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Exploring the Use of High and Low Demand Simulation for Human Performance Assessment during Multi-Organ Retrieval with the Joint Scrub Practitioner

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ABSTRACT

Introduction. The National Organ Retrieval Service (NORS) 2015 review recommended a Joint Scrub Practitioner for abdominal and cardiac teams during combined organ retrieval. To evaluate the feasibility of this role, and to understand the functional implications, this study explores the use of simulation and provides a novel and comprehensive approach to assess individual and team performance in simulated multi-organ retrievals.

Methods. Two high fidelity simulations were conducted in an operating theatre with porcine organs, en bloc, placed in a mannequin. For Donation after Brainstem Death (DBD) simulation, an anaesthetic machine provided simulated physiological output. Retrievals following Donation after Circulatory Death (DCD) began with rapid arrival in theatre of the mannequin. Cardiothoracic (lead surgeon) and abdominal (lead and assistant surgeons; joint scrub practitioner, n=9) teams combined for the retrievals. Data collected before, during and after simulations used self-report and expert observers to assess: attitudinal expectations, mental readiness, mental effort, non-technical skills, teamwork, task workload, and social validation perceptions.

Results. Attitudinal changes regarding feasibility of a Joint Scrub Practitioner for DBD and DCD are displayed in Figure 2. There were no significant differences in mental readiness prior to simulations nor in mental effort indicated afterwards; however, variance was noted between simulations for individual team members. Non-technical skills were slightly lower in DCD than in DBD. Global ratings of teamwork were significantly ($p<.05$) lower in DCD than in DBD. Measures of attitude indicated less support for the proposed Joint Scrub Practitioner role for DCD than for DBD.

Discussion. The paper posits that the Joint Scrub Practitioner role in DCD multi-organ retrieval may bring serious and unanticipated challenges. Further work to determine the feasibility of the NORS recommendation is required. Measures of team performance and individual psychological response can inform organ retrieval feasibility considerations nationally and internationally.

WHAT THIS PAPER ADDS

What is already known:

- A joint scrub practitioner model had worked previously in DBD retrievals in Scotland, but there was no experience of this approach in DCD retrievals or elsewhere in the UK.
- Assessing the influence of individual and team factors on team performance in simulation-based training and feasibility studies is critical.

What this study adds:

- This simulation suggests that the Joint Scrub Practitioner role in DCD multi-organ retrieval may bring serious and unanticipated challenges.
- This is the first study to explore individual psychological and teamwork measures in simulated multi-organ retrievals, thus providing a novel and comprehensive approach to the assessment of human performance in this context.

INTRODUCTION

The National Organ Retrieval Service (NORS) review published in May 2015 recommended a reconfiguration of organ retrieval team structure across the UK to introduce a Joint Scrub Practitioner role,[1]. Normally each scrub team in the UK would have its own scrub practitioner (one for each abdominal team and one for each cardiothoracic team). A joint scrub practitioner for combined abdominal and cardiothoracic retrieval in Scotland had worked previously for several years, but only in Donation after Brainstem Death (DBD) retrievals. DBD procedures are conducted with detailed and methodical surgical techniques, as the organs are maintained with warm oxygenated blood until the moment of preservation. By contrast, Donation after Circulatory Death (DCD) retrieval involves a 'super-rapid' approach to preserve the organs many minutes after the blood supply has ceased. The higher risk of losing organs due to warm ischemic injury results in significantly increased time pressure in DCD retrieval in comparison with DBD.

Adverse physical stress along with excess cognitive loading in organ retrieval is a significant concern, yet there are no published studies which explore this serious problem. Combined cardiothoracic and abdominal DBD retrieval involves a surgical procedure lasting approximately 4 hours. During this time, the two surgical teams generally alternate at the operating table during the operative phase prior to cold preservation ('warm phase'; ~3 hours). The warm phase dissection seeks to prepare the organs for rapid removal after preservation. This is followed by the 'cold phase' dissection when the organs are removed as quickly but as carefully as possible, without damage, and ensuring the organs are safe to transplant.

In DCD retrieval, 4 hours of surgery must be condensed into approximately 1 hour. Both teams must operate simultaneously, as fast as possible, despite inadequate space at the table. Too slowly, and the organs will be damaged by passive warming in the body. Too quickly, and the organs will be damaged by surgical haste. Removing one scrub practitioner, who is minimising delay by anticipating instruments and techniques, could lead to an intolerable escalation in cognitive loading with consequent organ loss.

Although there was experience in Scotland with one abdominal and one cardiothoracic team working together with a single, 'joint' scrub practitioner in DBD retrievals, there was no experience of this approach in DCD retrievals. The joint scrub practitioner model evolved in Scotland when there were no DCD retrievals, and retrieval volumes were low. This was before the NORS system was introduced, and when it was common to attend combined retrievals with the same abdominal and cardiothoracic teams most of the time, which allowed for a gradual evolution of shared practice. Today the situation is different, as volumes have doubled, and it is difficult to predict which abdominal and cardiothoracic teams will combine for retrievals. This prevents shared learning and raises widespread concerns that the introduction of a new team structure would be detrimental to team performance.

Elsewhere in the UK, there was no experience of different teams working together with a single scrub practitioner in DBD or DCD retrievals. We therefore determined to investigate the feasibility of the joint scrub practitioner model in DBD and DCD retrieval, and to compare cognitive aspects between the two.

Simulation-based team training in healthcare has been increasingly adopted in the last decade; and the seriousness of organ retrieval mandates that a simulation approach be used in the first instance to determine the feasibility of the joint scrub practitioner,[2, 3]. Every donation counts and there could be a significant risk to staff, and surgical safety and quality, if the new configuration was implemented without a clear evidence base. Assessing the influence of individual and team factors on team performance is critical, yet not routinely included in simulation-based training,[3-6]. This is the first study to explore individual psychological and teamwork measures in simulated multi-organ retrievals, thus providing a novel and comprehensive approach to the assessment of human performance in this context.

Organ retrieval is cognitively and technically demanding, requiring the co-ordinated teamwork of specialist staff,[7]. Although individual expertise is important, effective coordination is essential to achieve expert team performance and satisfactory outcomes,[8]. Surgical teams often consist of individuals with diverse levels of expertise, training history, and experience. Individual team members receive extensive training in their respective disciplines, but much less training on how to interact and work as a team,[4, 9, 10]. Moreover, such multidisciplinary teams frequently work under challenging conditions involving high stress, fatigue, and time pressure,[4, 5, 11, 12]. Effective teamwork is therefore crucial for successful service delivery in organ retrieval and to reduce the likelihood of errors occurring in such pressured circumstances,[5].

The technical performance of surgeons relies partly on effective collaboration, dependent on cognitive and interpersonal skills,[13]. These nontechnical skills are defined as ‘cognitive and social skills that underpin knowledge and expertise in high

demand workplaces',[14; p. 5]. Four categories of non-technical skills required for effective surgical performance [NOTSS; 15, 16] have been identified: situation awareness, decision making, communication and teamwork, and leadership. Nontechnical skills and individual psychological factors are essential to effective team performance at each retrieval event, and for staff to manage successive demands of repeated retrieval,[15, 17-20]. In contrast to DBD, DCD donation is associated with greater risks of graft failure and complications, which adds additional complexity to the work of organ retrieval teams,[21].

The objective of the study was to assess individual psychological and teamwork variables, across two simulated conditions that varied in complexity and time pressure (DBD: low demand and DCD: high demand), to compare the cognitive aspects, and to determine the feasibility of the proposed new team configuration. Although this research was exploratory, and the key aim was to establish relevant variables and uncover directions for future research, the scenarios were structured to explore the hypothesis that simulated DCD and DBD retrievals were quantitatively distinct undertakings in the single scrub practitioner scenario. Best practice for comprehensive team performance measurement in simulation-based training in healthcare suggests multiple measures are necessary,[4], including measures of behavioural, cognitive, and attitudinal components of performance,[5]. Thus, to ensure rigour and the highest quality study design possible, each of these aspects were included. This paper is important as it explores the use of simulation to foresee potential challenges and directly informs the feasibility considerations of the proposed new team reconfiguration. Additionally, it offers a new approach by being the first study to

examine individual and team performance measures in multi-organ retrieval simulations.

METHODS

Simulation design

Simulations of DBD (Scenario 1) and DCD (Scenario 2) multi-organ retrievals were undertaken at the Scottish Centre for Simulation and Clinical Human Factors (SCSCHF), Larbert, Scotland. The simulation day was attended by the Edinburgh abdominal team and the Newcastle cardiothoracic team. Both retrievals were performed in an operating theatre, with a mannequin containing porcine heart, lungs, liver, and kidneys, en bloc. Physiological parameters were provided by the simulated anaesthetic monitors during the DBD retrieval, whereas the simulation of DCD retrieval, which occurs after circulatory death, did not involve such data. Both simulations were observed via one-way mirror by expert clinicians (scrub practitioners and a surgeon) and human performance science researchers. The simulation scenarios, designed by experienced organ retrieval staff, included information on age of donor, cause of death/injury, medical history, medications, allergies, and organs placed. The Supplementary Material Scenario 1 DBD and Supplementary Material Scenario 2 DCD contain full details of the simulation set up, including description of the donor's medical history provided with each scenario, theatre preparation, mannequin set up and donor operative procedure. Ethical approval for the study was granted by the relevant institutional ethics committee of the University of Edinburgh.

Participants

The sample for the study included all members of the abdominal and cardiothoracic surgical teams participating in the simulated multi-organ retrieval (n=9). The team comprised Lead Cardiothoracic Surgeon, Lead Abdominal Surgeon, Assistant Abdominal Surgeon, Joint Scrub Practitioner, Specialist Nurse for Organ Donation (SNOD), and four theatre staff members responsible for organ preservation and perfusion. Members of the operating team comprised 6 males and 3 females (age range 29 to 49; experience range 6.5-27 years). Further demographic information is presented in Table 1, though individual details of age and gender are not provided to preserve anonymity of participants.

Table 1 – Participant Demographic Information

		Years of experience	
Simulation Role	Professional Role	In current role	In total
Joint Scrub Practitioner	Staff Nurse	6	7
Cardiothoracic Lead Surgeon	Peri CCT National Fellow in Cardiothoracic Transplantation	12	18
Abdominal Lead Surgeon	Transplant Surgeon (Registrar)	2	7
Abdominal Assistant Surgeon	Transplant fellow	0.66	8
Specialist Nurse Organ Donation	Specialist Nurse Organ Donation	0.66	25
Theatre Staff 1	Staff Nurse - Team Lead	0.58	10
Theatre Staff 2	Abdominal Organ Preservation	14	27
Theatre Staff 3	Perfusionist	6.5	6.5
Theatre Staff 4	Senior ODP (Organ Perfusion Practitioner)	0.25	26

Measures

Measures were selected based on the following criteria: previous use within performance contexts (e.g., expedient to complete and with minimum intrusion), strong validity and reliability statistics, endorsement within the field, offer a combination of behavioural, cognitive, and attitudinal assessment, and most appropriate to meet the study objectives. Further details can be found in the Supplementary Material Methods.

Attitudinal expectations. Assessed via response to two statements addressing attitude to the proposed reconfiguration, which were developed for this study. Respondents were asked to indicate if they agreed or disagreed that; (1) a single scrub practitioner could perform the task, and (2) the reconfiguration was a good idea. Responses were made on a 5-point Likert scale (strongly agree to strongly disagree).

Mental readiness. The Mental Readiness Form Likert,[MRF; 22, 23] was used to determine levels of cognitive anxiety, somatic anxiety, and self-confidence. The form consisted of three separate items with 11-point Likert scales. Each respondent indicated the level that corresponded to how they currently felt. Verbal anchors for the scales were: ‘worried – not worried, ‘tense – not tense’ and ‘confident – not confident’ to assess cognitive anxiety, somatic anxiety, and self-confidence respectively.

Mental effort. The Rating Scale of Mental Effort,[RSME; 24] measured the mental effort invested in the task performance via a unidimensional rating scale presented as a vertical axis with a range of 0 to 150. Three verbal anchors on the scale corresponded to 0 (not at all effortful), 75 (moderately effortful), and 150 (very effortful). Participants marked the axis with a single horizontal line to indicate how much effort it took to complete the task.

Non-technical skills. The Non-technical Skills for Surgeons,[NOTSS; 25] and the Scrub Practitioners' List of Intraoperative Non-Technical Skills,[SPLINTS; 26] systems were combined to create a single observation system for the non-technical skills of organ retrieval teams. Previously these behaviour observation systems were developed to assess non-technical skills in simulated and live theatre environments, using a prescribed list of non-technical skills necessary for performance as a surgeon or as a scrub practitioner. Good and poor example behaviours relating to each skill were provided, and a rating scale from 1 to 4 was used to rate behaviours,[16, 17, 27, 28].

Teamwork. The Team Emergency Assessment Measure (TEAM) was designed to assess the performance of healthcare teams,[29-31]. This instrument consisted of 12 items asking the participants how they perceived the team performed across the duration of the task (e.g., leadership, communication, and morale). Eleven items were rated on 0 to 4 scale, with verbal anchors ('never/hardly ever', 'seldom', 'about as often as not', 'often', and 'nearly always/always'). The final item asked participants to give a global rating of the team's performance on a scale from 1 to 10.

Task workload. Task workload was measured for the Joint Scrub Practitioner using the National Aeronautics and Space Administration – Task Load Index [NASA-TLX; 32]. This tool provided a subjective measure of workload and has been applied in various high-risk domains, including healthcare and nursing,[32, 33, 34]. In contrast with the unidimensional effort rating scale of RSME, this instrument determines the individual contribution to workload from six sources; mental, physical, and temporal demands, frustration, complexity, and performance. In addition to the standard NASA-TLX procedure, and to track momentary changes in workload, the Scrub Practitioner

was asked to identify key stages in the team performance and indicate the overall load experienced across time.

Perception of simulation training. A short survey based on the social validation technique,[35, 36] was designed to assess training perceptions of participants. The respondents were asked to indicate on a 7-point Likert scale (Not at all – Extremely) to what extent they agreed or disagreed with the following statements: (1) the learning objectives set for this simulation training are important to me; (2) the procedures used in the simulation training were acceptable to meet the learning objectives; (3) I am satisfied with the results of the simulation training. Additionally, a box below each of the scale was provided to make any additional comments.

Procedure

Participants were familiarised with the aims of the simulation study, read the Information Sheet, and gave written consent to take part. Participants then completed the demographics sheet. Measures were administered during the simulations in the sequence shown in Figure 1. Measures were administered in the same order for the second simulation scenario. Expert ratings of non-technical skills were completed via live observation during both simulated retrievals.

[Insert Figure 1 here]

Data analysis

Attitudinal expectations were compared pre and post and contrasted between the two simulation conditions (DBD – low demand, DCD – high demand). Data collected through MRF and RSME tools, and global ratings of team performance were

subjected to paired samples *t*-test analysis. Self-rated non-technical skills and teamwork components were contrasted between the two conditions and compared with expert assessments.

RESULTS

Attitudes. Figure 2 illustrates attitudinal changes (pre-post) for each simulation condition. Attitude measures taken prior to the DBD scenario showed that 7 participants (78%) thought that a single scrub practitioner 'can' effectively assist both surgical teams during the multi-organ DBD retrieval, and 5 (56%) agreed that team reconfiguration for DBD 'should' be done. The remaining 2 (22%) for 'can be done' and 4 (44%) for 'should be done' neither agreed nor disagreed. Attitudes towards reconfiguration remained mostly positive after the simulated DBD retrieval (can be done: 7 (78%) agreed, 2 (22%) moved from neutral to disagreed; should be done: 5 (56%) agreed, 1 (11%) neither agreed nor disagreed, 3 (33%) moved from neutral to disagreed). Importantly, two out of the three surgeons disagreed that team reconfiguration was a good idea. Prior to the DCD simulated retrieval only 1 participant (11%) agreed, 3 (33%) neither agreed nor disagreed, and 5 (56%) disagreed that a joint scrub practitioner 'can' perform required tasks for an effective DCD retrieval. No participants thought that reconfiguration for the DCD 'should be done', 3 (33%) neither agreed nor disagreed, and 6 (67%) disagreed. The number of those who agreed and those who disagreed that this 'can be done' increased following the simulation (3 agreed, 6 disagreed). In contrast, the number of those who disagreed that it 'should be done' also increased from 6 (67%) pre to 8 (89%) post simulation.

[Insert Figure 2 here]

Mental readiness. The paired samples *t*-test (DCD vs. DBD) analysis showed no significant difference between conditions for all three scales (cognitive anxiety $t(8) = -0.20$, $p = 0.84$; somatic anxiety $t(8) = 1.49$, $p = 0.17$; self-confidence $t(8) = 1.35$, $p = 0.21$; see Table 2). Although the difference was not statistically significant, likely due to the small sample, it is worth noting that the data showed differential changes according to role (surgeon or scrub practitioner). Surgical staff reported being 36% less worried and 40% more confident in DCD simulation compared to DBD, whereas the data from the theatre staff and the scrub practitioner showed an opposite pattern – a 37% increase in cognitive anxiety and a 21% decrease in self-confidence.

Table 2 – Mental Readiness Results: Percentage change from DBD to DCD

	Cognitive Anxiety	Somatic Anxiety	Self-Confidence
Overall Team	↓ 3 %	↓ 16 %	↓ 39 %
Surgeons	↓ 36 %	↓ 50 %	↑ 40 %
Theatre Staff + SNOD	↑ 37 %	↓ 17 %	↓ 21 %
Scrub Practitioner	↑ 22 %	no change	↓ 125 %

Mental effort. Participants reported low to moderate mental effort invested in the task performance for both simulated conditions. A mean rating of 62.87, SD = 21.13 was reported in the first scenario, and a mean rating of 61.12, SD = 28.83 in DCD retrieval (75 was the anchor point for Moderately Effortful). This difference between two conditions was not significant with $t(7) = 0.31$, and $p = 0.76$.

Non-technical skills and teamwork. Non-technical skills and teamwork were self-assessed to be lower in the DCD scenario than DBD, and a similar trend was observed in expert ratings of these constructs. Global ratings of team performance were significantly lower in the DCD scenario (9.22, SD = 0.83), than in the DBD (8.22

SD) scenario, t (8) = 3.00, $p < 0.05$. Overall, there was little variation in the scores for non-technical skills and specific teamwork ratings across the sample in both simulations. For example, in the self-assessed non-technical skills data out of 252 total ratings (14 non-technical skills, 2 scenarios, 9 participants), 'marginal performance' was reported only twice and by the same participant, 'not applicable' was chosen 35 times, and the remaining 217 ratings were 'acceptable' or 'good'. Expert ratings showed even less variation and 23 out of 28 mean scores were 4 out of 4, indicating a ceiling effect.

Task workload. The results of the NASA-TLX measure identified different patterns of task workload in DBD and DCD simulated retrievals. As shown in Figure 3, in the DCD simulation, mental demand, temporal demand, and frustration components of the workload were rated higher than in DBD. While in the DBD simulation, physical demands and effort were rated higher than in DCD. The patterns of momentary changes for DBD and DCD retrievals also varied.

[Insert Figure 3 here]

Perception of simulated training. Overall the participants of this study had a positive perception of the simulation training day. They perceived the task to be important (M = 6.44, SD = 0.73), thought the training procedures were acceptable (M = 5.11, SD = 1.45), and were satisfied with the results (M = 5.55, SD = 1.23). Despite positive ratings, a number of participants disclosed concerns about how the simulated experience would translate into real life DCD retrieval. Below is a comment left by one participant indicative of this concern:

I don't feel they are an accurate depiction of what a real retrieval is like. The communication side of things including the brief was excellent and the equipment and organs helped it to seem real in one respect, but the actual retrieval procedure was not. It is usually a mad 10 minutes in a DCD with lots of shouting and everyone rushing as fast as they can and this was not transferred to the training simulation today. Therefore, I don't think a decision can be made about the effectiveness of one nurse in a DCD retrieval based on this. – Theatre Staff Member

DISCUSSION

The analysis of attitudinal changes indicated that proposed reconfiguration of organ retrieval teams for DCD multi organ retrieval was not supported by the participants in this study. This is consistent with the conclusions drawn by the clinical observers of the simulation event, presented at the National Organ Donation and Transplantation congress,[37]. The results of the current study provide valuable information on relevant individual and team factors that can further inform the feasibility considerations of the proposed reconfiguration and have important implications for the design of the future simulation-based training for organ retrieval teams. This study also highlights the value of using simulation to identify the impact of proposed changes on human performance.

The self-reported mental readiness measurement did not indicate an overall change in cognitive anxiety, somatic anxiety, or self-confidence between the two conditions. Moreover, scores were slightly higher in the first condition, which may indicate that participants became familiar with being in the environment of the

simulation centre by the time the second scenario commenced. This suggests that the 'order of events' may have had an impact on the data collected during simulation. Data obtained via the MRF, has important implications for future training design, as it indicated that the simulation environment failed to recreate the pressure of the DCD multi organ retrieval,[38].

Low levels of mental effort invested in the task performance reported by the participants, and the feedback gathered via social validation survey, also indicated that the DCD scenario was not perceived as more challenging than DBD in this simulated event. Since it is widely acknowledged by staff that DCD retrievals are much more pressured than DBD, this has to be transferred into the simulation training environment,[4, 6]. This may be achieved through introducing stressors such as noise, interruptions, and time pressure that are typical in the operating theatre,[39] and are easy to reproduce in the simulated environment. Moreover, the order of scenarios has to be considered to account for practice and carryover effects associated with repeated measures design,[40].

The changes in cognitive anxiety, somatic anxiety, and self-confidence were indicative of increased pressure experienced by the Scrub Practitioner. However, a number of limitations have to be taken into consideration when interpreting these results. Firstly, the trait anxiety of the participants was not measured, which may have affected the findings. Secondly, only one individual performing the Joint Scrub Practitioner role was assessed in this study, so these results cannot be generalised. Finally, the focus of the simulation day was on the evaluation of this role, which may explain why this individual felt more pressure than the rest of the organ retrieval team.

Thus, in order to draw conclusions regarding the feasibility of role reconfiguration further research is necessary.

The low variations in rating scores gathered through teamwork and non-technical skills assessments, indicated a possible ‘ceiling’ effect, and suggests that further training of expert observers may be required to collect meaningful data,[5, 17, 27]. Moreover, a more sensitive rating scale, than the one used in NOTSS,[25] and SPLINTS ,[26] may be required to assess team performance and non-technical skills in organ retrieval. The combination of these two rating systems adapted to the organ retrieval context received very positive feedback from the expert observers, suggesting further development and validation of this tool as a potential avenue for future research in the assessment and training of non-technical skills in organ retrieval.

The results of the NASA TLX measurement provided insight into the different factors that contribute to task workload and have significant implications for future training. Once main sources of workload are identified they can be targeted by specific training or reorganisation of the work process. Of the six subscales, mental demand and time pressure contributed most to the perceived workload of the Scrub Practitioner in the DCD simulated retrieval. These results suggest that any further training and reorganisation of the work process should focus on decreasing the mental demands and time pressure of the task on the Joint Scrub Practitioner. There is scope for further research to identify the cognitive demands on scrub practitioners in DBD and DCD retrieval.

Human performance data collected during this innovative simulation provided novel and valuable information on individual and team factors which can contribute to

feasibility considerations for proposed changes to organ retrieval teams. Moreover, this study suggests that despite limitations simulation can contribute significant information to determining the impact of proposed changes in protocol. Importantly, the paper posits that there are serious and unanticipated changes to the Joint Scrub Practitioner role in DCD multi-organ retrieval that should be explored more fully. Given the overall attitudes expressed towards the proposed reconfiguration, and the conclusions drawn by clinical observers, it is unlikely that implementation of the NHSBT recommendation is possible without major adjustments to working practices and training of the organ retrieval teams. Although further work to determine the feasibility of the NORS recommendation is required, the use of simulation provided a safe environment to identify the physical and practical issues of the proposed change in protocol and allowed the research team to test the gathering of Human Performance Assessment data to inform future in-situ data collection.

The methods employed during this study also revealed a number of important considerations to inform the planning of future simulation-based training events, including the need to: increase the demands of simulation training, enhance the training of expert observer raters, utilise more sensitive rating scales, and consider the order effect of scenarios. As demonstrated in this study, human performance measures utilised in this training environment offer both a practical and time efficient means of assessment, and can be contextualised for organ retrieval teams. Although, it is problematic to spot meaningful differences using statistical analysis on a small sample and generalise such findings to wider population, the numerical ratings used in this study are very effective to gain rapid information and are appropriate for use in and immediately following simulation to gather self-report data from all participants at

once. Furthermore, human performance assessment of multi organ retrieval teams is hugely important, offers powerful data, and brings new insight and understanding to surgeons and retrieval staff nationally and internationally.

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The results of this study have been previously presented in poster format at international and national conferences:

Martindale A, Richards H, Morozova G, Stirling J, Currie I. Human performance assessment of multi-organ retrieval with the joint scrub practitioner in the United Kingdom. 2017. Poster session presented at European Society for Organ Transplantation, Barcelona, Spain.

Martindale A, Richards H, Morozova G, Stirling J, Currie I. Human performance assessment of multi-organ retrieval with the joint scrub practitioner. 2017. Poster session presented at British Transplant Society Congress, Harrogate, United Kingdom.

Stirling J, Morozova G, Richards H, Martindale A, Currie I. Evaluation of the NORS joint scrub practitioner role in multi-organ retrieval in the United Kingdom. 2016. Poster session presented at European Organ Donation Congress, Barcelona, Spain.

Martindale A, Richards H, Morozova G, Stirling J, Currie I. Assessing changes in individual psychological and teamwork factors for reconfigured organ retrieval team during high and low demand simulation. 2016. Poster session presented at National Organ Donation and Transplant Congress 2016, Warwick, United Kingdom.

CONTRIBUTORSHIP STATEMENT

Gala Morozova (GM) – RA, co-created study proposal, contributed to study design and measures selection, carried out data collection and data analysis, prepared first draft of study report, contributed to preparation and revision of the manuscript for publication.

Amanda Martindale – Co-PI, co-created study proposal, contributed to study design and measures selection, carried out data collection, supervised data analysis and write up by GM, prepared the manuscript for publication.

Hugh Richards – Co-PI, co-created study proposal, contributed to study design, carried out data collection, supervised data analysis and write up by GM, contributed to preparation and revision of the manuscript for publication.

John Stirling – initiated and contributed to study proposal, co-organised the simulation event, facilitated data collection, and reviewed the manuscript for publication.

Ian Currie – initiated and contributed to study proposal, co-organised the simulation event, created simulation scenarios, facilitated data collection, critically reviewed and edited the manuscript for publication.

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