors with physician burnout and job satisfaction: A nationwide cross-sectional survey in Taiwan. *BMJ Open*. 2020;10:35948.

30. McGaghie WC, Issenberg SB, Cohen ER, Barsuk JH, Wayne DB. Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. *Acad Med.* 2011;86:706–11.
31. Motola I, Devine LA, Chung HS, Sullivan JE, Issenberg SB, Barry S, et al. Medical Teacher Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82 Issenberg (2013) Simulation in healthcare education: A best evidence practical guide. AMEE Guide No Simulation in healthcare education: A best evidence . *Med Teach.* 2013;82:1511–30.
32. Tsang A, Harris DM. How We Teach: Generalizable Education Research Faculty and second-year medical student perceptions of active learning in an integrated curriculum. *Adv Physiol Educ.* 2016;40:446–53.
33. Weller JM. Simulation in undergraduate medical education: Bridging the gap between theory and practice. *Med Educ.* 2004;38:32–8.
34. Clark CE. Problem-based learning: How do the outcomes compare with traditional teaching? *Br J Gen Pract.* 2006;56:722–3.
35. Health Education England. Enhancing UK Core Medical Training through simulation-based education: an evidence-based approach A report from the joint JRCPTB/HEE Expert Group on Simulation in Core Medical Training. 2016.

## Figures

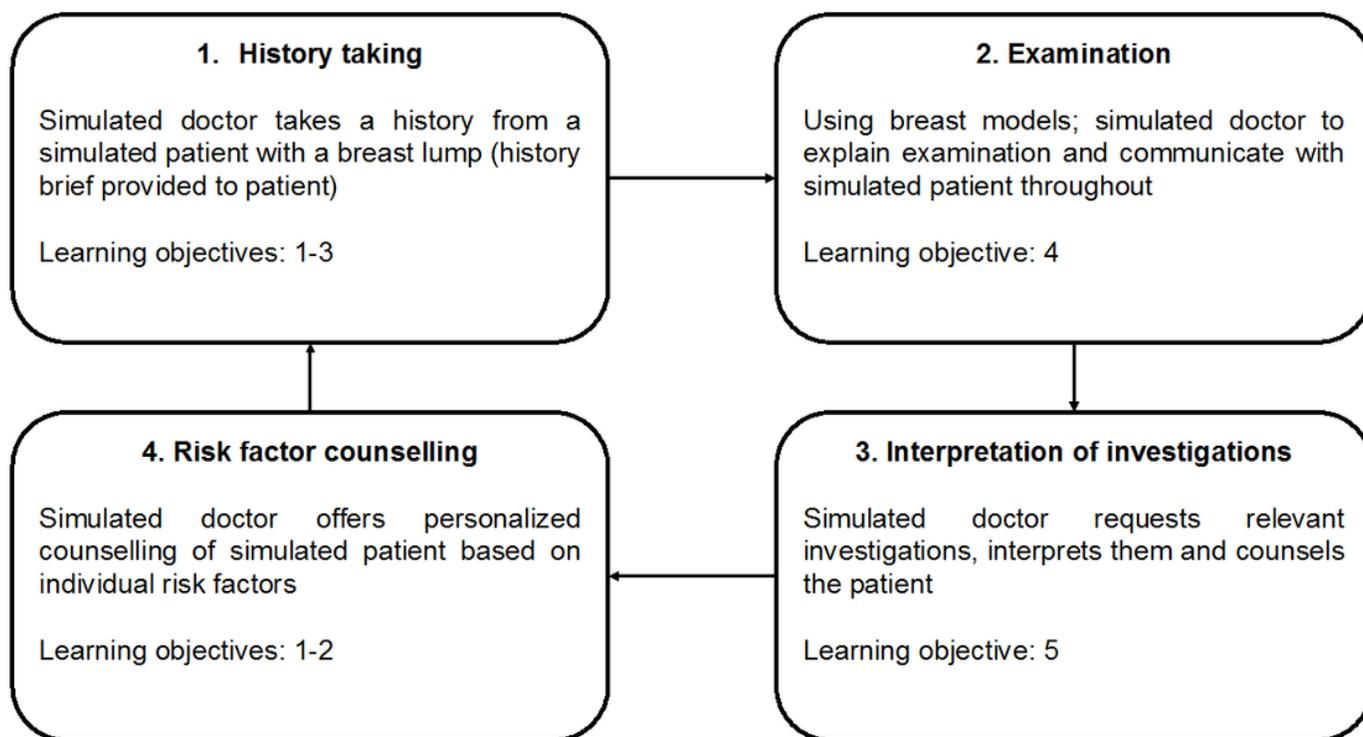


Figure 1

Format of the breast surgery clinic session with learning objectives (numbered in Table 1) mapped to each station.

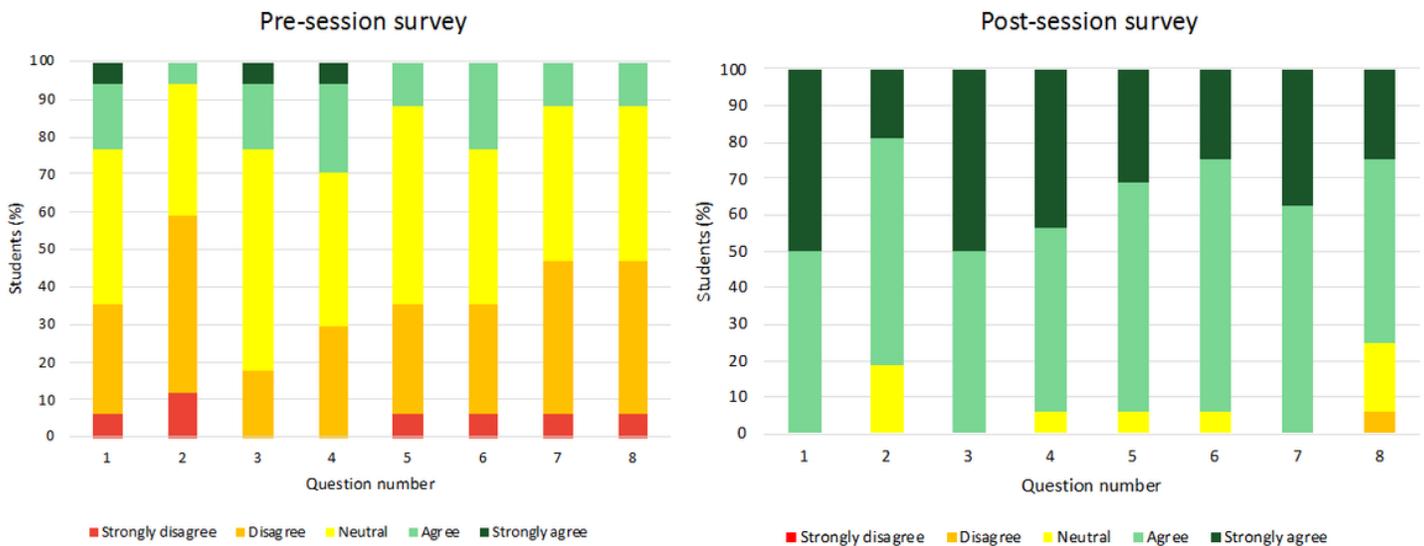


Figure 2

Pre- and post-teaching survey responses. Numbered questions refer to those in Table 1.

## Supplementary Files

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