Instrument for the evaluation of higher surgical training experience in the operating theatre

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Abstract

Introduction Surgical trainees have to achieve a set level of operative competence under the timeframe set by the intercollegiate surgical curriculum. The operating theatre as the primary learning environment needs to be conductive to achieve successful training. In this project, we developed and validated a 27-item questionnaire which aims to evaluate the training experience of higher surgical trainees in the operating theatre. Methods Initial questionnaire was developed by reviewing existing instruments. The questionnaire was then modified in a focus group to explore themes perceived to be important to training. The modified questionnaire was sent out to obtain the content validity index (CVI) of each item. Lastly, the final version was disseminated and Cronbach's alpha was derived to measure the internal consistency of the questionnaire. Results The Initial version of 33 questions was modified in focus group into a 29-item 4-point Likert scale questionnaire covering three areas. 14 responses were received from higher surgical trainee and consultants to determine the CVI. 27 out of 29 items reached the threshold index of 0.87. Finally, the 27-item questionnaire achieved a Cronbach's alpha of 0.88 from 17 responses. Discussion The Cronbach's coefficient of 0.89 in the resultant questionnaire is comparable to other existing medical education evaluation tools, which indicates a high internal consistency. Our validated questionnaire can be utilized to identify areas that needs to be improved as perceived by higher surgical trainees and to improve their training experience in theatre.

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Methods

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Results

The Initial version of 33 questions was modified in focus group into a 29-item 4-point Likert scale questionnaire covering three areas. 14 responses were received from higher surgical trainee and consultants to determine the CVI. 27 out of 29 items reached the threshold index of 0.87. Finally, the 27-item questionnaire achieved a Cronbach's alpha of 0.88 from 17 responses.

Discussion

The Cronbach's coefficient of 0.89 in the resultant questionnaire is comparable to other existing medical education evaluation tools, which indicates a high internal consistency. Our validated questionnaire can be utilized to identify areas that needs to be improved as perceived by higher surgical trainees and to improve their training experience in theatre.

Key Points:

1. The operating theatre being the primary learning environment for trainees to acquire procedural skills, needs to be optimized to ensure effective training can take place
2. We developed a 27-item questionnaire which aims to evaluate the training experience of higher surgical trainees in the operating theatre
3. The content validity index and Cronbach's α both indicate that our instrument has a high content validity and internal consistency compared to similar evaluation questionnaire
4. Three themes are perceived to be important for higher surgical training: trainer support & supervision, operating opportunities and theatre atmosphere.
5. Our instrument is applicable across surgical sub-specialties and can be easily adapted for other training programs.

Word count: 2311

Keywords: Learning Environment, Self-Assessment Questionnaire,Surgical Training

Introduction

Surgical training in the United Kingdom consists of a well-defined curriculum set by the Intercollegiate Surgical Curriculum Project (1). In order to meet the outcome of this curriculum and progress through different stages in their training, surgical trainees need to demonstrate competency in specialty-based knowledge, clinical judgement and operative skills at each benchmark review. Given the time constraints from the European Working Time Directive and general service provision within the NHS, educational opportunities are limited and these opportunities need to be utilized strategically (2). The operating theatre being the primary learning environment for trainees to acquire procedural skills, needs to be optimized to ensure effective training can take place.

The operating theatre as a learning environment is well studied in current literature (3,4). Common themes of such a conductive learning environment include relationship-based mentoring, availability of time and structured teaching (5). Trainees' positive perception on the quality of the learning environment is imperative for successful training (3,6). As such, studies on evaluating the learning environment in the form of trainee-led feedback questionnaire have been performed in the past. Notable examples include the Postgraduate Hospital Education Environment Measure (7) and the Anaesthetic Trainee Theatre Education Environment Measure (8). An effective feedback instrument will allow trainers to identify the strengths and weaknesses in the learning environment, guide future changes, and ensure successful training. Regarding feedback instrument for the theatre learning environment, the Cassar questionnaire was developed almost two decades ago and is orientated towards basic surgical trainees (9). In this study, we built on the Cassar questionnaire and developed an updated feedback instrument that reflects the evolvement of surgical training in the past twenty years and tailored this instrument towards higher surgical trainees. This instrument was then validated in a three-stage validation process and is currently utilized in our local specialty training program.

Methods

Initial Development of Items

We identified The Surgical Learning Educational Environment Measure (9) and used this as a starting point in the development of our instrument. This questionnaire developed by Cassar was principally aimed at basic surgical trainees, we therefore removed the items that are less relevant to higher surgical trainees. Further changes were made after reviewing the Anaesthetic Theatre Educational Environment Measure (8), the Postgraduate Hospital Education Environment Measure (7) and the Dundee Ready Education Environment

Measure (10). The initial items for inclusion in our own questionnaire were then put through a validation process initially with a focus group.

Focus Group

This first version of the instrument was taken to a focus group of locally recruited higher surgical trainees. The focus group was facilitated by the authors. Their views on the items in the instrument were explored. Discussions were focused on review of the proposed item set, if any further relevant items should be added and if the wordings of the items need to be changed. The end product was then taken to the second stage of the validation process.

Content Validity and Internal Consistency

The second version of the instrument was sent out to the local higher surgical trainees and consultant trainers of various surgical subspecialties. They were asked to review the instrument and determine how relevant each individual item is when assessing the theatre learning environment. Each item was scored on a Likert scale of 1 (not relevant, can be excluded from the instrument) to 4 (highly relevant, must be included in the instrument). Two content validity index values (CVI) of each item were independently derived from the scores in the trainee and trainer group. Seven higher surgical trainees and seven consultant trainers were involved in this process, the acceptable CVI values of panel of this size is 0.83 (11). Only items which have reached a cut-off CVI score in the trainee group were included in the third version of the instrument. CVI scores in the trainer group were used to compare and contrast with the scores in the trainee group.

The third version of the instrument was sent out to the local higher surgical trainees. They were asked to complete the questionnaire regarding their training experience at their current rotation. Each item was scored on a Likert scale of 1 (strongly disagree) to 4 (strongly agree). The scores are reversed in negatively worded items. Cronbach's α was derived from these responses for the overall instrument, as well as the three subdomains that the instrument aims to measure: trainer support and supervision, operating opportunities, and theatre atmosphere.

Reporting Guidelines

This study was reported in accordance to SQUIRE guideline

Ethical Consideration

This study was registered with our hospital clinical governance department and compliant with our institutional ethical guideline

Results

Focus Group

The first version of the instrument consisted of 33 questions covering three subdomains: trainer support and supervision, operating opportunities, and theatre atmosphere. Eight higher surgical trainees in otolaryngology were present in the focus group and the discussion lasted for 27 minutes. Their views of the attributes of a conductive learning environment in the operating theatre were explored. There was consensus that the three subdomains are appropriate qualitative measures and important factors in forming the learning environment in the operating theatre. Five items were thought to be redundant or non-specific, subsequently removed or integrated into existing items (table. 1). Item "*I can comfortably express my preference to if music is played in theatre* " was added. At the end of the focus group, the instrument consisted of 29 items and this version was taken to the second stage of the validation process.

Content Validity Index

From the responses collected from higher surgical trainees, 20 items (69.0%) had a CVI of 1, 7 items (24.1%) had a CVI of 0.86, 1 item (3.4%) had a CVI of 0.71 and 1 item (3.4%) had a CVI of 0.43. The critical CVI cut-off for a panel of seven is 0.83 (11). Item "*The theatre staff are friendly* " with a CVI of 0.71 and item 29

"*I feel that I can freely give preference to if music is played in theatre* " with a CVI of 0.43 were removed. 27 items which have reached the cut-off CVI from trainee responses were included at the end of this validation stage. From the responses collected from consultant trainers, 27 items reached the cut-off CVI of 0.83. Item "*I get bleeped during operations* " had a CVI of 0.71 and item "*I can comfortably express my preference to if music is played in theatre* " had a CVI of 0.43.

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The 27-item questionnaire received 17 responses from the local higher surgical trainees. Cronbach's α of the overall questionnaire was 0.88. Of the three subscales in the instrument, Cronbach's α was 0.81 in trainer support and supervision, 0.77 in operating opportunities and 0.67 in theatre atmosphere.

Scores of final 27 items

The mean score of all the respondents was 62.5 (range 51 – 75, SD 8.60). With *strongly disagree* converted to 0, *strongly agree* converted to 3 and reversed scoring on negatively worded items, the minimal and maximal score obtainable in the instrument on the 4-point Likert scale was 0 and 81. This derives a mean percentage score of 77.2% in the overall instrument. The percentage score of the three subscales were 84.0% in trainer support and supervision, 69.4% in operating opportunities and 80.7% in theatre atmosphere. Item "*I feel that I have autonomy in theatre* " had the highest percentage score of 90.2% and item " *There is too much time pressure on elective lists for me to get the most out of theatre teaching* " had the lowest percentage score of 56.9%.

The final instrument at the end of the validation process consists of 27 items (Appendix. 1)

Discussion

The operating theatre as a learning environment is unique that it is a high-risk environment and shaped heavily by human factors. Modern surgical training curriculum often incorporates skills lab and simulations to navigate this. However, non-technical skills such as team work, leadership and situation awareness are difficult to address in a simulated environment (12). Compounded by the lack of suitable analogous surgical models for the simulation of procedures, the operating theatre remains the predominant learning environment for trainees to acquire both technical and non-technical skills despite recent technological advances. Therefore, it is imperative that the theatre learning environment is evaluated regularly to address its deficiencies as perceived by trainees themselves in order to enhance learner performance.

In our study, items were taken from the widely used Cassar Surgical Theatre Educational Environment Measure and discussed in a focus group of higher surgical trainees. The Cassar instrument has been adapted and validated in various studies aimed at different populations (13–15). In these studies the subscale structure of the instrument had largely preserved in their factor analysis, hence it is not surprising that the participants in our focus group agreed on the three existing subscales in being the main constructs in the theatre learning environment. Similarly, like the aforementioned studies, population and discipline-specific factors had precipitated the collapse of items in our version of the instrument which aimed at higher surgical trainees. "*I am too busy doing other work to go to theatre* " was removed as trainees felt the item was not applicable to them because higher surgical trainees will have protected theatre sessions incorporated into their job plan. "*I am so stressed in theatre that I do not learn as much as I could* " was removed as trainees felt that this statement did not identify any elements in the learning environment as the source of stress and could be interpreted as trainees not coping with the program.

The CVI and Cronbach's α both indicate that our instrument has a high content validity and internal consistency. Two items were excluded from the instrument because they did not reach a critical CVI after being reviewed by the panel of higher surgical trainees. It is surprising that item "*The theatre staff are friendly* " did not reach the critical CVI as theatre staff personalities has been found to be a consistent theme in influencing the theatre atmosphere and hence, the learning environment (8,14). This could be because the item was perceived to be redundant as there are already other items addressing theatre nursing staff and anesthetists in the instrument. The friendliness of theatre staff was also accessed by item "*I feel part*

of a team in theatre ", therefore the removed item was not assessing a unique element and hence would not reduce the overall scope of the instrument. Item "*I can comfortably express my preference to if music is played in theatre* " had the lowest CVI of 0.43 in both higher surgical trainee panel and consultant trainer panel. Interestingly, this was an extra item added upon discussion with the focus group in the initial stage of the study. Participants felt that music improves the calmness and atmosphere of the theatre. Current literature supports this view but suggested that music can also be distracting and cause impaired communications (16). Studies have also shown that surgeons were the more empowered group amongst theatre staff when it comes to choosing music (17). However, the importance of this was not recognized by either panel in our study.

Cronbach's α of the final 27-item instrument was 0.88. This is comparable to similar established instruments, such as the Surgical Theatre Educational Environment Measure (0.877) (9) and the Postgraduate Hospital Education Environment Measure (0.899) (18). When looking at individual Cronbach's α in the three subscales, these values are also in range with studies that had broken down the Postgraduate Hospital Education Environment Measure into individual subscales (19).

Although the aim of our study is to develop and validate a feedback instrument, the initial responses from higher surgical trainees were also analysed in order to provide a current view of the theatre learning environment. The mean score of our study population (77.2%) was similar to the mean score of the Surgical Theatre Educational Environment Measure (74.4%) (9). Similarly, operating opportunities had the lowest subscale score compared to the other subscales. This may reflect that naturally, opportunities for trainees to operate is the most challenging aspect to optimise in the learning environment as this is dependent on multiple factors such as variety of cases and time pressure.

A conductive learning environment has been shown to be associated with improved learner performances and help develop the trainees' surgical confidence (20). By regularly evaluating how trainees perceive their training experiences in the operating theatre, programs can identify areas that needed to be improved on to ensure successful training. The limitation of our instrument lies within the validation process as only local higher surgical trainees were involved and thus could incur a systemic selection bias. Factors and items perceived to be important could be population-specific, making the instrument only applicable to surgical training programs with similar curriculum structure and work culture. This is particularly relevant in the United Kingdom with the introduction of the revised curriculum in August 2020, as surgical training across sub-specialties have been largely unified with Generic Professional Capabilities and Capabilities in Practice. Nonetheless, the transparent development and validation process depicted in our study can be easily adapted by other institutions or specialty training programs, thereby creating feedback instrument that is targeted at clinical learners at different level and the wider clinical learning environment.

Table.1 Items removed in focus group

Appendix.1 Instrument for the evaluation of higher surgical training experience in the operating theatre

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