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A comparison of simulation debriefs with traditional needs assessment methods

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ABSTRACT

Objective: To better understand the potential of a needs assessment approach utilizing qualitative data from manikin-based and virtual-patient simulation debriefing sessions compared to traditional data collection methods (i.e., focus groups and interviews).

Design: Original data from simulation debrief sessions was compared and contrasted with data from an earlier assessment of critical care needs in a community setting (using focus groups and interviews), thus undertaking secondary analysis of data. Time and cost data were also examined. Debrief sessions were coded utilizing deductive and inductive techniques. Matrices were utilized to explore the commonalities, differences, and emergent findings across the methods.

Setting: Critical care unit in a community hospital setting.

Results: Interviews and focus groups yielded 684 and 647 minutes of audio-recordings. The manikin-based debrief recordings averaged 22 minutes (total = 130 minutes) and virtual-patient debrief recordings averaged 31 minutes (total = 186 minutes). The approximate cost for the interviews and focus groups was $13,560, for manikin-based simulation debriefs was $4,030 and for the virtual patient debriefs was $3,475. Fifteen of 20 total themes were common across the simulation debriefs and interview/focus group data. Simulation-specific themes were identified, including fidelity (environment, equipment and psychological) and the multiple roles of the simulation instructor (educative, promoting reflection, and assessing needs).

Conclusions: Given current fiscal realities, the dual benefit of being educative and identifying needs is appealing. While simulation is an innovative method to conduct needs assessments, it is important to recognize that there are trade-offs with the selection of methods.

Strengths and limitations of this study:

- Simulation is an innovative methodology to undertake needs assessments
- Utilizing simulation permits the development of an environment that enables the learner to perform naturally and gain insight into the complexity of the actual workplace
- Study adds to the relative dearth of qualitative work in simulation and medical education
- Study sample is relatively small and is performed at a single center
- Cross sectional nature of the study does not permit generalizations

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INTRODUCTION

Calls for innovative strategies in conducting needs assessments (NAs) have been made in the medical literature over an extended period of time.[1–5] Simulation is a valuable educational tool and evaluation/ assessment modality. Through a process of experiential learning and deliberate practice, the use of simulation in health professionals' education has been shown to consistently improve the acquisition of knowledge, skills and behaviors.[6,7] However, there is a paucity of literature on the role of simulation in performing NAs, including the use of simulation to determine system and/or institutional level gaps for change management. Simulation holds potential as a NA method to promote a better understanding of these gaps given that it aims "to develop an environment that enables the learner to perform naturally to gain insight into the complexity of the actual workplace".[8 (p59)] In addition, there is a general lack of qualitative studies in simulation in medical education and a need for rigorous, high quality, qualitative investigations.[9–11]

Recognition and care of critically ill patients in community settings is complex, requiring skilled staff and optimal use of resources at the site, plus a coordinated system for interaction with, and transfer to the referral centre when needed. In 2006, the Critical Care Strategy was announced by the Ministry of Health and Long-Term Care of Ontario, Canada. The purpose of this on-going initiative is to improve access, quality, and system integration to ensure all citizens of Ontario have equal access to high-quality critical care. In keeping with this mandate, a comprehensive NA was completed by members of the current research team, which identified gaps in caring for critically ill patients at a single community hospital.[12] These results provided insights into the needs of a community to optimize care of its critically ill patients, as well as suggestions for how a referral hospital may best support its community site. However, the cost and time required to complete this study was substantial and the process requires streamlining in order to be feasible to implement across numerous sites.

This earlier study included interviews, focus groups, Manikin-Based Simulation (MBS) and Virtual Patient Simulation (VPS), questionnaires and a family survey. Following the MBS and VPS, 20 minute debrief sessions were held, and video recorded. These debrief sessions were not included in the comprehensive NA but rather were included as normal pedagogical practice in providing feedback for simulation participants and to facilitate development of reflective skills for simulation participants.[13] However, upon reviewing the recordings, it was notable that many of the same themes that were discussed in the larger NA were also identified by participants in these debriefs. This serendipitous finding suggested that simulation debriefs could be of value as data for NA either alongside or instead of traditional approaches.

This study aims to better understand the potential of a NA approach utilizing qualitative data from MBS and VPS debriefing sessions to explore the system, team and individual level needs in caring for critically ill patients in a community context, compared to traditional methods (i.e., focus groups and interviews). We also aimed to compare feasibility in terms of time and cost.

METHODS

Secondary analysis has been recognized as an important, yet underutilized research approach.[14] It has been defined as the reanalysis of an existing data set, which may be used to investigate new research questions or verify previous research findings.[14,15] For the current research, original data were compared and contrasted from simulation debriefs with data from the earlier assessment of critical care needs in a community setting, enabling exploration of the current research question from our existing data.

Design and Analysis

Original study data collection and analysis

Full information regarding the original study can be found in Sarti *et al.*[12] Interviews and focus groups were designed to follow a semi-structured, broad, pre-determined line of inquiry that was flexible permitting exploration of themes. Data from each interview and focus group were transcribed, entered into NVIVO software and inductive coding techniques applied informed by Creswell's thematic analysis approach.[16]

Simulation

Simulations were conducted at the community hospital to obtain data on human and social capital at the community hospital, including interdisciplinary team functioning, crisis resource management and critical care knowledge and skills.[6,17,18] The simulation component of the NA consisted of two forms of simulation, MBS (e.g. SimMan) and VPS (e.g. interactive video with patient actors), followed by debriefing sessions guided by the literature.[6,13,18–20] To maximize participants' exposure to the various cases, each team completed two MBS and two VPS sessions. Canadian experts in critical care designed the scenarios to represent prototypical clinical encounters. These scenarios were originally developed for residents in Canada, with the Acute Critical Events Simulation course. The scenarios, which included cases of impending respiratory failure, shock, sepsis and arrhythmias, were reviewed by an interdisciplinary panel, modified to reflect the realities of practice in the community hospital, and were video-recorded. To assess performance during simulation, custom task checklists and two validated global rating scales were completed.[19,20] Only quantitative data from the simulations was included in the original NA,[12] given that debriefs have not been described as NA tools.

The MBS and VPS were followed by a 20 minute debrief session, which were video recorded. The debriefs were designed to establish an engaging and supportive learning environment, promote facilitated reflection and discussion, explore performance gaps and provide feedback to the participants with respect to the scenarios.[21] Facilitators used a blended approach, including focused facilitation to encourage critical reflection and deeper understanding of events and also to provide information through directed performance feedback and teaching.[22] In addition to the standard learner-centred debriefing, participants were encouraged to discuss their practice context and reality.

Time and cost analysis

Time for each of the data collection methods, interviews, focus groups and debriefs, were captured from audio files. Data on the financial costs were captured in budgets and expenditure tracking documents, including equipment, travel expenses and hourly salary rates. MBS specific costs included manikin rental, rental van for transportation. Both MBS and VPS required use of computer programs, a simulation instructor and technologist. Travel was required for both forms of simulation and focus groups. The interviews from the earlier study were held via telephone. The debriefs, interviews and focus groups all required a facilitator, audio recorder, transcriptionist, researcher and research assistant to perform coding and thematic analysis. Investment costs for initial implementation of a simulation program, annual operational maintenance and replacement expenses were not considered. Time and cost to prepare the interview/focus group guides and simulation cases were not included in the analysis, as there was not enough data available to accurately estimate.

Secondary Data Analysis

Data analysis comprised secondary thematic analysis and comparative analysis.[14,15] Comparative analysis was required to compare and contrast the data from the earlier study with the MBS and VPS debriefs.

Thematic analysis of the debriefs was performed.[23–25] Transcripts were entered into NVIVO software. Codes identified in previous work/inquiry were applied to the data.[16] To enhance study rigour multiple coders coded the transcripts, including two researchers who were involved with coding in the original NA (AS, SS), and one researcher who was not involved with coding in the original study (RA). Researchers actively searched for disconfirming data and identification of additional codes; inductive and deductive approaches were utilized. Themes, and their definitions, were decided through researcher discussion and consensus. Qualitative data from the simulation debriefs was contrasted to the qualitative data obtained with the earlier NA (focus groups and interviews). The final analytic component included reading through all the transcripts in each data collection modality (traditional, VPS and MBS) so as to selectively identify areas of convergence and divergence in both the content and structure of the transcript per data collection method.[26]

RESULTS

Participants

There were 31 participants in the focus groups (13 from the community hospital, 11 from the referral hospital and 7 in an inter-hospital focus group; this included 12 physicians, 14 nurses and 5 respiratory therapists (RTs) and 22 participants in the interviews (2 regional leaders, 7 community hospital leaders and 13 referral hospital leaders). In the simulations, there were 13 participants from the community hospital (6 physicians, 6 nurses and 1 RT) who formed 6 teams (see Table 1).

Table 1 Participant demographics Earlier Comprehensive NA	
Interviews	**Total = 22**
Regional leaders	2
Community hospital leaders	7
Referral hospital leaders	13
Focus Groups	**Total = 31**
Community hospital	6-MD, 6-RN, 1-RT
Referral hospital	4-MD, 5-RN, 2-RT
Interhospital	2-MD, 3-RN, 2-RT
Simulation Debriefs	
Manikin-based simulations (MBS)	**Total = 13** **(6 MD, 6 RN, 1 RT)**
Community hospital	6 teams (1-MD, 1-RN +/- RT per team) each team performed 2 MBS cases
Virtual patient simulations (VPS)	**Total = 13** **(6 MD, 6 RN, 1 RT)**
Community hospital	6 teams (1-MD, 1-RN +/- RT per team**) each team performed 2 VPS cases***
MD = physician; RN = nurse; RT = respiratory therapist; ** One VPS was completed by a physician alone (no other team member) ***One team completed only one of the two VPS cases.	

Time and cost analysis

The 22 interviews (average 31 minutes; range 15–48 minutes) and 6 focus groups (average 108 minutes; range 57–154 minutes) yielded 684 and 647 minutes of audio recordings, for a total of 1331 minutes. The MBS debriefs averaged 22 minutes (range 17-30 minutes; total = 130 minutes) and VPS debriefs averaged 31 minutes (range 25-48 minutes; total = 186 minutes). The results of the cost analysis are displayed in Table 2. The total cost for interviews and focus groups was approximately $13,560, for MBS was $4,030 and for VPS debriefs was $3,475.

Table 2: Cost comparison across the data collection tools

Items	Interviews / Focus Groups	Virtual Patient Simulations	High fidelity Simulations
Costs with running the simulations [1]			
Rental Van - Bringing equipment to site	N/A	N/A	**$550**
Facility rates [2]	N/A	No charge	No charge
Manikin daily rental fee	N/A	N/A	**$500**
Computer Software program	N/A	$0 (Newly developed software program Licencing fee)	$0 (Software program owned)
Needles / gauze / syringes / etc. for MBS	N/A	N/A	No additional charge Re-usable materials.
Simulation Instructor [3]	N/A	**$1002** ($1250-$248 for the debrief)	**$1074** ($1250-$176 for the debrief)
Technologist [4]	N/A	**$400**	**$400**
Subtotal	N/A	**$1,402**	**$2,524**
Cost specifically required for the NA / debrief [1]			
Facilitator	**$1332** (22.2hrs x $60/hr)	**$248** (3.1hrs x $80/hr)	**$176** (2.2hrs x $80/hr)
Travel to the site [5]	**$360** ($120 x 3 visits to the site for focus groups)	**$120**	**$120**
Audio recorder	No additional expense (If you have to buy one it is about $250)	No additional expense	No additional expense
Transcription [6]	**$1,434** Interviews = 11.4 data hours x 2.5 transcription hours per hour of data x $20 /hr = 570 FGs = 10.8 data hours x 4 transcription hours per hour of data x $20/hr = 864	**$248** (3.1 hours x 4 x 20 = 248)	**$176** (2.2 hours x 4 x 20)
NVIVO data entry [7]	**$1,554** (22.2 x 35 x 2)	**$217** (3.1 x 35 x 2)	**$154** (2.2 x 35 x 2)
Data analysis – coding and thematic analysis [8]	**$8,880** (22.2 data hours x 2 researchers	**$1,240** (3.1 x data hours x 2 researchers	**$880** (2.2 data hours x 2researchers

	at 80 /hr for 2.5 hours per hour of collected data)	at 80 /hr for 2.5 hours per hour of collected data)	at 80 /hr for 2.5 hours per hour of collected data)
Subtotal	**$13,560**	**$2,073**	**$1,506**
Total	**$13,560**	**$3,475**	**$4,030**

[1] Note all funds are reported in Canadian dollars.

[2] Facility rates at this site were not charged. Note that typical rental costs are between 200-300/hr.

[3] Cost assumes access to a trained instructor. Instructor training would be an additional cost. The daily cost for a simulation instructor is $1250. The cost of the debrief sessions has been separated in this table.

[4] Cost assumes access to a trained technologist. Training would be an additional cost.

[5] Land travel at $0.54/km. Travel required for simulations and FGs (Interviews were via telephone).

[6] Transcription costs - For one to one interview assumes 2.5 hours per one hour recording for transcription. For focus group and simulation debriefs assumes 4 hours per one hour recording. Transcriptionist rate is $20 per hour.

[7] NVivo data entry – Research assistant salary $35 per hour – assumes 2 hours required per hour of data.

[8] Data Analysis includes researcher salary of $80 per hour. Considers 2 researchers for coding with approximately 2.5 hours for each researcher per hour of data collected.

Comparative analysis

Data from VPS and MBS debriefs contributed to 15 of 20 total themes compared to the earlier study (See online supplement A). When comparing the top five themes in terms of highest frequency two themes consistently appear across all three data collection modalities: knowledge, skills and abilities (NA interviews and focus groups N=104, MBS N=53, VPS N=127), and solutions (NA interviews and focus groups N=193, MBS N=28, VPS N=57). Similarly, when comparing the five themes with the lowest frequency counts two themes appear across all data collection modalities: leadership (NA interviews and focus groups N=23, MBS N=6, VPS N=10) and night/week-end (NA interviews and focus groups N=48, MBS N=5, VPS=27). Themes not identified with either form of simulation debriefs included palliative/end-of-life care, patients post-referral hospital, lack of understanding, vision, and family and patient thoughts. A descriptive matrix with the themes and representative quotes from the various data collection methods is presented in online supplement B. In general, for the themes common to both

interviews/focus groups and simulation debriefs similar high-level needs were identified, and similar overarching conclusions could be drawn from the simulation debriefs compared to the earlier NA. However, more descriptive data was discovered with the earlier NA versus the simulation debriefs where data was more direct and to the point.

As an exemplar, knowledge, skills and abilities (KSA) was identified across all methods. A key gap identified within this theme was the management of respiratory failure and ventilation. This gap was identified in the interviews, focus groups and simulation debriefs. Key issues identified in the earlier study and simulation debriefs, within this topic included basic and difficult ventilation strategies, troubleshooting and managing status asthmaticus. Weaning and lung protective strategies specifically, were only identified in the interviews and focus groups. Both the earlier study and simulation debriefs identified system level gaps that contributed to this need, including the need for 24-hour RT coverage. Where this need was identified in the simulation debriefs, a greater depth of data emerged during the focus groups surrounding the nature and impact of the gap / lack of 24-hour coverage. In the following focus group, participants discussed challenges of weaning patients:

> *We've been wanting to put patients on APRV at night and it makes it difficult because as they improve their volumes are going to get larger and it's something that you really have to watch on the vent, and the nurses don't. They'll watch but they don't really understand as much as what we do, the doctors have no idea, it's just really us. We're leery sometimes to put somebody on bi-level APRV, whatever you want to call it, because we're not here 24 hours to watch the whole process happen.*

The main themes identified from the simulation (not found in the interview/focus group data) were related to the fidelity of the simulation (environmental, equipment and psychological) and the role of the simulation instructor in teaching and promotion of reflection (See online supplement C). In addition,

the theme of interruption was identified only in the MBS debriefs, which occurred when the facilitator interrupted a participant to provide teaching/impart knowledge.

In some instances, lower fidelity led to the discovery of gaps in practice. In the following example the creation of an 'unreal' environment, led to the discovery of a system-level gap. In this situation, the participant highlighted that receiving blood work quickly in the MBS, which does not match their reality and may impact patient care:

> *The blood work is too long in [the community hospital]. It's horrible. Like you can do a code for an hour and you won't even know your potassium, your calcium, or your CBC; it's just a disaster.*

Thus, the role of the facilitator was coded as producing several themes that only emerged within the MBS and VPS datasets. Unlike the traditional NA facilitator, the simulation facilitators carried out multiple roles. Two codes (promoting reflection and teaching) were evident in the educative roles the facilitator played. That is, the facilitator served to further engage the learners in the simulated scenario by promoting reflection through reflective cues. We defined reflection as the "process of learning through and from experience towards gaining new insights of self and/or practice." [27(p1)] The following is an example of the facilitator providing reflective cues linking learning to the experience:

> *Facilitator: So that was an issue that was brought up by a couple of other nurses, not having an RT and not having ventilation. Having regular ventilation control, do you agree with that or do you have a different opinion?*
>
> *Participant: I think there should be an RT 24/24 in this hospital*

Also, the teaching code was evident throughout both MBS and VPS. These educative remarks/exchanges were designed by the facilitator to provide information to the participants to impart knowledge rather than cuing the participants to reflect specifically on their experience.

Facilitator: The only thing I point out to you is that sometimes we like to choose the gentler sedatives, but they're going to need sedation then they just may need more adequate haemodynamic support as well.

Finally, a code that only appeared in MBS data was one called 'interruption'. This code highlighted the conflicting roles of 'educator' and 'researcher'. During the simulation debriefs, at times the facilitator would interrupt the participants to provide education. In the following example, the participant starts to discuss a potential need to have an oscillator (a specialized ventilator). The instructor interrupts the flow of the simulation debrief with directed questioning to provide education that this would not be required in their setting:

Participant: And we don't have an oscillator if we truly needed one and we don't…

Facilitator: Do you think you need an oscillator?

Participant: No, absolutely not

In contrast, in the following quote a focus group participant describes wanting to have the resource and skills to place Swan-Ganz catheters (a procedure not widely used in tertiary critical care). In this instance, the moderator does not provide education as is typical in interview/focus groups, but rather summarizes and continues to probe to ensure understanding of the needs. In this situation, the participants leave with the same perspective – that this is perceived as being a priority.

Participant: We are not utilizing for example using Swan-Ganz… I tried to put Swan-Ganz for some of my patients that I thought they need it but then most of the nurses said, well last time we had it was 10 years ago, lost experience with that and we don't have the modalities… Maybe that will give the nurses more confidence when they do it more frequent.

Facilitator: So is that ongoing education of the nursing staff…

Participant: Absolutely, because that's what the ICU needs.

A comparison of the three different data collection methods (traditional, VPS and MBS) is displayed in Table 3. The areas of convergence or where all three data collection modalities revealed the same element (to varying degrees) included: variation in reflection, and uncovering system level barriers. Areas of divergence included: time, structure, facilitator skill level, and education (the degree to which education was 'built-in' the method). The two elements that were present in the simulation data collection methods were the ability to conduct multiple cases in one session, as well as the simultaneous multiple roles played by the facilitator.

Table 3 Multimodal comparative data display

Observation/Notation	Traditional Interviews/Focus Groups (FGs)	VPS	MBS
Skill level of facilitator	Moderate	High	Extremely High
Time (average duration)	Interviews - 31 minutes FGs - 108 minutes	31 minutes	22 minutes
Structure	Inquiry involves continuous questioning and answers	Multiple cases involving a structure of playing part of a case, stopping to debrief/discuss, playing more of the case, stopping to debrief, discuss, etc.	2 cases in 15 minutes with a 5/10 min structure, that is 5 mins devoted to what the participants thought about the scenario, did they like it, was it realistic, etc., then 10 minutes to reflect on the case regarding their own practice realities.
Variation in reflection	Reflect on past experience	Serves as a prompt to reflection on reality (not focused on VPS case)	Immediacy of reflection tied tightly / coupled to simulation scenario, thus creating a platform for, 1) reflection in/on simulation, and 2) reflect on reality
Educative purpose	Low	High	High
Roles of the Facilitator	Single: Researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor
Trade-offs with various roles of the moderator / facilitator	Not applicable	Triple role = more potential for impact	Triple role = more potential for impact ie, if teaching and interrupt may lead to less

			data collected for the research purpose (i.e., identifying needs)
Uncovering system level barriers	Requires a lot of time and perhaps multiple lines of questioning and/or interviews	Moderate ability to probe system level abilities (as people want to waver and chat around many issues – not as streamlined and direct as sim scenarios)	Streamlined to uncover system level barriers
Technical difficulties	No occurrence in this dataset. Would be limited possibility (e.g., audio recorder failure)	"Technical glitch" RC Sim Team B (e.g., blood gases results do not come up) and as a result they had to move on.	No occurrence in this dataset but could happen, more technical aspects hence likely greater risk than with traditional methods
Multiple cases at once	Not applicable	Multiple cases	1 case per scenario

DISCUSSION

This study explored the potential use of MBS and VPS debriefs as NA tools, and revealed that debriefs may be more efficient, in terms of time and cost at capturing similar needs contrasted to traditional methods of data collection (interviews/focus groups). Our investigation has also highlighted various trade offs which exist with selecting simulation as a NA method.

Time and Cost

With respect to time, the simulation debriefs yielded a considerably shorter total length of audio recording (76% less time than interviews/focus groups). As such the costs specifically required for the NA were significantly lower for the simulations compared to the interviews and focus groups (73% less cost incurred). Even when taking into consideration the total costs of running the simulation cases before the debriefs and the debriefs themselves, the cost remained lower due to the high cost of transcription, NVIVO data entry and data analysis with larger volume of data collected. It is notable, that for this cost of simulations multiple goals may be achieved, in that the observed simulation scenario

performance allows for quantitative measure of performance gaps, may serve as pre-intervention baseline performance data, and may reveal additional unperceived performance gaps, not otherwise captured in interviews, focus groups or debriefs, as demonstrated in our earlier study.[12] It is important to note that cost analysis did not include the initial investment costs or maintenance of a simulation program. Hence, if there were not a program in place, the cost of simulation would be increased.[28] The cost of a manikin-based simulator is substantially higher than a virtual patient simulator,[29] which is an important consideration for those considering using simulation as debriefs in NA.

Comparative Analysis

Even with substantially less time spent in the simulation debriefs, the majority of themes were identified in the simulation debriefs compared to the interviews and focus groups. Perhaps capturing needs is better accomplished when participants have an experiential and emotional encounter (possibly feeling more vulnerable), with the discussion occurring close to the event and promoting active participation. Theory underpinning the debriefs includes facilitating the transformation of experience into learning through reflection where, "the ultimate goal of debriefing is for learners to reflect on and make sense of their simulation experience and generate meaningful learning that translates to clinical practice."[22] Links between emotion and cognition have been suggested and hence, actively experiencing an event accompanied by intense emotions, may result in long-lasting learning.[27,30] Simulation provides a model setting to better understand complex medical practice, allowing the opportunity to identify needs at various levels (system/team/individual), and across various complex intertwined elements (material/social/cultural) within unique systems. As the learners work to make sense of the simulation experience in reference to their own world, there is the opportunity to both identify needs and provide education.

Although the majority of themes were identified in the simulation debriefs (15 of 20), as compared to the interview and focus groups, a greater depth of data was captured through the more traditional methods. With NAs, initial data collection may inform subsequent data collection decisions.31 In addition, priorities must be set, which includes identifying needs of greatest importance and most amenable to change.[32] Depending on the purpose and scope of a given NA, simulation debriefs may stand alone or may be used to make decisions surrounding whether more extensive data is required. Performing simulation debriefs may also help identify the highest priority needs and determine the initial set of needs to be targeted, in that the needs which are most readily uncovered may be the highest priority contrasted to those that require more probing and questioning.

The findings highlight that not all themes identified in the interviews and focus groups were captured in the debriefs. More specifically, palliative and end-of-life care was not identified in the debriefs, nor was the vision of participants or two themes relating to the inter-hospital interaction (patients' post-referral hospital and lack of understanding). In addition, although the theme of patient transfers was identified across all methods, the relative frequency and depth of data was much lower in the debriefs compared to the interviews and focus groups. This is an important, yet not unexpected finding, given the simulation cases were not specifically designed to explore the areas of end-of-life care or the interaction between the community and referral hospital, contrasted to the traditional NA which undertook a broad line of inquiry along with probing into various aspects of critical care, including both end-of-life care and inter-hospital interactions. The debriefs also did not include asking participants their vision and this data would be unlikely to emerge independent of directed inquiry. This finding highlights the risk of

missing needs with the simulation debriefs and demonstrates the importance of scenario selection and development.

Trade-offs

In this investigation, multiple interrelated roles of the simulation facilitator during the debriefs were identified, including promoting reflection, teaching participants, and exploring gaps in practice. Despite utilizing different cases, online supplement C reveals that the two simulation methods produced similar patterns in terms of thematic frequency scores. That is, the three highest rated simulation specific themes were reflection and teaching. Perhaps this finding is indicative of the method whereby education is infused, upfront in simulation. In this way, a strength of simulation debriefs may include that they can act simultaneously as an education tool and data collection modality.

Simulation debriefs focus on transformative learning through self-reflection may include individual and/or social engagement.[27] The simulation debriefs capitalized on the social spectrum of reflection and through critical discourse between the facilitator and participants, needs/gaps were uncovered beyond individual and team performance, also uncovering system level gaps. Thus, a strength of utilizing simulation debriefs may also include providing a tool for assessing needs across individual, team, and system levels. Furthermore, this finding highlights the importance of working to structure the debriefs to promote deeper reflection.[33]

It is important to note that having the simulation facilitator act in multiple roles inevitably presents challenges and trade-offs among these roles, which is a potential limitation of utilizing debrief session in

NAs. For example, in traditional interviews and focus groups the facilitator attempts to remain 'neutral' and does not provide education while they pursue questioning to better understand needs.[34] In contrast, in the simulation debriefs, the facilitator does not remain neutral, at times interrupting the participants to redirect and provide education, as evidenced by the emergence of the interruption code within the MBS data. Interruption was coded as instances whereby the facilitator would intentionally stop the conversation to correct participants when they were clearly discussing inaccurate content. When priority is given to the educative role, the actions of the facilitator risks not allowing the participants to explore and express details surrounding their needs. However, the educative element also promotes engagement through a collaborative approach and participants may leave with a better understanding and having learnt something. Making transparent, thoughtful decisions surrounding which methods to select, recognizing there are advantages and disadvantages to each, is fundamental to performing NAs.[34–37] If debriefs are to be more widely used in NAs, we need to better understand the tradeoffs and their impact on the NA.

In this study, very experienced master instructors facilitated the debriefs. The quality of the debriefs may be linked to this, in that someone of lesser experience may not have been able to uncover these gaps, while providing skilled education, which potentially limits general use of debriefs in NA. How educators facilitate debriefings has been shown to be highly variable.[38] Debrief facilitation also appears to be influenced by the professional background and style of the facilitators. In their exploratory investigation, van Soeren *et al.*[9] described how some facilitators assumed the role of an interprofessional guide whereas others assumed the role of teacher, tending to impart their knowledge. This variability in facilitation is an important consideration for assessing needs, in that if the facilitator were to have a style more strongly connected with teaching, then needs may not be readily uncovered.

In addition, the skill level of MBS and VPS may be different (i.e., higher level/more experienced) than that of a facilitator collecting data in a more traditional qualitative manner.

Strengths of our study include highlighting the efficiency in using MBS and VPS simulation as a timely and cost efficient alternative to employing traditional (interviews and focus groups) methods albeit under certain assumptions (i.e., the research team had access to a simulation center with pre-developed simulation scenarios for both the MBS and VPS sessions). This finding is interconnected to the issue of the breadth and depth in data coverage. That is, the results of this study demonstrate similarities in breadth of themes using traditional methods and simulation debrief with the notable difference in terms of depth. Undeniably, the qualitative interviews and focus groups were able to provide more depth and richness in the data as opposed to the simulation techniques which were considerably shorter in terms of transcript coverage. However, simulation offers the added benefit of providing quantitative performance data which can serve as a baseline and to triangulate with the debrief data.

This was an exploratory study, which included secondary analysis of an existing dataset. Where secondary analysis has been recognized as an important, underutilized research approach, there are limitations to this method. The quality of the secondary data analysis rests on the quality of the existing dataset.[14] It is important to highlight that, as described, our earlier study was performed with a rigorous methodology with numerous methods in place to ensure high quality and credibility of our findings. One concern noted in the literature is the potential '*problem of data fit.*'[15] In the current study, '*the problem of not having been there*' has been cited as a concern, in that challenges exist when the secondary researcher was not involved in the original data collection.[15] Furthermore, limitations of this study include the relatively small sample size and the focus on a single center. Further research is

required to better understand the utility of simulation as a NA tool, the design features for NA, and type of needs best identified using this approach.

In conclusion, this investigation provides support for the use of simulation debriefs as a NA method, to explore needs at the system, team and individual levels. Qualitative data collected during debriefs may be a suitable substitute to the typical interviews and/or focus groups. Simulation debriefs promote a participatory, collaborative, approach with the educative function built in. Given current fiscal realities, the dual benefit of being both educative whilst identifying needs is appealing. While simulation is an innovative and effective method to conduct NAs, it is important to recognize that there are trade-offs with selection of methods requiring careful scenario design and debriefing.

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Online Supplement A: Qualitative data display comparing the frequency of themes across the various data collection tools

	Data Collection Tools			
Themes	**Earlier NA (interviews and focus groups)**	**Debrief after MBS**	**Debrief after VPS**	**Total MBS + VPS**
Community Hospital				
Knowledge, Skills and Abilities	104	53	74	127
Roles	100	36	83	119
Communication	92	13	21	34
Patient Flow	95	2	35	37
Resources - Human	80	32	32	64
Resources - Physical	44	13	24	37
Confidence/Comfort	49	25	16	41
Team	35	26	16	42
Palliative/EOLC*	27	0	0	0
Leadership	23	6	4	10
Inter-hospital Interaction				
Transfer	200	3	21	24
Communication	192	13	21	34
Patients post referral hospital	49	0	0	0
Relationship	51	10	7	17
Lack of understanding	47	0	0	0
Additional Themes				
Solutions	193	28	29	57
Education/Training	182	13	10	23
Vision	40	0	0	0
Family and patient thoughts	31	0	0	0
Night/Weekend	48	5	22	27

*EOLC – End of life care

Online Supplement B: Descriptive Matrix / Qualitative display with representative quotes from the various data collection methods

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
Community hospital			
Knowledge, Skills and Abilities	Just on a side note, from our standpoint we take care of ventilation basically on our own. We just have a protocol, the doctor signs it, they don't on the whole really understand too much about ventilation. Sometimes it would be nice if we could talk to a Respirologist because you're like, I don't know how else to ventilate this patient, I've exhausted all of my things and we don't have anyone to turn to. I know some of us in our department really feel alone sometimes because there isn't that expertise and nobody knows how the vent works except for us.	I'm the one, I will tell you, I know nothing about ventilators, deficient in ventilators. If the RT will not help me, I will transfer the patients. And the RT will tell us and I ask the RT, "Am I the only one?" He said, "No all of you." The RT, they are on their own on the ventilator which is scary.	But that second case, what's important there, when you start Ambu bagging oh my god I'm feeling stiffness there, the lung is stiff. That's when I said, "Oh my god, here we go with the ventilator." Like I'm going to have problem dealing with a stiff lung because I don't have an experience too much about a stiff lung with a ventilator…
Roles	There's usually, the nurses are in our ICU so doctors will do the rounds in the morning or I mean throughout the day but it's mainly nurse driven. We do have RTs that check on the ventilators during the day. But then there's no RT available at night. So as of midnights from 7 o'clock in the morning there's no RT in the building. They have them on call and then there's obviously the emergency physician on call or we can call the primary physician or the physician on call. (CH nursing focus group)	In the floor the nurses there will help, but again we have shortages of nurses there and limited knowledge and experience on the floor.	As nurses we feel, with a lack of RT, lack of physician, we're the only one, so for me to take care of two… You know what I mean, two ventilators is very…
Communication	And the other problem quite frankly is that our time is very limited and sometimes when nurses are looking after several patients or are on breaks, etc., we just do not have adequate	F2 - They're initiating bullet communications, yeah. F1 - Yeah, I'm not familiar with that F2 - If they're initiating bullet rounds for the	Like some will, I will sometimes just call and give you a heads up if you can come up and help out. Sometimes we'll just call a Code Blue and some people misinterpret that as

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
	communication. It's a problem to me because my focal point of communication is the nurse and if when I am there and the nurse is available, and the nurse is not available the communication breaks down. (CH interdisciplinary focus group)	whole, you know, this is a new process... Mod - So, it's like a multi-team professional...	being a cardiac arrest but it could be someone crashing as well. But I don't like to use that if it's someone that's not imminently going to code because then it misinterprets your message.
Patient Flow	Because you know what, sometimes we transfer a patient to [the RH] through CritiCall** because we don't have… You know, it's a vented patient because we don't have either the bed up here or the staff to look after that patient. When in fact if we had two less patients in the unit, they were on the floor, on the surgical floor, the medical floor, we could keep that patient. (CH leader)	Like thyroids, they put them in the ICU, like tell me, like really, a thyroidectomy in the ICU; I'm like, I've never seen that. And when you do a pre-op they really want you to say the patient needs ICU monitoring post-op and I'm like, no I don't know.	Well access to an ICU bed, they do not want us… Like sometimes they bring the patient because there's nothing really on the medical ward to resuscitate…
Resources - Human	Like it's not uncommon for me [RT] to be at a C-section in the OR in my greens with a baby and then I'm getting called for Emerg, for the floors, for ICU. Well I can't come, I'm in with this baby and you're being pulled in 15 different directions. (Interhospital focus group)	I think we probably need two more, a good… If I could get two young Internists, like a Respirologist, even an Intensivist would be good here. And have a bigger group and split shifts like they do in other hospitals, they do days, nights. I think that would be best for people in [Location 2]. Because myself, being on call after three days I was like, well I'm just going to make a mistake, I mean it's… You know, it's…	And that's something… I find… We've got a small ICU so then we don't have an RT, we don't have doctors.
Resources - Physical	… if she's not oxygenating well either, you might need an oscillator or nitric or something like that which we don't use. So she'd have to be transferred to tertiary care. (CH nursing focus group)	Yes, it's a little more complicated because we don't have a good equipment for bedside echo-cardiographic; bedside echo is difficult. And if the patient is ventilated it's difficult to move them down to the Ultrasound department. There is emergency echo available for cardiac-tamponade, so that we can check at the bedside, but not for a full echo.	I mean we, well in the last month we've had four ventilators on and off at a time, which is a lot for our unit, and it's taxing our staff and… Because we're one to one here because of our lack of…
Confidence/Comfort	Asthmatic patients. They need to be paralyzed and there is a lack of confidence with running paralytics or whatever the situation might be,	F2 - I think it would be important too when you're going for a break that you make sure that you give a report on that patient and	I always feel unsatisfied about performance in these things… Well I feel like I should be able to really be more clear about what's probably

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
	I don't know if that is an anesthesia issue. I am not quite certain what that whole thing is but a lot of times we get these asthmatic patients that we need to knock out their drive to breath and we can't keep them here because we can't run the paralytics.	they're responsible for that patient. So should that doctor come down they could address certain issues, "I'm going for a break" is not good enough. That happens in our ICU, people go for break and I feel responsible but I don't know anything about them. M1 - Because things can change so quickly, whether its ICU or the ER, where ever F1 - It just helps to have a bit of a report. I think this place is just so busy, I think people are feeling stressed and overwhelmed.	going on, you know, in the case of the second case I found I was really thinking all over the place. MBS D
Team	I believe that the focus, the central point of the team is the nurse because she or he occasionally is the one who is there constantly. The rest of the team is only intermittently present but the problem is that communication within this broad team is basically through the nurse. I don't communicate as directly with speech therapy. The speech therapy communicates with the nurse and the nurse communicates with me.	...the question is to find the doctor and go there and see the patient. Or if she crashed, they're going to create the bed easily, because to tell you the truth not all patients in the ICU are critically ill. Some of them were admitted because you need them before surgery, because there surgery requires an ICU bed and this is how you occupy a bed. Or a patient waiting for an angiogram to be done in the [Organization 1] in the last five days, they shift them easily. So, finding a bed is not the problem, finding a doctor to be there, take decision to be there, to help finding a team, we are missing a team. RC Sim A So but still in the morning in the ICU we don't have an ICU ICU, the same way you think there is an ICU; we don't have ICU team. Our ICU is an open door for everybody to come and admit patients. You go to the ICU you see eight patient there with five different names of doctors taking care of them. So there is five doctors	But I think the main resources is we have to have a team like what we had here; we don't have it here. We're a very close unit and we… I mean, for nurses

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
		looking after ICU and you got to inside the ICU there is no doctor, because everybody will come, see the patient, leave. But we don't have a team ICU which is run by an Intensivist or one doctor, nurses, RT, that they will go and do the round in all the patients, decide what's the plan, decide who's going to come in, who has to leave. Respond to anything down on the floor if somebody is [unclear; full] crashing or crashing. We don't have that and that's what makes it sometimes very difficult for the nurses out on the floor or in the ICU, is the availability of the doctors to come and help during the day or during the night. RC sim A	
Palliative/EOLC	And I'm a big advocate for bringing it up with the family and discussing what it involves, and I find in our unit we don't always have the support of the physician when it comes to a point even where sometimes it should be broached that this would not be the best solution. And should the person be extubated should we discuss this DNR further?	Not identified	Not identified
Leadership	…structural change, nursing staff change, and physicians have very little impact on what comes directly through the administration of this hospital. They [administration] very rarely would ask for our input. You know, nursing and physicians probably are the biggest drivers of direct change that can affect care.	Mod - What about the ward care? Do you have a feel for that? M1 - Well I mean the only feel I have is administratively, because as the Medical Director I'm dealing with a lot of issues and moving people to the floor and moving them out to the community. RC Sim E	Mod: Listen, vented patients are very rarely one to two unless they're very stable on a ventilator even in a tertiary units, so. M1: That should be echoed to some of the management who think they should be two to one MBS B
Interhospital Interaction			

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
Transfer	Any strength can also be a weakness and sometimes I do agree that sometimes I think they hang on to the patient far too long.	...and when it comes that I'm against a wall because I don't have facilities, then you say, "no, no, no, now bring it to us." You will be the one to decide...you did the things that we should do, which I call the standard of care in ICU, and there are things we don't have in there now, now bring the patient to us and we can deal with it. RC Sim A	Mod - But you're thinking longitudinally and what happens after the person... M2 - That will push me to say, "Okay, here we go again" I put them on a ventilator, the RT is going to come, and okay this happened, okay. You know what? Send them to [the referral hospital]. And that's the reason we are sending. Mod - That's not necessarily inappropriate... MBS B
Communication	We're not very good in fact at keeping communication going. Like we get a patient in transfer, I never ever call back...I don't even know if they get the Discharge Summary, it's beyond me.	- ...in order to reduce our transfer to ICU [the referral hospital] we have to be part of the ICU [referral hospital]. Hopefully, this ICU will be a branch of your ICU that we will have some kind of communications. I don't want to transfer patients to you. I want advise. I want you to know what I have here and what else I should do, and I should want to do it here	Add Quote
Patients post referral hospital	So, you know, sometimes we will have patients in the ICU that are waiting for a chronic vent bed. They are from [the community] and the family wants them back in [the community] but there is limited capacity just because of the number of beds, the critical care beds that they have. If they're blocked by one or two chronic vents then they don't have the capacity to look after more acute patients.	Not identified	Not identified
Relationship	So my perception is that it's very good. There's good interaction. I think that there's room for improvement. I think that there is more that can be done like collaboratively, between physicians and between nurses.	Like my goal here when I'm attending, and even when I attend the first one is hopefully we'll find a way to improve the situation. I'm looking for whatever it will take to improve the situation, we need help. My message to [the Referral Hospital], we need help and we need your help.	M1 - Very often we end up on the phone with people. Mod - And you talk to me, I'm an ICU doc at [organization 1] campus M1 - Okay. I'm forewarned. [Laugher] M2 - Perfect, now I have a connection.
Lack of	I think they forget too sometimes that there is		

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
understanding	a traveling issue. You know how come they are not here yet? Well because we had to call Ornge*** and it took two and a half hour versus an hour and a quarter by land but we can accommodate that patient. Just little hiccups that they might forget about just because they don't have to deal with all this stuff. They don't send patients out like we do. So I don't know if they have a major understanding of how much time it takes and how frustrating it is.	Not identified	Not identified
Additional themes			
Solutions	Ultimately what I'd like to see is I think the team, meaning all the physicians available and the various para-health disciplines, the Respiratory Therapists, even Pharmacists, but Nursing in particular, to have access to a hands-on experience in a tertiary care critical care unit. So, where they'd spend a week, Nurses and Respiratory Therapists be paid, a paid position where they'd spend a week and just work alongside several different people, in a tertiary care setting.	The only thing I know that I've been thinking about a little lately is that as a physician that maybe I should be saying, "You go and do such and such and then when it's done you tell me," kind of. But we don't do it that way very much eh? Like we really talk more as a team and we sort of like, we kind of… Maybe we should be doing more of that kind of closed loop kind of communication…	We do have the Stroke Program in Emergency which they use the teleconference, which would be a huge asset if that could be utilized in the ICU. Because I know [Name 2] comes here and then so he… It doesn't have to be him but there's… So if we have a team dedicated and available and sitting in the ICU, that will help, to see the patients and look after all the patients and being in communication with [the referral hospital] and then see how things will go
Education/Training	But as far as normal sort of formal education for physicians, as a structured education in the hospital it's none … There's not a lot of, there are no sort of formal teaching sessions, either where physicians and nurses get together to discuss difficult cases and things like that.	F2: Teaching, teaching, teaching is a big big factor in this establishment. F1: That's my biggest thing is… F2: We don't have, we don't get it.	And we don't have an educator …. And you need an educator and you need to educate everybody the same so that everybody works the same. Everybody does their own thing…
Vision	I mean if you get hit in the street you should have the same care, either if you are here or [at the RH]. So now how can we make this happen, that's the big thing. (CH focus group) But I think from an Administrative standpoint what I would like to see is increased	Not identified	Not identified

Themes	Interviews and Focus Groups	Debrief after VPS	Debrief after MBS
	collaboration around education, and ensuring that quality and safety standards are more consistently applied across the LHIN.		
Family and patient thoughts	Sometimes the barrier is the perception, the expectations of the family that surely they could do something for us in the big city. And that's not an uncommon... And I hear it from the physicians there. I don't think this is going to turn out well but the family would really like this patient to be [at the RH].	Not identified	Not identified

Themes	Debrief after VPS	Debrief after MBS
Fidelity		
- Environment	F1 – I took another blood pressure? Mod – That's the recent one… M1 – I think it's supposed to be in real time, right? Mod – Yeah M1 – Has he had the bolus? Mod – Yes, he has M1 – He's still sitting at 87 so I would give another bolus, that would be great.	Mod - …how much time do you think the case took? M2 – Not that long, 15, 20 minutes? Mod – It was a nine minute case. M2 – That was nine minutes, eh? F1 – Oh wow, it did feel longer. Mod – It's funny how the sensation of time changes.
- Equipment	Mod – I'm not sure why it's not coming up here. It's a technical glitch. There it is, okay, and I have the admission blood work as well if you want to compare it, you just let me know what you want to see and I'll show you.	Mod – Are there any other obstacles that do not make it as real as in real life? Because we recognize simulations are not meant to be perfect… F2 – Well, just the equipment, right. I didn't have any of the right drugs there or the stuff to prepare the drugs. And, it's normally not that fast. Mod – But it's not meant to be, and it's also because we are in a temporary sim centre. In a full sim centre we actually have all the equipment. F2 – I'm sure there is other stuff
- Psychologic	Mod – Ok, that's is for the simulation F1 – That's a lot less stressful like that. You can think and you	It's different to see, let's say somebody, "Oh yeah, he's vomiting blood" but you know from someone actually vomiting

	can visualize, it's pretty real, it's good.	300, 400 cc's of blood, you're in a different mindset.
Learning Style	Do you have any questions about this form of simulation or any questions about the case itself? M1: No, fantastically done, fantastically done. I don't know how you could divide the programming, but it's fantastic.	I enjoy learning like this, like I find it really good to… F2: This is much better than like say like self-learning packages where you read something and then just… This is a much better experience.
Teaching	Mod – Ok, do you want any blood work? M1 – I think that would be a good start (laughs) F1 – Ok, sounds good. Do you want any blood cultures or anything? Mod – What would you like? M1 – Let's get blood and urine, put in a foley. Mod – Give me specifics about what you want for blood work	The only thing I point out to you is that sometimes we like to choose the gentler sedatives, but they're going to need sedation then they just may need more adequate haemodynamic support as well.
Reflection	Mod2: So you came very early to the decision to move the patient to the ICU, how complicated can that be? M1: It will take, they will create very quickly… the question is to find the doctor to go there and see the patient. Or if she crashed, they're going to create the bed easily, because to tell you the truth not all the patients in the ICU is critically ill. Some of them were admitted because you need them before surgery, because their surgery require ICU beds what you do you occupy a bed, so. Or a patient waiting for angiogram to be done in the [Organization 1] in the last five days, they shift them easily. So finding a bed is not the problem, finding some, a doctor to be there, take decision to be there, to help, finding a team, we are missing a team.	Mod – So that was an issue that was brought up by a couple of other nurses, not having an RT and not having ventilation. Having regular ventilation control, do you agree with that or do you have a different opinion? I just thought I'd bring it up. F3 – I think there should be an RT 24/24 in this hospital

Online supplement C: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after MBS**	**Debrief after VPS**	**Total MBS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

BMJ Open

A comparison of simulation debriefs with traditional needs assessment methods

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A comparison of simulation debriefs with traditional needs assessment methods

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ABSTRACT

Objective: To better understand the potential of a needs assessment approach utilizing qualitative data from manikin-based and virtual-patient simulation debriefing sessions compared to traditional data collection methods (i.e., focus groups and interviews).

Design: Original data from simulation debrief sessions was compared and contrasted with data from an earlier assessment of critical care needs in a community setting (using focus groups and interviews), thus undertaking secondary analysis of data. Time and cost data were also examined. Debrief sessions were coded utilizing deductive and inductive techniques. Matrices were utilized to explore the commonalities, differences, and emergent findings across the methods.

Setting: Critical care unit in a community hospital setting.

Results: Interviews and focus groups yielded 684 and 647 minutes of audio-recordings. The manikin-based debrief recordings averaged 22 minutes (total = 130 minutes) and virtual-patient debrief recordings averaged 31 minutes (total = 186 minutes). The approximate cost for the interviews and focus groups was $13,560, for manikin-based simulation debriefs was $4,030 and for the virtual patient debriefs was $3,475. Fifteen of 20 total themes were common across the simulation debriefs and interview/focus group data. Simulation-specific themes were identified, including fidelity (environment, equipment and psychological) and the multiple roles of the simulation instructor (educative, promoting reflection, and assessing needs).

Conclusions: Given current fiscal realities, the dual benefit of being educative and identifying needs is appealing. While simulation is an innovative method to conduct needs assessments, it is important to recognize that there are trade-offs with the selection of methods.

Strengths and limitations of this study:

- Simulation is an innovative methodology to undertake needs assessments
- Utilizing simulation permits the development of an environment that enables the learner to perform naturally and gain insight into the complexity of the actual workplace
- Study adds to the relative dearth of qualitative work in simulation and medical education
- Study sample is relatively small and is performed at a single center
- Cross sectional nature of the study does not permit generalizations

INTRODUCTION

Calls for innovative strategies in conducting needs assessments (NAs) have been made in the medical literature over an extended period of time.[1–5] A needs assessment (NA) is a systematic process to collect and analyze information on a target group's needs (gaps between current and desired situations). [6] Whereas, simulation is a valuable educational tool and evaluation/ assessment modality. Through a process of experiential learning and deliberate practice, the use of simulation in health professionals' education has been shown to consistently improve the acquisition of knowledge, skills and behaviors.[7,8] However, there is a paucity of literature on the role of simulation in performing NAs, including the use of simulation to determine system and/or institutional level gaps for change management. Simulation holds potential as a NA method to promote a better understanding of these gaps given that it aims "to develop an environment that enables the learner to perform naturally to gain insight into the complexity of the actual workplace".[9 (p59)] In addition, there is a general lack of qualitative simulation studies in medical education that compare simulation to more traditional qualitative methods.[10-12]

Recognition and care of critically ill patients in community settings is complex, requiring skilled staff and optimal use of resources at the site, plus a coordinated system for interaction with, and transfer to the referral centre when needed. In 2006, the Critical Care Strategy was announced by the Ministry of Health and Long-Term Care of Ontario, Canada. The purpose of this on-going initiative is to improve access, quality, and system integration to ensure all citizens of Ontario have equal access to high-quality critical care. In keeping with this mandate, a comprehensive NA was completed by members of the current research team, which identified gaps in caring for critically ill patients at a single community hospital.[13] These results provided insights into the needs of a community to optimize care of its critically

ill patients, as well as suggestions for how a referral hospital may best support its community site. However, the cost and time required to complete this study was substantial and the process requires streamlining in order to be feasible to implement across numerous sites.

This earlier study included interviews, focus groups, Manikin-Based Simulation (MBS) and Virtual Patient Simulation (VPS), questionnaires and a family survey. Following each of the MBS and VPS, 20 minute debrief sessions were held, and video recorded. These debrief sessions were not included in the comprehensive NA but rather were included as normal pedagogical practice in providing feedback for simulation participants and to facilitate development of reflective skills and teaching for simulation participants.[14] However, upon reviewing the recordings, it was notable that many of the same themes that were discussed in the larger NA were also identified by participants in these debriefs. This serendipitous finding suggested that simulation debriefs could be of value as data for NA either alongside or instead of traditional approaches. The overarching guiding research questions included: 1) How do the needs identified through simulation compare with those identified using traditional methods of NA data collection? 2) Can similar data be captured more efficiently in the simulation debrief session compared to lengthier traditional methods? and 3) What are the strengths and limitations of utilizing simulation in NA?

Specifically, this study aims to better understand the potential of a NA approach utilizing qualitative data from MBS and VPS debriefing sessions to explore the system, team and individual level needs in caring for critically ill patients in a community context, compared to traditional methods (i.e., focus groups and interviews). We also aimed to compare feasibility in terms of time and cost.

METHODS

Secondary analysis has been recognized as an important, yet underutilized research approach.[14] It has been defined as the reanalysis of an existing data set, which may be used to investigate new research questions or verify previous research findings. [15,16] For the current research, original data were compared and contrasted from simulation debriefs with data from the earlier assessment of critical care needs in a community setting, enabling exploration of the current research question from our existing data.

Design and Analysis

Original study data collection and analysis

The original mixed-method study was conducted between June 2011 and February 2012. A conceptual framework, centered on the critically ill patient guided the design and selection of that data collection instruments. Different perspectives sampled included regional leaders, healthcare professionals at the community and its' referral hospital, as well as family members of patients who had received care at the community ICU. Interviews and focus groups were designed to follow a semi-structured, broad, pre-determined line of inquiry that was flexible permitting exploration of themes. Data from each interview and focus group were transcribed, entered into NVIVO software and inductive coding techniques were applied as informed by Creswell's thematic analysis approach.[17] The constant comparative method was used as data were analyzed.[16] Full information regarding the original study can be found in Sarti *et al.*[13]

Simulation

Simulations were conducted at the community hospital to obtain data on human and social capital at the community hospital, including interdisciplinary team functioning, crisis resource management and critical care knowledge and skills.[7,18,19] The simulation component of the NA consisted of two forms of simulation, MBS (e.g. SimMan) and VPS (e.g. interactive video with patient actors), each followed by

debriefing sessions utilizing an expert facilitator engaging participants in reflective and focused discussion on a particular scenario while simultaneously providing teaching.[7,14,19-21] To maximize participants' exposure to the various cases, each team completed two MBS and two VPS sessions. Canadian experts in critical care designed the scenarios to represent prototypical clinical encounters. These scenarios were originally developed for residents in Canada, with the Acute Critical Events Simulation course. The scenarios, which included cases of impending respiratory failure, shock, sepsis and arrhythmias, were reviewed by an interdisciplinary panel, modified to reflect the realities of practice in the community hospital, and were video-recorded. To assess performance during simulation, custom task checklists and two validated global rating scales were completed.[20,21] Only quantitative data from the simulations was included in the original NA,[13] given that debriefs have not been described as NA tools.

The MBS and VPS scenarios were each followed by a 20 minute debrief session, which were video recorded. The debriefs were designed to establish an engaging and supportive learning environment, promote facilitated reflection and discussion, explore performance gaps and provide feedback to the participants with respect to the scenarios.[22] Facilitators used a blended approach, including focused facilitation to encourage critical reflection and deeper understanding of events and also to provide information through directed performance feedback and teaching.[23] In addition to the standard learner-centred debriefing, participants were encouraged to discuss their practice context and reality.

Time and cost analysis

Time for each of the data collection methods, interviews, focus groups and debriefs, were captured from audio files. Data on the financial costs were captured in budgets and expenditure tracking documents,

including equipment, travel expenses and hourly salary rates. MBS specific costs included manikin rental, rental van for transportation. Both MBS and VPS required use of computer programs, a simulation instructor and technologist. Travel was required for both forms of simulation and focus groups. The interviews from the earlier study were held via telephone. The debriefs, interviews and focus groups all required a facilitator, audio recorder, transcriptionist, researcher and research assistant to perform coding and thematic analysis. Investment costs for initial implementation of a simulation program, annual operational maintenance and replacement expenses were not considered. Time and cost to prepare the interview/focus group guides and simulation cases were not included in the analysis, as there was not enough data available to accurately estimate.

Secondary Data Analysis

Data analysis comprised secondary thematic analysis and comparative analysis.[15,16] Comparative analysis was required to compare and contrast the data from the earlier study with the MBS and VPS debriefs.

Thematic analysis of the debriefs was performed.[24-26] Transcripts were entered into NVIVO software. Codes identified in previous work/inquiry were applied to the data.[17] To enhance study rigour multiple coders coded the transcripts, including two researchers who were involved with coding in the original NA (AS, SS), and one researcher who was not involved with coding in the original study (RA). Researchers actively searched for disconfirming data and identification of additional codes; inductive and deductive approaches were utilized. Themes and their definitions were decided through researcher discussion and negotiation. Qualitative data from the simulation debriefs was contrasted to the qualitative data obtained with the earlier NA (focus groups and interviews). The final analytic component included reading through all the transcripts in each data collection modality (traditional, VPS

and MBS) so as to selectively identify areas of convergence and divergence in both the content and structure of the transcript per data collection method.[27]

Study Rigor

Multiple strategies were employed to minimize threats to the validity/credibility of the study. Efforts were made to search for disconfirming evidence through the use of purposive sampling, with the selection of participants to provide a balanced representation of the collective group, including potential differences of opinion. Two forms of triangulation were employed to achieve a balanced perspective and enhance the reliability of the conclusions: 1) data source triangulation (using multiple data sources and informants), and 2) investigator triangulation (using more than one person to collect, analyze and interpret data).

Patient Public Involvement

Patients and / or public were not involved in this study.

RESULTS

Participants

There were 31 participants in the focus groups (13 from the community hospital, 11 from the referral hospital and 7 in an inter-hospital focus group; this included 12 physicians, 14 nurses and 5 respiratory therapists (RTs) and 22 participants in the interviews (2 regional leaders, 7 community hospital leaders and 13 referral hospital leaders). In the simulations, there were 13 participants from the community hospital (6 physicians, 6 nurses and 1 RT) who formed 6 teams (see Table 1).

Table 1 Participant demographics Earlier Comprehensive NA	
Interviews	**Total = 22**
- Regional leaders	2
- Community hospital leaders	7
- Referral hospital leaders	13
Focus Groups	**Total = 31**
- Community hospital	6-MD, 6-RN, 1-RT
- Referral hospital	4-MD, 5-RN, 2-RT
- Interhospital	2-MD, 3-RN, 2-RT
Simulation Debriefs	
Manikin-based simulations (MBS)	**Total = 13** **(6 MD, 6 RN, 1 RT)**
- Community hospital	6 teams (1-MD, 1-RN +/- RT per team) each team performed 2 MBS cases
Virtual patient simulations (VPS)	**Total = 13** **(6 MD, 6 RN, 1 RT)**
- Community hospital	6 teams (1-MD, 1-RN +/- RT per team**) each team performed 2 VPS cases***
MD = physician; RN = nurse; RT = respiratory therapist; ** One VPS was completed by a physician alone (no other team member) ***One team completed only one of the two VPS cases.	

Time and cost analysis

The 22 interviews (average 31 minutes; range 15–48 minutes) and 6 focus groups (average 108 minutes; range 57–154 minutes) yielded 684 and 647 minutes of audio recordings, for a total of 1331 minutes.

The MBS debriefs averaged 22 minutes (range 17-30 minutes; total = 130 minutes) and VPS debriefs averaged 31 minutes (range 25-48 minutes; total = 186 minutes). The results of the cost analysis are displayed in Table 2. The total cost for interviews and focus groups was approximately $13,560, for MBS was $4,030 and for VPS debriefs was $3,475.

Table 2: Cost comparison across the data collection tools

Items	Interviews / Focus Groups	Virtual Patient Simulations	High fidelity Simulations
Costs with running the simulations [1]			
Rental Van - Bringing equipment to site	N/A	N/A	**$550**
Facility rates [2]	N/A	No charge	No charge
Manikin daily rental fee	N/A	N/A	**$500**
Computer Software program	N/A	$0 (Newly developed software program Licencing fee)	$0 (Software program owned)
Needles / gauze / syringes / etc. for MBS	N/A	N/A	No additional charge Re-usable materials.
Simulation Instructor [3]	N/A	**$1002** ($1250-$248 for the debrief)	**$1074** ($1250-$176 for the debrief)
Technologist [4]	N/A	**$400**	**$400**
Subtotal	N/A	**$1,402**	**$2,524**
Cost specifically required for the NA / debrief [1]			
Facilitator	**$1332** (22.2hrs x $60/hr)	**$248** (3.1hrs x $80/hr)	**$176** (2.2hrs x $80/hr)
Travel to the site [5]	**$360** ($120 x 3 visits to the site for focus groups)	**$120**	**$120**
Audio recorder	No additional expense (If you have to buy one it is about $250)	No additional expense	No additional expense
Transcription [6]	**$1,434** Interviews = 11.4 data hours x 2.5 transcription hours per hour	**$248** (3.1 hours x 4 x 20 = 248)	**$176** (2.2 hours x 4 x 20)

	of data x $20 /hr = 570 FGs = 10.8 data hours x 4 transcription hours per hour of data x $20/hr = 864		
NVIVO data entry [7]	**$1,554** (22.2 x 35 x 2)	**$217** (3.1 x 35 x 2)	**$154** (2.2 x 35 x 2)
Data analysis – coding and thematic analysis [8]	**$8,880** (22.2 data hours x 2 researchers at 80 /hr for 2.5 hours per hour of collected data)	**$1,240** (3.1 x data hours x 2 researchers at 80 /hr for 2.5 hours per hour of collected data)	**$880** (2.2 data hours x 2researchers at 80 /hr for 2.5 hours per hour of collected data)
Subtotal	**$13,560**	**$2,073**	**$1,506**
Total	**$13,560**	**$3,475**	**$4,030**

[1] Note all funds are reported in Canadian dollars.

[2] Facility rates at this site were not charged. Note that typical rental costs are between 200-300/hr.

[3] Cost assumes access to a trained instructor. Instructor training would be an additional cost. The daily cost for a simulation instructor is $1250. The cost of the debrief sessions has been separated in this table.

[4] Cost assumes access to a trained technologist. Training would be an additional cost.

[5] Land travel at $0.54/km. Travel required for simulations and FGs (Interviews were via telephone).

[6] Transcription costs - For one to one interview assumes 2.5 hours per one hour recording for transcription. For focus group and simulation debriefs assumes 4 hours per one hour recording. Transcriptionist rate is $20 per hour.

[7] NVivo data entry – Research assistant salary $35 per hour – assumes 2 hours required per hour of data.

[8] Data Analysis includes researcher salary of $80 per hour. Considers 2 researchers for coding with approximately 2.5 hours for each researcher per hour of data collected.

Comparative analysis

Data from VPS and MBS debriefs contributed to 15 of 20 total themes compared to the earlier study (See online supplement A). When comparing the top five themes in terms of highest frequency two themes consistently appear across all three data collection modalities: knowledge, skills and abilities (NA interviews and focus groups N=104, MBS N=53, VPS N=127), and solutions (NA interviews and focus groups N=193, MBS N=28, VPS N=57). Similarly, when comparing the five themes with the lowest frequency counts two themes appear across all data collection modalities: leadership (NA interviews and focus groups N=23, MBS N=6, VPS N=10) and night/week-end (NA interviews and focus groups N=48,

MBS N=5, VPS=27). Themes not identified with either form of simulation debriefs included palliative/end-of-life care, patients post-referral hospital, lack of understanding, vision, and family and patient thoughts. A descriptive matrix with the themes and representative quotes from the various data collection methods is presented in online supplement B. In general, for the themes common to both interviews/focus groups and simulation debriefs similar high-level needs were identified, and similar overarching conclusions could be drawn from the simulation debriefs compared to the earlier NA. However, more descriptive data was discovered with the earlier NA versus the simulation debriefs where data was more direct and to the point.

As an exemplar, knowledge, skills and abilities (KSA) was identified across all methods. A key gap identified within this theme was the management of respiratory failure and ventilation. This gap was identified in the interviews, focus groups and simulation debriefs. Key issues identified in the earlier study and simulation debriefs, within this topic included basic and difficult ventilation strategies, troubleshooting and managing status asthmaticus. Weaning and lung protective strategies specifically, were only identified in the interviews and focus groups. Both the earlier study and simulation debriefs identified system level gaps that contributed to this need, including the need for 24 hour RT coverage. Where this need was identified in the simulation debriefs, a greater depth of data emerged during the focus groups surrounding the nature and impact of the gap / lack of 24 hour coverage. In the following focus group, participants discussed challenges of weaning patients:

> *We've been wanting to put patients on APRV at night and it makes it difficult because as they improve their volumes are going to get larger and it's something that you really have to watch on the vent, and the nurses don't. They'll watch but they don't really understand as much as what we do, the doctors have no idea, it's just really us. We're leery sometimes to put somebody on bi-level APRV, whatever you want to call it, because we're not here 24 hours to watch the whole process happen.*

The main themes identified from the simulation (not found in the interview/focus group data) were related to the fidelity of the simulation (environmental, equipment and psychological) and the role of the simulation instructor in teaching and promotion of reflection (See online supplement C). In addition, the theme of interruption was identified only in the MBS debriefs, which occurred when the facilitator interrupted a participant to provide teaching/impart knowledge.

In some instances, lower fidelity led to the discovery of gaps in practice. In the following example the creation of an 'unreal' environment, led to the discovery of a system-level gap. In this situation, the participant highlighted that receiving blood work quickly in the MBS, which does not match their reality and may impact patient care:

> *The blood work is too long in [the community hospital]. It's horrible. Like you can do a code for an hour and you won't even know your potassium, your calcium, or your CBC; it's just a disaster.*

Thus, the role of the facilitator was coded as producing several themes that only emerged within the MBS and VPS datasets. Unlike the traditional NA facilitator, the simulation facilitators carried out multiple roles. Two codes (promoting reflection and teaching) were evident in the educative roles the facilitator played. That is, the facilitator served to further engage the learners in the simulated scenario by promoting reflection through reflective cues. We defined reflection as the "process of learning through and from experience towards gaining new insights of self and/or practice." [28(p1)] The following is an example of the facilitator providing reflective cues linking learning to the experience:

> *Facilitator: So that was an issue that was brought up by a couple of other nurses, not having an RT and not having ventilation. Having regular ventilation control, do you agree with that or do you have a different opinion?*
>
> *Participant: I think there should be an RT 24/24 in this hospital*

Also, the teaching code was evident throughout both MBS and VPS. These educative remarks/exchanges were designed by the facilitator to provide information to the participants to impart knowledge rather than cuing the participants to reflect specifically on their experience.

> *Facilitator: The only thing I point out to you is that sometimes we like to choose the gentler sedatives, but they're going to need sedation then they just may need more adequate haemodynamic support as well.*

Finally, a code that only appeared in MBS data was one called 'interruption'. This code highlighted the conflicting roles of 'educator' and 'researcher'. During the simulation debriefs, at times the facilitator would interrupt the participants to provide education. In the following example, the participant starts to discuss a potential need to have an oscillator (a specialized ventilator). The instructor interrupts the flow of the simulation debrief with directed questioning to provide education that this would not be required in their setting:

> *Participant: And we don't have an oscillator if we truly needed one and we don't…*
>
> *Facilitator: Do you think you need an oscillator?*
>
> *Participant: No, absolutely not*

In contrast, in the following quote a focus group participant describes wanting to have the resource and skills to place Swan-Ganz catheters (a procedure not widely used in tertiary critical care). In this instance, the moderator does not provide education as is typical in interview/focus groups, but rather summarizes and continues to probe to ensure understanding of the needs. In this situation, the participants leave with the same perspective – that this is perceived as being a priority.

> *Participant: We are not utilizing for example using Swan-Ganz… I tried to put Swan-Ganz for some of my patients that I thought they need it but then most of the nurses said, well last time*

we had it was 10 years ago, lost experience with that and we don't have the modalities… Maybe that will give the nurses more confidence when they do it more frequent.

Facilitator: So is that ongoing education of the nursing staff…

Participant: Absolutely, because that's what the ICU needs.

A comparison of the three different data collection methods (traditional, VPS and MBS) is displayed in Table 3. The areas of convergence or where all three data collection modalities revealed the same element (to varying degrees) included: variation in reflection and uncovering system level barriers. Areas of divergence included: time, structure, facilitator skill level, and education (the degree to which education was 'built-in' the method). The two elements that were present in the simulation data collection methods were the ability to conduct multiple cases in one session, as well as the simultaneous multiple roles played by the facilitator.

Table 3 Multimodal comparative data display

Observation/Notation	Traditional Interviews/Focus Groups (FGs)	VPS	MBS
Skill level of facilitator	Moderate	High	Extremely High
Time (average duration)	Interviews - 31 minutes FGs - 108 minutes	31 minutes	22 minutes
Structure	Inquiry involves continuous questioning and answers	Multiple cases involving a structure of playing part of a case, stopping to debrief/discuss, playing more of the case, stopping to debrief, discuss, etc.	2 cases in 15 minutes with a 5/10 min structure, that is 5 mins devoted to what the participants thought about the scenario, did they like it, was it realistic, etc., then 10 minutes to reflect on the case regarding their own practice realities.
Variation in reflection	Reflect on past experience	Serves as a prompt to reflection on reality (not focused on VPS case)	Immediacy of reflection tied tightly / coupled to simulation scenario, thus creating a platform for, 1) reflection in/on simulation,

			and 2) reflect on reality
Educative purpose	Low	High	High
Roles of the Facilitator	Single: Researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor
Trade-offs with various roles of the moderator / facilitator	Not applicable	Triple role = more potential for impact	Triple role = more potential for impact i.e., if teaching and interrupt may lead to less data collected for the research purpose (i.e., identifying needs)
Uncovering system level barriers	Requires a lot of time and perhaps multiple lines of questioning and/or interviews	Moderate ability to probe system level abilities (as people want to waver and chat around many issues – not as streamlined and direct as sim scenarios)	Streamlined to uncover system level barriers
Technical difficulties	No occurrence in this dataset. Would be limited possibility (e.g., audio recorder failure)	"Technical glitch" RC Sim Team B (e.g., blood gases results do not come up) and as a result they had to move on.	No occurrence in this dataset but could happen, more technical aspects hence likely greater risk than with traditional methods
Multiple cases at once	Not applicable	Multiple cases	1 case per scenario

DISCUSSION

This study explored the potential use of MBS and VPS debriefs as NA tools and revealed that debriefs may be more efficient under certain circumstances, in terms of time and cost at capturing similar needs contrasted to traditional methods of data collection (interviews/focus groups). Our investigation has also highlighted various trade offs which exist with selecting simulation as a NA method.

Time and Cost

With respect to time, the simulation debriefs yielded a considerably shorter total length of audio recording (76% less time than interviews/focus groups). As such the costs specifically required for the NA were significantly lower for the simulations compared to the interviews and focus groups (73% less

cost incurred). Even when taking into consideration the total costs of running the simulation cases before the debriefs and the debriefs themselves, the cost remained lower due to the high cost of transcription, NVIVO data entry and data analysis with larger volume of data collected. It is notable, that for this cost of simulations multiple goals may be achieved, in that the observed simulation scenario performance allows for quantitative measure of performance gaps, may serve as pre-intervention baseline performance data, and may reveal additional unperceived performance gaps, not otherwise captured in interviews, focus groups or debriefs, as demonstrated in our earlier study.[13] It is important to note that cost analysis did not include the initial investment costs or maintenance of a simulation program. Hence if there were not a program in place, the cost of simulation would be increased.[29] The cost of a manikin-based simulator is substantially higher than a virtual patient simulator,[30] which is an important consideration for those considering using simulation as debriefs in NA.

Comparative Analysis

Even with substantially less time spent in the simulation debriefs, the majority of themes were identified in the simulation debriefs compared to the interviews and focus groups. Perhaps capturing needs is better accomplished when participants have an experiential and emotional encounter (possibly feeling more vulnerable), with the discussion occurring close to the event and promoting active participation. Theory underpinning the debriefs includes facilitating the transformation of experience into learning through reflection where, "the ultimate goal of debriefing is for learners to reflect on and make sense of their simulation experience and generate meaningful learning that translates to clinical practice."[23] Links between emotion and cognition have been suggested and hence, actively experiencing an event accompanied by intense emotions, may result in long-lasting learning.[28,31] Broadening the concept of participation, increasingly the importance of materiality (i.e., objects and technologies) and relations

(with social and material 'forces') are being recognized in the literature through a sociomaterial approach to practice and learning.[32] Fenwick argues that materials, often missing from learning accounts, cannot be ignored as they fundamentally impact human activity (medical practice and knowledge), further stating that "any medical practice is a collective sociomaterial enactment, not a question solely of an individual's skill." [32(p48)] With this approach, simulation provides a model setting to better understand complex medical practice, hence allowing the opportunity to identify needs at various levels (system/team/individual) and across various complex intertwined elements (material/social/cultural) within unique systems. As the learners work to make sense of the simulation experience in reference to their own world, there is the opportunity to both identify needs and provide education. By identifying and interrupting matters that had previously felt settled, the so called "black boxes that masquerade as matters of fact" may be opened.[32 (p50)]

Although the majority of themes were identified in the simulation debriefs (15 of 20), as compared to the interview and focus groups, a greater depth of data was captured through the more traditional methods. With NAs, initial data collection may inform subsequent data collection decisions.[33] In addition, priorities must be set, which includes identifying needs of greatest importance and most amenable to change.[33] Depending on the purpose and scope of a given NA, simulation debriefs may stand alone or may be used to make decisions surrounding whether more extensive data is required. Performing simulation debriefs may also help identify the highest priority needs and determine the initial set of needs to be targeted, in that the needs which are most readily uncovered may be the highest priority contrasted to those that require more probing and questioning.

The findings highlight that not all themes identified in the interviews and focus groups were captured in the debriefs. More specifically, palliative and end-of-life care was not identified in the debriefs, nor was the vision of participants or two themes relating to the inter-hospital interaction (patients' post-referral hospital and lack of understanding). In addition, although the theme of patient transfers was identified across all methods, the relative frequency and depth of data was much lower in the debriefs compared to the interviews and focus groups. This is an important, yet not unexpected finding, given the simulation cases were not specifically designed to explore the areas of end-of-life care or the interaction between the community and referral hospital, contrasted to the traditional NA which undertook a broad line of inquiry along with probing into various aspects of critical care, including both end-of-life care and inter-hospital interactions. The debriefs also did not include asking participants their vision and this data would be unlikely to emerge independent of directed inquiry. This finding highlights the risk of missing needs with the simulation debriefs and demonstrates the importance of scenario selection and development.

Trade-offs

In this investigation, multiple interrelated roles of the simulation facilitator during the debriefs were identified, including promoting reflection, teaching participants, and exploring gaps in practice. Despite utilizing different cases, online supplement C reveals that the two simulation methods produced similar patterns in terms of thematic frequency scores. That is, the three highest rated simulation specific themes were reflection and teaching. Perhaps this finding is indicative of the method whereby education is infused, upfront in simulation. In this way, a strength of simulation debriefs may include that they can act simultaneously as an education tool and data collection modality.

Simulation debriefs focus on transformative learning through self-reflection may include individual and/or social engagement.[28] The simulation debriefs capitalized on the social spectrum of reflection and through critical discourse between the facilitator and participants, needs/gaps were uncovered beyond individual and team performance, also uncovering system level gaps. Thus, a strength of utilizing simulation debriefs may also include providing a tool for assessing needs across individual, team, and system levels. Furthermore, this finding highlights the importance of working to structure the debriefs to promote deeper reflection,[34] hence potentially surfacing unknown unknowns which combined with the quantitative data (normative needs) from the simulation offers more depth than eliciting only felt needs (known unknowns).

It is important to note that having the simulation facilitator act in multiple roles inevitably presents challenges and trade-offs among these roles, which is a potential limitation of utilizing debrief session in NAs. For example, in the traditional interviews and focus groups the facilitator remains 'neutral' and does not provide education while they pursue questioning to better understand the needs.[35] In contrast, in the simulation debriefs, the facilitator does not remain neutral, at times interrupting the participants to redirect and provide education, as evidenced by the emergence of the interruption code within the MBS data. Interruption was coded as instances whereby the facilitator would intentionally stop the conversation to correct participants when they were clearly discussing inaccurate content. When priority is given to the educative role, the actions of the facilitator risks not allowing the participants to explore and express details surrounding their needs. However, the educative element also promotes engagement through a collaborative approach and participants may leave with a better understanding and having learnt something. Making transparent, thoughtful decisions surrounding which methods to select, recognizing there are advantages and disadvantages to each, is fundamental to

performing NAs.[35-38] If debriefs are to be more widely used in NAs, we need to better understand the tradeoffs and their impact on the NA.

In this study, very experienced master instructors facilitated the debriefs. The quality of the debriefs may be linked to this, in that someone of lesser experience may not have been able to uncover these gaps, while providing skilled education, which potentially limits general use of debriefs in NA. How educators facilitate debriefings has been shown to be highly variable.[39] Debrief facilitation also appears to be influenced by the professional background and style of the facilitators. In their exploratory investigation, van Soeren *et al.*[10] described how some facilitators assumed the role of an interprofessional guide whereas others assumed the role of teacher, tending to impart their knowledge. This variability in facilitation is an important consideration for assessing needs, in that if the facilitator were to have a style more strongly connected with teaching, then needs may not be readily uncovered. As simulation instructors interact with participants in collecting data for the NA, their role must be considered as meaning is actively co-constructed.[40] In addition, the skill level of MBS and VPS may be different (i.e., higher level/more experienced) than that of a facilitator collecting data in a more traditional qualitative manner.

Strengths of our study include highlighting the efficiency in using MBS and VPS simulation as a timely and potentially cost-efficient alternative to employing traditional (interviews and focus groups) methods albeit under certain assumptions (i.e., the research team had access to a simulation center with pre-developed simulation scenarios for both the MBS and VPS sessions). This finding is interconnected to the issue of the breadth and depth in data coverage. That is, the results of this study demonstrate similarities in breadth of themes using traditional methods and simulation debrief with the notable difference in terms of depth. Undeniably, the qualitative interviews and focus groups were able to

provide more depth and richness in the data as opposed to the simulation techniques which were considerably shorter in terms of transcript coverage. However, simulation offers the added benefit of providing quantitative performance data which can serve as a baseline and to triangulate with the debrief data.

This was an exploratory study, which included secondary analysis of an existing dataset. Where secondary analysis has been recognized as an important, underutilized research approach, there are limitations to this method. The quality of the secondary data analysis rests on the quality of the existing dataset.[15] It is important to highlight that, as described, our earlier study was performed with a rigorous methodology with numerous methods in place to ensure high quality and credibility of our findings. One concern noted in the literature is the potential '*problem of data fit.*'[16] In the current study, the data was not originally collected for the current research objective, however, the available data was well positioned to answer the current research questions in an exploratory manner. In addition, '*the problem of not having been there*' has been cited as a concern, in that challenges exist when the secondary researcher was not involved in the original data collection.[16] Furthermore, limitations of this study include the relatively small sample size and the focus on a single center. Further research is required to better understand the utility of simulation as a NA tool, the design features for NA, and type of needs best identified using this approach. Moreover, it will be imperative that various stakeholder groups participate in each type of data collection methods so as to make more definitive conclusions.

In conclusion, this investigation provides support for the use of simulation debriefs as a NA method, to explore needs at the system, team and individual levels. Qualitative data collected during debriefs may be a suitable substitute to the typical interviews and/or focus groups. Simulation debriefs promote a

participatory, collaborative, approach with the educative function built in. Given current fiscal realities, the dual benefit of being both educative whilst identifying needs is appealing albeit under certain conditions. While simulation is an innovative and effective method to conduct NAs, it is important to recognize that there are trade-offs with selection of methods requiring careful scenario design and debriefing.

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Online Supplement A: Qualitative data display comparing the frequency of themes across the various data collection tools

	Data Collection Tools			
Themes	**Earlier NA (interviews and focus groups)**	**Debrief after HFS**	**Debrief after VPS**	**Total HFS + VPS**
Community Hospital				
Knowledge, Skills and Abilities	104	53	74	127
Roles	100	36	83	119
Communication	92	13	21	34
Patient Flow	95	2	35	37
Resources - Human	80	32	32	64
Resources - Physical	44	13	24	37
Confidence/Comfort	49	25	16	41
Team	35	26	16	42
Palliative/EOLC	27	0	0	0
Leadership	23	6	4	10
Inter-hospital Interaction				
Transfer	200	3	21	24
Communication	192	13	21	34
Patients post referral hospital	49	0	0	0
Relationship	51	10	7	17
Lack of understanding	47	0	0	0
Additional Themes				
Solutions	193	28	29	57
Education/Training	182	13	10	23
Vision	40	0	0	0
Family and patient thoughts	31	0	0	0
Night/Weekend	48	5	22	27

Online supplement B: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after HFS**	**Debrief after VPS**	**Total HFS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

Online supplement C: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after MBS**	**Debrief after VPS**	**Total MBS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

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A comparison of simulation debriefs with traditional needs assessment methods

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A comparison of simulation debriefs with traditional needs assessment methods

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Aimee J Sarti contributed to the study conceptualization and led data collection, data analysis, manuscript development and review. Rola Ajjawi contributed to the study conceptualization, data analysis, manuscript development and review. Stephanie Sutherland contributed to the study conceptualization, data analysis, manuscript development and review. Angele Landriault contributed to data collection, data analysis, manuscript development and review. John Kim contributed to the study conceptualization, data collection, manuscript preparation and review. Pierre Cardinal contributed to the study conceptualization, data collection, data analysis, manuscript development and review. Thus, all authors meet the ICMJE criteria for authorship.

ABSTRACT

Objective: To better understand the potential of a needs assessment approach utilizing qualitative data from manikin-based and virtual-patient simulation debriefing sessions compared to traditional data collection methods (i.e., focus groups and interviews).

Design: Original data from simulation debrief sessions was compared and contrasted with data from an earlier assessment of critical care needs in a community setting (using focus groups and interviews), thus undertaking secondary analysis of data. Time and cost data were also examined. Debrief sessions were coded utilizing deductive and inductive techniques. Matrices were utilized to explore the commonalities, differences, and emergent findings across the methods.

Setting: Critical care unit in a community hospital setting.

Results: Interviews and focus groups yielded 684 and 647 minutes of audio-recordings. The manikin-based debrief recordings averaged 22 minutes (total = 130 minutes) and virtual-patient debrief recordings averaged 31 minutes (total = 186 minutes). The approximate cost for the interviews and focus groups was $13,560, for manikin-based simulation debriefs was $4,030 and for the virtual patient debriefs was $3,475. Fifteen of 20 total themes were common across the simulation debriefs and interview/focus group data. Simulation-specific themes were identified, including fidelity (environment, equipment and psychological) and the multiple roles of the simulation instructor (educative, promoting reflection, and assessing needs).

Conclusions: Given current fiscal realities, the dual benefit of being educative and identifying needs is appealing. While simulation is an innovative method to conduct needs assessments, it is important to recognize that there are trade-offs with the selection of methods.

Strengths and limitations of this study:

- Simulation is an innovative methodology to undertake needs assessments
- Utilizing simulation permits the development of an environment that enables the learner to perform naturally and gain insight into the complexity of the actual workplace
- Study adds to the relative dearth of qualitative work in simulation and medical education
- Study sample is relatively small and is performed at a single center
- Cross sectional nature of the study does not permit generalizations

INTRODUCTION

Calls for innovative strategies in conducting needs assessments (NAs) have been made in the medical literature over an extended period of time.[1–5] A needs assessment (NA) is a systematic process to collect and analyze information on a target group's needs (i.e., examine gaps between current and desired situations). [6] Simulation holds potential as a NA method to promote a better understanding of these gaps given that it aims "to develop an environment that enables the learner to perform naturally to gain insight into the complexity of the actual workplace".[7 (p59)] Prior research has demonstrated that simulation permits trainees to live through a realistic experience, make mistakes in a safe environment and practice before they actually perform on real people.[8,9] Similarly, medical educators also find simulation experiences to be stimulating and realistic, and provide opportunities for the integration of basic clinical teaching with advanced problem solving especially given the opportunities to reflect on the case after the simulation scenario.[8] Through a process of experiential learning and deliberate practice, the use of simulation in health professionals' education has been shown to consistently improve the acquisition of knowledge, skills and behaviors.[10,11] However, there is a paucity of literature on the role of simulation in performing NAs, including the use of simulation to determine system and/or institutional level gaps for change management. In addition, there is a general lack of qualitative simulation studies in medical education that compare simulation to more traditional qualitative methods.[12-14]

Recognition and care of critically ill patients in community settings is complex, requiring skilled staff and optimal use of resources at the site, plus a coordinated system for interaction with, and transfer to the referral centre when needed. In 2006, the Critical Care Strategy was announced by the Ministry of Health and Long-Term Care of Ontario, Canada. The purpose of this on-going initiative is to improve access, quality, and system integration to ensure all citizens of Ontario have equal access to high-quality critical care. In keeping with this mandate, a comprehensive NA was completed by members of the

current research team, which identified gaps in caring for critically ill patients at a single community hospital.[15] These results provided insights into the needs of a community to optimize care of its critically ill patients, as well as suggestions for how a referral hospital may best support its community site. However, the cost and time required to complete this study was substantial and the process requires streamlining in order to be feasible to implement across numerous sites.

This earlier study included interviews, focus groups, Manikin-Based Simulation (MBS) and Virtual Patient Simulation (VPS), questionnaires and a family survey. Following each of the MBS and VPS, 20 minute debrief sessions were held, and video recorded. These debrief sessions were not included in the comprehensive NA but rather were included as normal pedagogical practice in providing feedback for simulation participants and to facilitate development of reflective skills and teaching for simulation participants.[16] However, upon reviewing the recordings, it was notable that many of the same themes that were discussed in the larger NA were also identified by participants in these debriefs. This serendipitous finding suggested that simulation debriefs could be of value as data for NA either alongside or instead of traditional approaches. The overarching guiding research questions included: 1) How do the needs identified through simulation compare with those identified using traditional methods of NA data collection? 2) Can similar data be captured more efficiently in the simulation debrief session compared to lengthier traditional methods? and 3) What are the strengths and limitations of utilizing simulation in NA?

Specifically, this study aims to better understand the potential of a NA approach utilizing qualitative data from MBS and VPS debriefing sessions to explore the system, team and individual level needs in caring for critically ill patients in a community context, compared to traditional methods (i.e., focus groups and interviews). We also aimed to compare feasibility in terms of time and cost.

METHODS

Secondary analysis has been recognized as an important, yet underutilized research approach.[16] It has been defined as the reanalysis of an existing data set, which may be used to investigate new research questions or verify previous research findings. [17,18] For the current research, original data were compared and contrasted from simulation debriefs with data from the earlier assessment of critical care needs in a community setting, enabling exploration of the current research question from our existing data.

Patient and Public Statement

Patients were not involved in the design and/or recruitment for this study.

Design and Analysis

Original study data collection and analysis

The original mixed-method study was conducted between June 2011 and February 2012. A conceptual framework, centered on the critically ill patient guided the design and selection of that data collection instruments. Different perspectives sampled included regional leaders, healthcare professionals at the community and its' referral hospital, as well as family members of patients who had received care at the community ICU. Interviews and focus groups were designed to follow a semi-structured, broad, pre-determined line of inquiry that was flexible permitting exploration of themes. Data from each interview and focus group were transcribed, entered into NVIVO software and inductive coding techniques were applied as informed by Creswell's thematic analysis approach.[19] The constant comparative method was used as data were analyzed.[18] Full information regarding the original study can be found in Sarti *et al.*[15]

Simulation

Simulations were conducted at the community hospital to obtain data on human and social capital at the community hospital, including interdisciplinary team functioning, crisis resource management and critical care knowledge and skills.[10,20,21] The simulation component of the NA consisted of two forms of simulation, MBS (e.g. SimMan) and VPS (e.g. interactive video with patient actors), each followed by debriefing sessions utilizing an expert facilitator engaging participants in reflective and focused discussion on a particular scenario while simultaneously providing teaching.[10,16,21-23] To maximize participants' exposure to the various cases, each team completed two MBS and two VPS sessions. Canadian experts in critical care designed the scenarios to represent prototypical clinical encounters. These scenarios were originally developed for residents in Canada, with the Acute Critical Events Simulation course. The scenarios, which included cases of impending respiratory failure, shock, sepsis and arrhythmias, were reviewed by an interdisciplinary panel, modified to reflect the realities of practice in the community hospital, and were video-recorded. To assess performance during simulation, custom task checklists and two validated global rating scales were completed.[22,23] Only quantitative data from the simulations was included in the original NA,[15] given that debriefs have not been described as NA tools.

The MBS and VPS scenarios were each followed by a 20 minute debrief session, which were video recorded. The debriefs were designed to establish an engaging and supportive learning environment, promote facilitated reflection and discussion, explore performance gaps and provide feedback to the participants with respect to the scenarios.[24] Facilitators used a blended approach, including focused facilitation to encourage critical reflection and deeper understanding of events and also to provide

information through directed performance feedback and teaching.[25] In addition to the standard learner-centred debriefing, participants were encouraged to discuss their practice context and reality.

Time and cost analysis

Time for each of the data collection methods, interviews, focus groups and debriefs, were captured from audio files. Data on the financial costs were captured in budgets and expenditure tracking documents, including equipment, travel expenses and hourly salary rates. MBS specific costs included manikin rental, rental van for transportation. Both MBS and VPS required use of computer programs, a simulation instructor and technologist. Travel was required for both forms of simulation and focus groups. The interviews from the earlier study were held via telephone. The debriefs, interviews and focus groups all required a facilitator, audio recorder, transcriptionist, researcher and research assistant to perform coding and thematic analysis. Investment costs for initial implementation of a simulation program, annual operational maintenance and replacement expenses were not considered. Time and cost to prepare the interview/focus group guides and simulation cases were not included in the analysis, as there was not enough data available to accurately estimate.

Secondary Data Analysis

Data analysis comprised secondary thematic analysis and comparative analysis.[17,18] Comparative analysis was required to compare and contrast the data from the earlier study with the MBS and VPS debriefs. Thematic analysis of the debriefs was performed.[26-28] Transcripts were entered into NVIVO software. Codes identified in previous work/inquiry were applied to the data.[19] To enhance study rigour multiple coders coded the transcripts, including two researchers who were involved with coding in the original

NA (AS, SS), and one researcher who was not involved with coding in the original study (RA). Researchers actively searched for disconfirming data and identification of additional codes; inductive and deductive approaches were utilized. Themes and their definitions were decided through researcher discussion and negotiation. Qualitative data from the simulation debriefs was contrasted to the qualitative data obtained with the earlier NA (focus groups and interviews). The final analytic component included reading through all the transcripts in each data collection modality (traditional, VPS and MBS) so as to selectively identify areas of convergence and divergence in both the content and structure of the transcript per data collection method.[29]

Study Rigor

Multiple strategies were employed to minimize threats to the validity/credibility of the study. Efforts were made to search for disconfirming evidence through the use of purposive sampling, with the selection of participants to provide a balanced representation of the collective group, including potential differences of opinion. Two forms of triangulation were employed to achieve a balanced perspective and enhance the reliability of the conclusions: 1) data source triangulation (using multiple data sources and informants), and 2) investigator triangulation (using more than one person to collect, analyze and interpret data).

RESULTS

Participants

There were 31 participants in the focus groups (13 from the community hospital, 11 from the referral hospital and 7 in an inter-hospital focus group; this included 12 physicians, 14 nurses and 5 respiratory therapists (RTs) and 22 participants in the interviews (2 regional leaders, 7 community hospital leaders

and 13 referral hospital leaders). In the simulations, there were 13 participants from the community hospital (6 physicians, 6 nurses and 1 RT) who formed 6 teams (see Table 1).

Table 1 Participant demographics

Earlier Comprehensive NA

Interviews	**Total = 22**
- Regional leaders	2
- Community hospital leaders	7
- Referral hospital leaders	13
Focus Groups	**Total = 31**
- Community hospital	6-MD, 6-RN, 1-RT
- Referral hospital	4-MD, 5-RN, 2-RT
- Interhospital	2-MD, 3-RN, 2-RT
Simulation Debriefs	
Manikin-based simulations (MBS)	**Total = 13 (6 MD, 6 RN, 1 RT)**
- Community hospital	6 teams (1-MD, 1-RN +/- RT per team) each team performed 2 MBS cases
Virtual patient simulations (VPS)	**Total = 13 (6 MD, 6 RN, 1 RT)**
- Community hospital	6 teams (1-MD, 1-RN +/- RT per team**) each team performed 2 VPS cases***

MD = physician; RN = nurse; RT = respiratory therapist; ** One VPS was completed by a physician alone (no other team member) ***One team completed only one of the two VPS cases.

Time and cost analysis

The 22 interviews (average 31 minutes; range 15–48 minutes) and 6 focus groups (average 108 minutes; range 57–154 minutes) yielded 684 and 647 minutes of audio recordings, for a total of 1331 minutes. The MBS debriefs averaged 22 minutes (range 17-30 minutes; total = 130 minutes) and VPS debriefs averaged 31 minutes (range 25-48 minutes; total = 186 minutes). The results of the cost analysis are

displayed in Table 2. The total cost for interviews and focus groups was approximately $13,560, for MBS was $4,030 and for VPS debriefs was $3,475.

Table 2: Cost comparison across the data collection tools

Items	Interviews / Focus Groups	Virtual Patient Simulations	High fidelity Simulations
Costs with running the simulations [1]			
Rental Van - Bringing equipment to site	N/A	N/A	**$550**
Facility rates [2]	N/A	No charge	No charge
Manikin daily rental fee	N/A	N/A	**$500**
Computer Software program	N/A	$0 (Newly developed software program Licencing fee)	$0 (Software program owned)
Needles / gauze / syringes / etc. for MBS	N/A	N/A	No additional charge Re-usable materials.
Simulation Instructor [3]	N/A	**$1002** ($1250-$248 for the debrief)	**$1074** ($1250-$176 for the debrief)
Technologist [4]	N/A	**$400**	**$400**
Subtotal	N/A	**$1,402**	**$2,524**
Cost specifically required for the NA / debrief [1]			
Facilitator	**$1332** (22.2hrs x $60/hr)	**$248** (3.1hrs x $80/hr)	**$176** (2.2hrs x $80/hr)
Travel to the site [5]	**$360** ($120 x 3 visits to the site for focus groups)	**$120**	**$120**
Audio recorder	No additional expense (If you have to buy one it is about $250)	No additional expense	No additional expense
Transcription [6]	**$1,434** Interviews = 11.4 data hours x 2.5 transcription hours per hour of data x $20 /hr = 570 FGs = 10.8 data hours x 4 transcription hours per hour of data x $20/hr = 864	**$248** (3.1 hours x 4 x 20 = 248)	**$176** (2.2 hours x 4 x 20)
NVIVO data entry [7]	**$1,554** (22.2 x 35 x 2)	**$217** (3.1 x 35 x 2)	**$154** (2.2 x 35 x 2)

Data analysis – coding and thematic analysis [8]	**$8,880** (22.2 data hours x 2 researchers at 80 /hr for 2.5 hours per hour of collected data)	**$1,240** (3.1 x data hours x 2 researchers at 80 /hr for 2.5 hours per hour of collected data)	**$880** (2.2 data hours x 2researchers at 80 /hr for 2.5 hours per hour of collected data)
Subtotal	**$13,560**	**$2,073**	**$1,506**
Total	**$13,560**	**$3,475**	**$4,030**

[1] Note all funds are reported in Canadian dollars.

[2] Facility rates at this site were not charged. Note that typical rental costs are between 200-300/hr.

[3] Cost assumes access to a trained instructor. Instructor training would be an additional cost. The daily cost for a simulation instructor is $1250. The cost of the debrief sessions has been separated in this table.

[4] Cost assumes access to a trained technologist. Training would be an additional cost.

[5] Land travel at $0.54/km. Travel required for simulations and FGs (Interviews were via telephone).

[6] Transcription costs - For one to one interview assumes 2.5 hours per one hour recording for transcription. For focus group and simulation debriefs assumes 4 hours per one hour recording. Transcriptionist rate is $20 per hour.

[7] NVivo data entry – Research assistant salary $35 per hour – assumes 2 hours required per hour of data.

[8] Data Analysis includes researcher salary of $80 per hour. Considers 2 researchers for coding with approximately 2.5 hours for each researcher per hour of data collected.

Comparative analysis

Data from VPS and MBS debriefs contributed to 15 of 20 total themes compared to the earlier study (See online supplement A). When comparing the top five themes in terms of highest frequency two themes consistently appear across all three data collection modalities: knowledge, skills and abilities (NA interviews and focus groups N=104, MBS N=53, VPS N=127), and solutions (NA interviews and focus groups N=193, MBS N=28, VPS N=57). Similarly, when comparing the five themes with the lowest frequency counts two themes appear across all data collection modalities: leadership (NA interviews and focus groups N=23, MBS N=6, VPS N=10) and night/week-end (NA interviews and focus groups N=48, MBS N=5, VPS=27). Themes not identified with either form of simulation debriefs included palliative/end-of-life care, patients post-referral hospital, lack of understanding, vision, and family and patient thoughts. A descriptive matrix with the themes and representative quotes from the various data collection methods is presented in online supplement B. In general, for the themes common to both

interviews/focus groups and simulation debriefs similar high-level needs were identified, and similar overarching conclusions could be drawn from the simulation debriefs compared to the earlier NA. However, more descriptive data was discovered with the earlier NA versus the simulation debriefs where data was more direct and to the point.

As an exemplar, knowledge, skills and abilities (KSA) was identified across all methods. A key gap identified within this theme was the management of respiratory failure and ventilation. This gap was identified in the interviews, focus groups and simulation debriefs. Key issues identified in the earlier study and simulation debriefs, within this topic included basic and difficult ventilation strategies, troubleshooting and managing status asthmaticus. Weaning and lung protective strategies specifically, were only identified in the interviews and focus groups. Both the earlier study and simulation debriefs identified system level gaps that contributed to this need, including the need for 24 hour RT coverage. Where this need was identified in the simulation debriefs, a greater depth of data emerged during the focus groups surrounding the nature and impact of the gap / lack of 24 hour coverage. In the following focus group, participants discussed challenges of weaning patients:

> *We've been wanting to put patients on APRV at night and it makes it difficult because as they improve their volumes are going to get larger and it's something that you really have to watch on the vent, and the nurses don't. They'll watch but they don't really understand as much as what we do, the doctors have no idea, it's just really us. We're leery sometimes to put somebody on bi-level APRV, whatever you want to call it, because we're not here 24 hours to watch the whole process happen.*

The main themes identified from the simulation (not found in the interview/focus group data) were related to the fidelity of the simulation (environmental, equipment and psychological) and the role of the simulation instructor in teaching and promotion of reflection (see online supplement C). In addition,

the theme of interruption was identified only in the MBS debriefs, which occurred when the facilitator interrupted a participant to provide teaching/impart knowledge.

In some instances, lower fidelity led to the discovery of gaps in practice. In the following example the creation of an 'unreal' environment, led to the discovery of a system-level gap. In this situation, the participant highlighted that receiving blood work quickly in the MBS, which does not match their reality and may impact patient care:

> *The blood work is too long in [the community hospital]. It's horrible. Like you can do a code for an hour and you won't even know your potassium, your calcium, or your CBC; it's just a disaster.*

Thus, the role of the facilitator was coded as producing several themes that only emerged within the MBS and VPS datasets. Unlike the traditional NA facilitator, the simulation facilitators carried out multiple roles. Two codes (promoting reflection and teaching) were evident in the educative roles the facilitator played. That is, the facilitator served to further engage the learners in the simulated scenario by promoting reflection through reflective cues. We defined reflection as the "process of learning through and from experience towards gaining new insights of self and/or practice." [30(p1)] The following is an example of the facilitator providing reflective cues linking learning to the experience:

> *Facilitator: So that was an issue that was brought up by a couple of other nurses, not having an RT and not having ventilation. Having regular ventilation control, do you agree with that or do you have a different opinion?*
>
> *Participant: I think there should be an RT 24/24 in this hospital*

Also, the teaching code was evident throughout both MBS and VPS. These educative remarks/exchanges were designed by the facilitator to provide information to the participants to impart knowledge rather than cuing the participants to reflect specifically on their experience.

Facilitator: The only thing I point out to you is that sometimes we like to choose the gentler sedatives, but they're going to need sedation then they just may need more adequate haemodynamic support as well.

Finally, a code that only appeared in MBS data was one called 'interruption'. This code highlighted the conflicting roles of 'educator' and 'researcher'. During the simulation debriefs, at times the facilitator would interrupt the participants to provide education. In the following example, the participant starts to discuss a potential need to have an oscillator (e.g., a specialized ventilator). The instructor interrupts the flow of the simulation debrief with directed questioning to provide education that this would not be required in their setting:

Participant: And we don't have an oscillator if we truly needed one and we don't…

Facilitator: Do you think you need an oscillator?

Participant: No, absolutely not

In contrast, in the following quote a focus group participant describes wanting to have the resource and skills to place Swan-Ganz catheters (a procedure not widely used in tertiary critical care). In this instance, the moderator does not provide education as is typical in interview/focus groups, but rather summarizes and continues to probe to ensure understanding of the needs. In this situation, the participants leave with the same perspective – that this is perceived as being a priority.

Participant: We are not utilizing for example using Swan-Ganz… I tried to put Swan-Ganz for some of my patients that I thought they need it but then most of the nurses said, well last time we had it was 10 years ago, lost experience with that and we don't have the modalities… Maybe that will give the nurses more confidence when they do it more frequent.

Facilitator: So is that ongoing education of the nursing staff…

Participant: Absolutely, because that's what the ICU needs.

A comparison of the three different data collection methods (traditional, VPS and MBS) is displayed in Table 3. The areas of convergence or where all three data collection modalities revealed the same element (to varying degrees) included: variation in reflection and uncovering system level barriers. Areas of divergence included: time, structure, facilitator skill level, and education (the degree to which education was 'built-in' the method). The two elements that were present in the simulation data collection methods were the ability to conduct multiple cases in one session, as well as the simultaneous multiple roles played by the facilitator.

Table 3 Multimodal comparative data display

Observation/Notation	Traditional Interviews/Focus Groups (FGs)	VPS	MBS
Skill level of facilitator	Moderate	High	Extremely High
Time (average duration)	Interviews - 31 minutes FGs - 108 minutes	31 minutes	22 minutes
Structure	Inquiry involves continuous questioning and answers	Multiple cases involving a structure of playing part of a case, stopping to debrief/discuss, playing more of the case, stopping to debrief, discuss, etc.	2 cases in 15 minutes with a 5/10 min structure, that is 5 mins devoted to what the participants thought about the scenario, did they like it, was it realistic, etc., then 10 minutes to reflect on the case regarding their own practice realities.
Variation in reflection	Reflect on past experience	Serves as a prompt to reflection on reality (not focused on VPS case)	Immediacy of reflection tied tightly / coupled to simulation scenario, thus creating a platform for, 1) reflection in/on simulation, and 2) reflect on reality
Educative purpose	Low	High	High
Roles of the Facilitator	Single: Researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor
Trade-offs with various roles of the moderator / facilitator	Not applicable	Triple role = more potential for impact	Triple role = more potential for impact i.e., if teaching and interrupt may lead to less data collected for the research purpose (i.e., identifying needs)
Uncovering system level barriers	Requires a lot of time and perhaps multiple lines of questioning and/or interviews	Moderate ability to probe system level abilities (as people want to waver and chat around many issues – not as streamlined and direct as sim scenarios)	Streamlined to uncover system level barriers
Technical difficulties	No occurrence in this dataset. Would be limited possibility (e.g., audio recorder failure)	"Technical glitch" RC Sim Team B (e.g., blood gases results do not come up) and as a result they had to move on.	No occurrence in this dataset but could happen, more technical aspects hence likely greater risk than with traditional

			methods
Multiple cases at once	Not applicable	Multiple cases	1 case per scenario

DISCUSSION

This study explored the potential use of MBS and VPS debriefs as NA tools and revealed that debriefs may be more efficient under certain circumstances, in terms of time and cost at capturing similar needs contrasted to traditional methods of data collection (interviews/focus groups). Our investigation has also highlighted various trade offs which exist with selecting simulation as a NA method.

Time and Cost

With respect to time, the simulation debriefs yielded a considerably shorter total length of audio recording (76% less time than interviews/focus groups). As such the costs specifically required for the NA were significantly lower for the simulations compared to the interviews and focus groups (73% less cost incurred). Even when taking into consideration the total costs of running the simulation cases before the debriefs and the debriefs themselves, the cost remained lower due to the high cost of transcription, NVIVO data entry and data analysis with larger volume of data collected. It is notable, that for this cost of simulations multiple goals may be achieved, in that the observed simulation scenario performance allows for quantitative measure of performance gaps, may serve as pre-intervention baseline performance data, and may reveal additional unperceived performance gaps, not otherwise captured in interviews, focus groups or debriefs, as demonstrated in our earlier study.[15] It is important to note that cost analysis did not include the initial investment costs or maintenance of a simulation program. Hence if there were not a program in place, the cost of simulation would be increased.[31] The cost of a manikin-based simulator is substantially higher than a virtual patient simulator,[32] which is an important consideration for those considering using simulation as debriefs in NA.

Comparative Analysis

Even with substantially less time spent in the simulation debriefs, the majority of themes were identified in the simulation debriefs compared to the interviews and focus groups. Perhaps capturing needs is better accomplished when participants have an experiential and emotional encounter (possibly feeling more vulnerable), with the discussion occurring close to the event and promoting active participation. Theory underpinning the debriefs includes facilitating the transformation of experience into learning through reflection where, "the ultimate goal of debriefing is for learners to reflect on and make sense of their simulation experience and generate meaningful learning that translates to clinical practice."[25] Links between emotion and cognition have been suggested and hence, actively experiencing an event accompanied by intense emotions, may result in long-lasting learning.[30,33] Broadening the concept of participation, increasingly the importance of materiality (i.e., objects and technologies) and relations (with social and material 'forces') are being recognized in the literature through a sociomaterial approach to practice and learning.[34] Fenwick argues that materials, often missing from learning accounts, cannot be ignored as they fundamentally impact human activity (medical practice and knowledge), further stating that "any medical practice is a collective sociomaterial enactment, not a question solely of an individual's skill." [34(p48)] With this approach, simulation provides a model setting to better understand complex medical practice, hence allowing the opportunity to identify needs at various levels (system/team/individual) and across various complex intertwined elements (material/social/cultural) within unique systems. As the learners work to make sense of the simulation experience in reference to their own world, there is the opportunity to both identify needs and provide education. By identifying and interrupting matters that had previously felt settled, the so called "black boxes that masquerade as matters of fact" may be opened.[34 (p50)]

Although the majority of themes were identified in the simulation debriefs (15 of 20), as compared to the interview and focus groups, a greater depth of data was captured through the more traditional methods. With NAs, initial data collection may inform subsequent data collection decisions.[35] In addition, priorities must be set, which includes identifying needs of greatest importance and most amenable to change.[35] Depending on the purpose and scope of a given NA, simulation debriefs may stand alone or may be used to make decisions surrounding whether more extensive data is required. Performing simulation debriefs may also help identify the highest priority needs and determine the initial set of needs to be targeted, in that the needs which are most readily uncovered may be the highest priority contrasted to those that require more probing and questioning.

The findings highlight that not all themes identified in the interviews and focus groups were captured in the debriefs. More specifically, palliative and end-of-life care was not identified in the debriefs, nor was the vision of participants or two themes relating to the inter-hospital interaction (patients' post-referral hospital and lack of understanding). In addition, although the theme of patient transfers was identified across all methods, the relative frequency and depth of data was much lower in the debriefs compared to the interviews and focus groups. This is an important, yet not unexpected finding, given the simulation cases were not specifically designed to explore the areas of end-of-life care or the interaction between the community and referral hospital, contrasted to the traditional NA which undertook a broad line of inquiry along with probing into various aspects of critical care, including both end-of-life care and inter-hospital interactions. The debriefs also did not include asking participants their vision and this data would be unlikely to emerge independent of directed inquiry. This finding highlights the risk of

missing needs with the simulation debriefs and demonstrates the importance of scenario selection and development.

Trade-offs

In this investigation, multiple interrelated roles of the simulation facilitator during the debriefs were identified, including promoting reflection, teaching participants, and exploring gaps in practice. Despite utilizing different cases, online supplement C reveals that the two simulation methods produced similar patterns in terms of thematic frequency scores. That is, the three highest rated simulation specific themes were reflection and teaching. Perhaps this finding is indicative of the method whereby education is infused, upfront in simulation. In this way, a strength of simulation debriefs may include that they can act simultaneously as an education tool and data collection modality.

Simulation debriefs focus on transformative learning through self-reflection may include individual and/or social engagement.[30] The simulation debriefs capitalized on the social spectrum of reflection and through critical discourse between the facilitator and participants, needs/gaps were uncovered beyond individual and team performance, also uncovering system level gaps. Thus, a strength of utilizing simulation debriefs may also include providing a tool for assessing needs across individual, team, and system levels. Furthermore, this finding highlights the importance of working to structure the debriefs to promote deeper reflection,[36] hence potentially surfacing unknown unknowns which combined with the quantitative data (normative needs) from the simulation offers more depth than eliciting only felt needs (known unknowns).

It is important to note that having the simulation facilitator act in multiple roles inevitably presents challenges and trade-offs among these roles, which is a potential limitation of utilizing debrief session in NAs. For example, in the traditional interviews and focus groups the facilitator remains 'neutral' and does not provide education while they pursue questioning to better understand the needs.[37] In contrast, in the simulation debriefs, the facilitator does not remain neutral, at times interrupting the participants to redirect and provide education, as evidenced by the emergence of the interruption code within the MBS data. Interruption was coded as instances whereby the facilitator would intentionally stop the conversation to correct participants when they were clearly discussing inaccurate content. When priority is given to the educative role, the actions of the facilitator risks not allowing the participants to explore and express details surrounding their needs. However, the educative element also promotes engagement through a collaborative approach and participants may leave with a better understanding and having learnt something. Making transparent, thoughtful decisions surrounding which methods to select, recognizing there are advantages and disadvantages to each, is fundamental to performing NAs.[37-40] If debriefs are to be more widely used in NAs, we need to better understand the tradeoffs and their impact on the NA.

In this study, very experienced master instructors facilitated the debriefs. The quality of the debriefs may be linked to this, in that someone of lesser experience may not have been able to uncover these gaps, while providing skilled education, which potentially limits general use of debriefs in NA. How educators facilitate debriefings has been shown to be highly variable.[41] Debrief facilitation also appears to be influenced by the professional background and style of the facilitators. In their exploratory investigation, van Soeren *et al.*[12] described how some facilitators assumed the role of an interprofessional guide whereas others assumed the role of teacher, tending to impart their knowledge.

This variability in facilitation is an important consideration for assessing needs, in that if the facilitator were to have a style more strongly connected with teaching, then needs may not be readily uncovered. As simulation instructors interact with participants in collecting data for the NA, their role must be considered as meaning is actively co-constructed.[42] In addition, the skill level of MBS and VPS may be different (i.e., higher level/more experienced) than that of a facilitator collecting data in a more traditional qualitative manner.

Strengths of our study include highlighting the efficiency in using MBS and VPS simulation as a timely and potentially cost-efficient alternative to employing traditional (interviews and focus groups) methods albeit under certain assumptions (i.e., the research team had access to a simulation center with pre-developed simulation scenarios for both the MBS and VPS sessions). This finding is interconnected to the issue of the breadth and depth in data coverage. That is, the results of this study demonstrate similarities in breadth of themes using traditional methods and simulation debrief with the notable difference in terms of depth. Undeniably, the qualitative interviews and focus groups were able to provide more depth and richness in the data as opposed to the simulation techniques which were considerably shorter in terms of transcript coverage. However, simulation offers the added benefit of providing quantitative performance data which can serve as a baseline and to triangulate with the debrief data.

This was an exploratory study, which included secondary analysis of an existing dataset. Where secondary analysis has been recognized as an important, underutilized research approach, there are limitations to this method. The quality of the secondary data analysis rests on the quality of the existing dataset.[17] It is important to highlight that, as described, our earlier study was performed with a rigorous methodology with numerous methods in place to ensure high quality and credibility of our findings.

One concern noted in the literature is the potential '*problem of data fit.*'[18] In the current study, the data was not originally collected for the current research objective, however, the available data was well positioned to answer the current research questions in an exploratory manner. In addition, '*the problem of not having been there*' has been cited as a concern, in that challenges exist when the secondary researcher was not involved in the original data collection.[18] Limitations of this study include the relatively small sample size and the focus on a single center. Furthermore, while the results are comparable in terms of frequency of mention they cannot be taken as absolutely equivalent, given the qualitative approach employed in this study. Further research is required to better understand the utility of simulation as a NA tool, the design features for NA, and type of needs best identified using this approach. Moreover, it will be imperative that various stakeholder groups participate in each type of data collection methods so as to make more definitive conclusions.

In conclusion, this investigation provides support for the use of simulation debriefs as a NA method, to explore needs at the system, team and individual levels. Qualitative data collected during debriefs may be a suitable substitute to the typical interviews and/or focus groups. Simulation debriefs promote a participatory, collaborative, approach with the educative function built in. Given current fiscal realities, the dual benefit of being both educative whilst identifying needs is appealing albeit under certain conditions. While simulation is an innovative and effective method to conduct NAs, it is important to recognize that there are trade-offs with selection of methods requiring careful scenario design and debriefing.

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Online Supplement A: Qualitative data display comparing the frequency of themes across the various data collection tools

	Data Collection Tools			
Themes	**Earlier NA (interviews and focus groups)**	**Debrief after HFS**	**Debrief after VPS**	**Total HFS + VPS**
Community Hospital				
Knowledge, Skills and Abilities	104	53	74	127
Roles	100	36	83	119
Communication	92	13	21	34
Patient Flow	95	2	35	37
Resources - Human	80	32	32	64
Resources - Physical	44	13	24	37
Confidence/Comfort	49	25	16	41
Team	35	26	16	42
Palliative/EOLC	27	0	0	0
Leadership	23	6	4	10
Inter-hospital Interaction				
Transfer	200	3	21	24
Communication	192	13	21	34
Patients post referral hospital	49	0	0	0
Relationship	51	10	7	17
Lack of understanding	47	0	0	0
Additional Themes				
Solutions	193	28	29	57
Education/Training	182	13	10	23
Vision	40	0	0	0
Family and patient thoughts	31	0	0	0
Night/Weekend	48	5	22	27

Online supplement B: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after HFS**	**Debrief after VPS**	**Total HFS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

Online supplement C: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after MBS**	**Debrief after VPS**	**Total MBS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

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A comparison of simulation debriefs with traditional needs assessment methods: A qualitative exploratory study in a critical care community setting

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A comparison of simulation debriefs with traditional needs assessment methods: A qualitative exploratory study in a critical care community setting

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ABSTRACT

Objective: To better understand the potential of a needs assessment approach utilizing qualitative data from manikin-based and virtual-patient simulation debriefing sessions compared to traditional data collection methods (i.e., focus groups and interviews).

Design: Original data from simulation debrief sessions was compared and contrasted with data from an earlier assessment of critical care needs in a community setting (using focus groups and interviews), thus undertaking secondary analysis of data. Time and cost data were also examined. Debrief sessions were coded utilizing deductive and inductive techniques. Matrices were utilized to explore the commonalities, differences, and emergent findings across the methods.

Setting: Critical care unit in a community hospital setting.

Results: Interviews and focus groups yielded 684 and 647 minutes of audio-recordings. The manikin-based debrief recordings averaged 22 minutes (total = 130 minutes) and virtual-patient debrief recordings averaged 31 minutes (total = 186 minutes). The approximate cost for the interviews and focus groups was $13,560, for manikin-based simulation debriefs was $4,030 and for the virtual patient debriefs was $3,475. Fifteen of 20 total themes were common across the simulation debriefs and interview/focus group data. Simulation-specific themes were identified, including fidelity (environment, equipment and psychological) and the multiple roles of the simulation instructor (educative, promoting reflection, and assessing needs).

Conclusions: Given current fiscal realities, the dual benefit of being educative and identifying needs is appealing. While simulation is an innovative method to conduct needs assessments, it is important to recognize that there are trade-offs with the selection of methods.

Strengths and limitations of this study:

- Simulation is an innovative methodology to undertake needs assessments
- Utilizing simulation permits the development of an environment that enables the learner to perform naturally and gain insight into the complexity of the actual workplace
- Study adds to the relative dearth of qualitative work in simulation and medical education
- Study sample is relatively small and is performed at a single center
- Cross sectional nature of the study does not permit generalizations

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INTRODUCTION

Calls for innovative strategies in conducting needs assessments (NAs) have been made in the medical literature over an extended period of time.[1–5] A needs assessment (NA) is a systematic process to collect and analyze information on a target group's needs (i.e., examine gaps between current and desired situations). [6] Simulation holds potential as a NA method to promote a better understanding of these gaps given that it aims "to develop an environment that enables the learner to perform naturally to gain insight into the complexity of the actual workplace".[7 (p59)] Prior research has demonstrated that simulation permits trainees to live through a realistic experience, make mistakes in a safe environment and practice before they actually perform on real people.[8,9] Similarly, medical educators also find simulation experiences to be stimulating and realistic, and provide opportunities for the integration of basic clinical teaching with advanced problem solving especially given the opportunities to reflect on the case after the simulation scenario.[8] Through a process of experiential learning and deliberate practice, the use of simulation in health professionals' education has been shown to consistently improve the acquisition of knowledge, skills and behaviors.[10,11] However, there is a paucity of literature on the role of simulation in performing NAs, including the use of simulation to determine system and/or institutional level gaps for change management. **In** addition, there is a general lack of qualitative simulation studies in medical education that compare simulation to more traditional qualitative methods.[12-14]

Recognition and care of critically ill patients in community settings is complex, requiring skilled staff and optimal use of resources at the site, plus a coordinated system for interaction with, and transfer to the referral centre when needed. In 2006, the Critical Care Strategy was announced by the Ministry of Health and Long-Term Care of Ontario, Canada. The purpose of this on-going initiative is to improve access, quality, and system integration to ensure all citizens of Ontario have equal access to high-quality

critical care. In keeping with this mandate, a comprehensive NA was completed by members of the current research team, which identified gaps in caring for critically ill patients at a single community hospital.[15] These results provided insights into the needs of a community to optimize care of its critically ill patients, as well as suggestions for how a referral hospital may best support its community site. However, the cost and time required to complete this study was substantial and the process requires streamlining in order to be feasible to implement across numerous sites.

This earlier study included interviews, focus groups, Manikin-Based Simulation (MBS) and Virtual Patient Simulation (VPS), questionnaires and a family survey. Following each of the MBS and VPS, 20 minute debrief sessions were held, and video recorded. These debrief sessions were not included in the comprehensive NA but rather were included as normal pedagogical practice in providing feedback for simulation participants and to facilitate development of reflective skills and teaching for simulation participants.[16] However, upon reviewing the recordings, it was notable that many of the same themes that were discussed in the larger NA were also identified by participants in these debriefs. This serendipitous finding suggested that simulation debriefs could be of value as data for NA either alongside or instead of traditional approaches. The overarching guiding research questions included: 1) How do the needs identified through simulation compare with those identified using traditional methods of NA data collection? 2) Can similar data be captured more efficiently in the simulation debrief session compared to lengthier traditional methods? and 3) What are the strengths and limitations of utilizing simulation in NA?

Specifically, this study aims to better understand the potential of a NA approach utilizing qualitative data from MBS and VPS debriefing sessions to explore the system, team and individual level needs in caring

for critically ill patients in a community context, compared to traditional methods (i.e., focus groups and interviews). We also aimed to compare feasibility in terms of time and cost.

METHODS

Secondary analysis has been recognized as an important, yet underutilized research approach.[16] It has been defined as the reanalysis of an existing data set, which may be used to investigate new research questions or verify previous research findings. [17,18] Utilizing an exploratory qualitative design, this current research utilized original data that were compared and contrasted from simulation debriefs with data from the earlier assessment of critical care needs in a community setting, enabling exploration of the current research question from our existing data.

Patient and Public Involvement

By employing a patient centred approach to research, the research questions and outcome measures were informed by patient outcomes in mind. That is, by understanding feasible and perhaps more timely approaches to conducting needs assessments earlier interventions can be implemented to facilitate patient care. It should be noted that patients nor patient advisors were involved in the recruitment or conduct of this study. Presentations at hospital medical rounds and continuing professional development sessions are the primary mechanisms to disseminate results to study participants

Design and Analysis

Original study data collection and analysis

The original mixed-method study was conducted between June 2011 and February 2012. A conceptual framework, centered on the critically ill patient guided the design and selection of that data collection instruments. Different perspectives sampled included regional leaders, healthcare professionals at the

community and its' referral hospital, as well as family members of patients who had received care at the community ICU. Interviews and focus groups were designed to follow a semi-structured, broad, pre-determined line of inquiry that was flexible permitting exploration of themes. Data from each interview and focus group were transcribed, entered into NVIVO software and inductive coding techniques were applied as informed by Creswell's thematic analysis approach.[19] The constant comparative method was used as data were analyzed.[18] Full information regarding the original study can be found in Sarti *et al.*[15]

Simulation

Simulations were conducted at the community hospital to obtain data on human and social capital at the community hospital, including interdisciplinary team functioning, crisis resource management and critical care knowledge and skills.[10,20,21] The simulation component of the NA consisted of two forms of simulation, MBS (e.g. SimMan) and VPS (e.g. interactive video with patient actors), each followed by debriefing sessions utilizing an expert facilitator engaging participants in reflective and focused discussion on a particular scenario while simultaneously providing teaching.[10,16,21-23] To maximize participants' exposure to the various cases, each team completed two MBS and two VPS sessions. Canadian experts in critical care designed the scenarios to represent prototypical clinical encounters. These scenarios were originally developed for residents in Canada, with the Acute Critical Events Simulation course. The scenarios, which included cases of impending respiratory failure, shock, sepsis and arrhythmias, were reviewed by an interdisciplinary panel, modified to reflect the realities of practice in the community hospital, and were video-recorded. To assess performance during simulation, custom task checklists and two validated global rating scales were completed.[22,23] Only quantitative data from

the simulations was included in the original NA,[15] given that debriefs have not been described as NA tools.

The MBS and VPS scenarios were each followed by a 20 minute debrief session, which were video recorded. The debriefs were designed to establish an engaging and supportive learning environment, promote facilitated reflection and discussion, explore performance gaps and provide feedback to the participants with respect to the scenarios.[24] Facilitators used a blended approach, including focused facilitation to encourage critical reflection and deeper understanding of events and also to provide information through directed performance feedback and teaching.[25] In addition to the standard learner-centred debriefing, participants were encouraged to discuss their practice context and reality.

Time and cost analysis

Time for each of the data collection methods, interviews, focus groups and debriefs, were captured from audio files. Data on the financial costs were captured in budgets and expenditure tracking documents, including equipment, travel expenses and hourly salary rates. MBS specific costs included manikin rental, rental van for transportation. Both MBS and VPS required use of computer programs, a simulation instructor and technologist. Travel was required for both forms of simulation and focus groups. The interviews from the earlier study were held via telephone. The debriefs, interviews and focus groups all required a facilitator, audio recorder, transcriptionist, researcher and research assistant to perform coding and thematic analysis. Investment costs for initial implementation of a simulation program, annual operational maintenance and replacement expenses were not considered. Time and cost to prepare the interview/focus group guides and simulation cases were not included in the analysis, as there was not enough data available to accurately estimate.

Secondary Data Analysis

Data analysis comprised secondary thematic analysis and comparative analysis.[17,18] Comparative analysis was required to compare and contrast the data from the earlier study with the MBS and VPS debriefs.

Thematic analysis of the debriefs was performed.[26-28] Transcripts were entered into NVIVO software. Codes identified in previous work/inquiry were applied to the data.[19] To enhance study rigour multiple coders coded the transcripts, including two researchers who were involved with coding in the original NA (AS, SS), and one researcher who was not involved with coding in the original study (RA). Researchers actively searched for disconfirming data and identification of additional codes; inductive and deductive approaches were utilized. Themes and their definitions were decided through researcher discussion and negotiation. Qualitative data from the simulation debriefs was contrasted to the qualitative data obtained with the earlier NA (focus groups and interviews). The final analytic component included reading through all the transcripts in each data collection modality (traditional, VPS and MBS) so as to selectively identify areas of convergence and divergence in both the content and structure of the transcript per data collection method.[29]

Study Rigor

Multiple strategies were employed to minimize threats to the validity/credibility of the study. Efforts were made to search for disconfirming evidence through the use of purposive sampling, with the selection of participants to provide a balanced representation of the collective group, including potential differences of opinion. Two forms of triangulation were employed to achieve a balanced perspective and enhance the reliability of the conclusions: 1) data source triangulation (using multiple data sources

and informants), and 2) investigator triangulation (using more than one person to collect, analyze and interpret data).

RESULTS

Participants

There were 31 participants in the focus groups (13 from the community hospital, 11 from the referral hospital and 7 in an inter-hospital focus group; this included 12 physicians, 14 nurses and 5 respiratory therapists (RTs) and 22 participants in the interviews (2 regional leaders, 7 community hospital leaders and 13 referral hospital leaders). In the simulations, there were 13 participants from the community hospital (6 physicians, 6 nurses and 1 RT) who formed 6 teams (see Table 1).

Table 1 Participant demographics

Earlier Comprehensive NA

Interviews	**Total = 22**
- Regional leaders	2
- Community hospital leaders	7
- Referral hospital leaders	13
Focus Groups	**Total = 31**
- Community hospital	6-MD, 6-RN, 1-RT
- Referral hospital	4-MD, 5-RN, 2-RT
- Interhospital	2-MD, 3-RN, 2-RT
Simulation Debriefs	
Manikin-based simulations (MBS)	**Total = 13 (6 MD, 6 RN, 1 RT)**
- Community hospital	6 teams (1-MD, 1-RN +/- RT per team) each team performed 2 MBS cases

Virtual patient simulations (VPS)	Total = 13 (6 MD, 6 RN, 1 RT)
- Community hospital	6 teams (1-MD, 1-RN +/- RT per team**) each team performed 2 VPS cases***

MD = physician; RN = nurse; RT = respiratory therapist; ** One VPS was completed by a physician alone (no other team member) ***One team completed only one of the two VPS cases.

Time and cost analysis

The 22 interviews (average 31 minutes; range 15–48 minutes) and 6 focus groups (average 108 minutes; range 57–154 minutes) yielded 684 and 647 minutes of audio recordings, for a total of 1331 minutes. The MBS debriefs averaged 22 minutes (range 17-30 minutes; total = 130 minutes) and VPS debriefs averaged 31 minutes (range 25-48 minutes; total = 186 minutes). The results of the cost analysis are displayed in Table 2. The total cost for interviews and focus groups was approximately $13,560, for MBS was $4,030 and for VPS debriefs was $3,475.

Table 2: Cost comparison across the data collection tools

Items	Interviews / Focus Groups	Virtual Patient Simulations	High fidelity Simulations
Costs with running the simulations [1]			
Rental Van - Bringing equipment to site	N/A	N/A	**$550**
Facility rates [2]	N/A	No charge	No charge
Manikin daily rental fee	N/A	N/A	**$500**
Computer Software program	N/A	$0 (Newly developed software program Licencing fee)	$0 (Software program owned)
Needles / gauze / syringes / etc. for MBS	N/A	N/A	No additional charge Re-usable materials.

Simulation Instructor [3]	N/A	**$1002** ($1250-$248 for the debrief)	**$1074** ($1250-$176 for the debrief)
Technologist [4]	N/A	**$400**	**$400**
Subtotal	N/A	**$1,402**	**$2,524**
Cost specifically required for the NA / debrief [1]			
Facilitator	**$1332** (22.2hrs x $60/hr)	**$248** (3.1hrs x $80/hr)	**$176** (2.2hrs x $80/hr)
Travel to the site [5]	**$360** ($120 x 3 visits to the site for focus groups)	**$120**	**$120**
Audio recorder	No additional expense (If you have to buy one it is about $250)	No additional expense	No additional expense
Transcription [6]	**$1,434** Interviews = 11.4 data hours x 2.5 transcription hours per hour of data x $20 /hr = 570 FGs = 10.8 data hours x 4 transcription hours per hour of data x $20/hr = 864	**$248** (3.1 hours x 4 x 20 = 248)	**$176** (2.2 hours x 4 x 20)
NVIVO data entry [7]	**$1,554** (22.2 x 35 x 2)	**$217** (3.1 x 35 x 2)	**$154** (2.2 x 35 x 2)
Data analysis – coding and thematic analysis [8]	**$8,880** (22.2 data hours x 2 researchers at 80 /hr for 2.5 hours per hour of collected data)	**$1,240** (3.1 x data hours x 2 researchers at 80 /hr for 2.5 hours per hour of collected data)	**$880** (2.2 data hours x 2researchers at 80 /hr for 2.5 hours per hour of collected data)
Subtotal	**$13,560**	**$2,073**	**$1,506**
Total	**$13,560**	**$3,475**	**$4,030**

[1] Note all funds are reported in Canadian dollars.

[2] Facility rates at this site were not charged. Note that typical rental costs are between 200-300/hr.

[3] Cost assumes access to a trained instructor. Instructor training would be an additional cost. The daily cost for a simulation instructor is $1250. The cost of the debrief sessions has been separated in this table.

[4] Cost assumes access to a trained technologist. Training would be an additional cost.

[5] Land travel at $0.54/km. Travel required for simulations and FGs (Interviews were via telephone).

[6] Transcription costs - For one to one interview assumes 2.5 hours per one hour recording for transcription. For focus group and simulation debriefs assumes 4 hours per one hour recording. Transcriptionist rate is $20 per hour.

[7] NVivo data entry – Research assistant salary $35 per hour – assumes 2 hours required per hour of data.

[8] Data Analysis includes researcher salary of $80 per hour. Considers 2 researchers for coding with approximately 2.5 hours for each researcher per hour of data collected.

Comparative analysis

Data from VPS and MBS debriefs contributed to 15 of 20 total themes compared to the earlier study (See online supplement A). When comparing the top five themes in terms of highest frequency two themes consistently appear across all three data collection modalities: knowledge, skills and abilities (NA interviews and focus groups N=104, MBS N=53, VPS N=127), and solutions (NA interviews and focus groups N=193, MBS N=28, VPS N=57). Similarly, when comparing the five themes with the lowest frequency counts two themes appear across all data collection modalities: leadership (NA interviews and focus groups N=23, MBS N=6, VPS N=10) and night/week-end (NA interviews and focus groups N=48, MBS N=5, VPS=27). Themes not identified with either form of simulation debriefs included palliative/end-of-life care, patients post-referral hospital, lack of understanding, vision, and family and patient thoughts. A descriptive matrix with the themes and representative quotes from the various data collection methods is presented in online supplement B. In general, for the themes common to both interviews/focus groups and simulation debriefs similar high-level needs were identified, and similar overarching conclusions could be drawn from the simulation debriefs compared to the earlier NA. However, more descriptive data was discovered with the earlier NA versus the simulation debriefs where data was more direct and to the point.

As an exemplar, knowledge, skills and abilities (KSA) was identified across all methods. A key gap identified within this theme was the management of respiratory failure and ventilation. This gap was identified in the interviews, focus groups and simulation debriefs. Key issues identified in the earlier study and simulation debriefs, within this topic included basic and difficult ventilation strategies, troubleshooting and managing status asthmaticus. Weaning and lung protective strategies specifically, were only identified in the interviews and focus groups. Both the earlier study and simulation debriefs

identified system level gaps that contributed to this need, including the need for 24 hour RT coverage. Where this need was identified in the simulation debriefs, a greater depth of data emerged during the focus groups surrounding the nature and impact of the gap / lack of 24 hour coverage. In the following focus group, participants discussed challenges of weaning patients:

> *We've been wanting to put patients on APRV at night and it makes it difficult because as they improve their volumes are going to get larger and it's something that you really have to watch on the vent, and the nurses don't. They'll watch but they don't really understand as much as what we do, the doctors have no idea, it's just really us. We're leery sometimes to put somebody on bi-level APRV, whatever you want to call it, because we're not here 24 hours to watch the whole process happen.*

The main themes identified from the simulation (not found in the interview/focus group data) were related to the fidelity of the simulation (environmental, equipment and psychological) and the role of the simulation instructor in teaching and promotion of reflection (see online supplement C). In addition, the theme of interruption was identified only in the MBS debriefs, which occurred when the facilitator interrupted a participant to provide teaching/impart knowledge.

In some instances, lower fidelity led to the discovery of gaps in practice. In the following example the creation of an 'unreal' environment, led to the discovery of a system-level gap. In this situation, the participant highlighted that receiving blood work quickly in the MBS, which does not match their reality and may impact patient care:

> *The blood work is too long in [the community hospital]. It's horrible. Like you can do a code for an hour and you won't even know your potassium, your calcium, or your CBC; it's just a disaster.*

Thus, the role of the facilitator was coded as producing several themes that only emerged within the MBS and VPS datasets. Unlike the traditional NA facilitator, the simulation facilitators carried out multiple roles. Two codes (promoting reflection and teaching) were evident in the educative roles the facilitator played. That is, the facilitator served to further engage the learners in the simulated scenario by promoting reflection through reflective cues. We defined reflection as the "process of learning through and from experience towards gaining new insights of self and/or practice." [30(p1)] The following is an example of the facilitator providing reflective cues linking learning to the experience:

> *Facilitator: So that was an issue that was brought up by a couple of other nurses, not having an RT and not having ventilation. Having regular ventilation control, do you agree with that or do you have a different opinion?*
>
> *Participant: I think there should be an RT 24/24 in this hospital*

Also, the teaching code was evident throughout both MBS and VPS. These educative remarks/exchanges were designed by the facilitator to provide information to the participants to impart knowledge rather than cuing the participants to reflect specifically on their experience.

> *Facilitator: The only thing I point out to you is that sometimes we like to choose the gentler sedatives, but they're going to need sedation then they just may need more adequate haemodynamic support as well.*

Finally, a code that only appeared in MBS data was one called 'interruption'. This code highlighted the conflicting roles of 'educator' and 'researcher'. During the simulation debriefs, at times the facilitator would interrupt the participants to provide education. In the following example, the participant starts to discuss a potential need to have an oscillator (e.g., a specialized ventilator). The instructor interrupts the flow of the simulation debrief with directed questioning to provide education that this would not be required in their setting:

> *Participant: And we don't have an oscillator if we truly needed one and we don't…*

Facilitator: Do you think you need an oscillator?

Participant: No, absolutely not

In contrast, in the following quote a focus group participant describes wanting to have the resource and skills to place Swan-Ganz catheters (a procedure not widely used in tertiary critical care). In this instance, the moderator does not provide education as is typical in interview/focus groups, but rather summarizes and continues to probe to ensure understanding of the needs. In this situation, the participants leave with the same perspective – that this is perceived as being a priority.

Participant: We are not utilizing for example using Swan-Ganz… I tried to put Swan-Ganz for some of my patients that I thought they need it but then most of the nurses said, well last time we had it was 10 years ago, lost experience with that and we don't have the modalities… Maybe that will give the nurses more confidence when they do it more frequent.

Facilitator: So is that ongoing education of the nursing staff…

Participant: Absolutely, because that's what the ICU needs.

A comparison of the three different data collection methods (traditional, VPS and MBS) is displayed in Table 3. The areas of convergence or where all three data collection modalities revealed the same element (to varying degrees) included: variation in reflection and uncovering system level barriers. Areas of divergence included: time, structure, facilitator skill level, and education (the degree to which education was 'built-in' the method). The two elements that were present in the simulation data collection methods were the ability to conduct multiple cases in one session, as well as the simultaneous multiple roles played by the facilitator.

Table 3 Multimodal comparative data display

Observation/Notation	Traditional Interviews/Focus Groups (FGs)	VPS	MBS
Skill level of facilitator	Moderate	High	Extremely High
Time (average duration)	Interviews - 31 minutes FGs - 108 minutes	31 minutes	22 minutes
Structure	Inquiry involves continuous questioning and answers	Multiple cases involving a structure of playing part of a case, stopping to debrief/discuss, playing more of the case, stopping to debrief, discuss, etc.	2 cases in 15 minutes with a 5/10 min structure, that is 5 mins devoted to what the participants thought about the scenario, did they like it, was it realistic, etc., then 10 minutes to reflect on the case regarding their own practice realities.
Variation in reflection	Reflect on past experience	Serves as a prompt to reflection on reality (not focused on VPS case)	Immediacy of reflection tied tightly / coupled to simulation scenario, thus creating a platform for, 1) reflection in/on simulation, and 2) reflect on reality
Educative purpose	Low	High	High
Roles of the Facilitator	Single: Researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor	Triple role: 1) teaching (education), 2) reflection, 3) researcher / needs assessor

Trade-offs with various roles of the moderator / facilitator	Not applicable	Triple role = more potential for impact	Triple role = more potential for impact i.e., if teaching and interrupt may lead to less data collected for the research purpose (i.e., identifying needs)
Uncovering system level barriers	Requires a lot of time and perhaps multiple lines of questioning and/or interviews	Moderate ability to probe system level abilities (as people want to waver and chat around many issues – not as streamlined and direct as sim scenarios)	Streamlined to uncover system level barriers
Technical difficulties	No occurrence in this dataset. Would be limited possibility (e.g., audio recorder failure)	"Technical glitch" RC Sim Team B (e.g., blood gases results do not come up) and as a result they had to move on.	No occurrence in this dataset but could happen, more technical aspects hence likely greater risk than with traditional methods
Multiple cases at once	Not applicable	Multiple cases	1 case per scenario

DISCUSSION

This study explored the potential use of MBS and VPS debriefs as NA tools and revealed that debriefs may be more efficient **under certain circumstances**, in terms of time and cost at capturing similar needs contrasted to traditional methods of data collection (interviews/focus groups). Our investigation has also highlighted various trade offs which exist with selecting simulation as a NA method.

Time and Cost

With respect to time, the simulation debriefs yielded a considerably shorter total length of audio recording (76% less time than interviews/focus groups). As such the costs specifically required for the NA were significantly lower for the simulations compared to the interviews and focus groups (73% less cost incurred). Even when taking into consideration the total costs of running the simulation cases before the debriefs and the debriefs themselves, the cost remained lower due to the high cost of transcription, NVIVO data entry and data analysis with larger volume of data collected. It is notable,

that for this cost of simulations multiple goals may be achieved, in that the observed simulation scenario performance allows for quantitative measure of performance gaps, may serve as pre-intervention baseline performance data, and may reveal additional unperceived performance gaps, not otherwise captured in interviews, focus groups or debriefs, as demonstrated in our earlier study.[15] It is important to note that cost analysis did not include the initial investment costs or maintenance of a simulation program. Hence if there were not a program in place, the cost of simulation would be increased.[31] The cost of a manikin-based simulator is substantially higher than a virtual patient simulator,[32] which is an important consideration for those considering using simulation as debriefs in NA.

Comparative Analysis

Even with substantially less time spent in the simulation debriefs, the majority of themes were identified in the simulation debriefs compared to the interviews and focus groups. Perhaps capturing needs is better accomplished when participants have an experiential and emotional encounter (possibly feeling more vulnerable), with the discussion occurring close to the event and promoting active participation. Theory underpinning the debriefs includes facilitating the transformation of experience into learning through reflection where, "the ultimate goal of debriefing is for learners to reflect on and make sense of their simulation experience and generate meaningful learning that translates to clinical practice."[25] Links between emotion and cognition have been suggested and hence, actively experiencing an event accompanied by intense emotions, may result in long-lasting learning.[30,33] Broadening the concept of participation, increasingly the importance of materiality (i.e., objects and technologies) and relations (with social and material 'forces') are being recognized in the literature through a sociomaterial approach to practice and learning.[34] Fenwick argues that materials, often missing from learning accounts, cannot be ignored as they fundamentally impact human activity (medical practice and

knowledge), further stating that "any medical practice is a collective sociomaterial enactment, not a question solely of an individual's skill." [34(p48)] With this approach, simulation provides a model setting to better understand complex medical practice, hence allowing the opportunity to identify needs at various levels (system/team/individual) and across various complex intertwined elements (material/social/cultural) within unique systems. As the learners work to make sense of the simulation experience in reference to their own world, there is the opportunity to both identify needs and provide education. By identifying and interrupting matters that had previously felt settled, the so called "black boxes that masquerade as matters of fact" may be opened.[34 (p50)]

Although the majority of themes were identified in the simulation debriefs (15 of 20), as compared to the interview and focus groups, a greater depth of data was captured through the more traditional methods. With NAs, initial data collection may inform subsequent data collection decisions.[35] In addition, priorities must be set, which includes identifying needs of greatest importance and most amenable to change.[35] Depending on the purpose and scope of a given NA, simulation debriefs may stand alone or may be used to make decisions surrounding whether more extensive data is required. Performing simulation debriefs may also help identify the highest priority needs and determine the initial set of needs to be targeted, in that the needs which are most readily uncovered may be the highest priority contrasted to those that require more probing and questioning.

The findings highlight that not all themes identified in the interviews and focus groups were captured in the debriefs. More specifically, palliative and end-of-life care was not identified in the debriefs, nor was the vision of participants or two themes relating to the inter-hospital interaction (patients' post-referral hospital and lack of understanding). In addition, although the theme of patient transfers was identified

across all methods, the relative frequency and depth of data was much lower in the debriefs compared to the interviews and focus groups. This is an important, yet not unexpected finding, given the simulation cases were not specifically designed to explore the areas of end-of-life care or the interaction between the community and referral hospital, contrasted to the traditional NA which undertook a broad line of inquiry along with probing into various aspects of critical care, including both end-of-life care and inter-hospital interactions. The debriefs also did not include asking participants their vision and this data would be unlikely to emerge independent of directed inquiry. This finding highlights the risk of missing needs with the simulation debriefs and demonstrates the importance of scenario selection and development.

Trade-offs

In this investigation, multiple interrelated roles of the simulation facilitator during the debriefs were identified, including promoting reflection, teaching participants, and exploring gaps in practice. Despite utilizing different cases, online supplement C reveals that the two simulation methods produced similar patterns in terms of thematic frequency scores. That is, the three highest rated simulation specific themes were reflection and teaching. Perhaps this finding is indicative of the method whereby education is infused, upfront in simulation. In this way, a strength of simulation debriefs may include that they can act simultaneously as an education tool and data collection modality.

Simulation debriefs focus on transformative learning through self-reflection may include individual and/or social engagement.[30] The simulation debriefs capitalized on the social spectrum of reflection and through critical discourse between the facilitator and participants, needs/gaps were uncovered beyond individual and team performance, also uncovering system level gaps. Thus, a strength of utilizing

simulation debriefs may also include providing a tool for assessing needs across individual, team, and system levels. Furthermore, this finding highlights the importance of working to structure the debriefs to promote deeper reflection,[36] hence potentially surfacing unknown unknowns which combined with the quantitative data (normative needs) from the simulation offers more depth than eliciting only felt needs (known unknowns).

It is important to note that having the simulation facilitator act in multiple roles inevitably presents challenges and trade-offs among these roles, which is a potential limitation of utilizing debrief session in NAs. For example, in the traditional interviews and focus groups the facilitator remains 'neutral' and does not provide education while they pursue questioning to better understand the needs.[37] In contrast, in the simulation debriefs, the facilitator does not remain neutral, at times interrupting the participants to redirect and provide education, as evidenced by the emergence of the interruption code within the MBS data. Interruption was coded as instances whereby the facilitator would intentionally stop the conversation to correct participants when they were clearly discussing inaccurate content. When priority is given to the educative role, the actions of the facilitator risks not allowing the participants to explore and express details surrounding their needs. However, the educative element also promotes engagement through a collaborative approach and participants may leave with a better understanding and having learnt something. Making transparent, thoughtful decisions surrounding which methods to select, recognizing there are advantages and disadvantages to each, is fundamental to performing NAs.[37-40] If debriefs are to be more widely used in NAs, we need to better understand the tradeoffs and their impact on the NA.

In this study, very experienced master instructors facilitated the debriefs. The quality of the debriefs may be linked to this, in that someone of lesser experience may not have been able to uncover these gaps, while providing skilled education, which potentially limits general use of debriefs in NA. How educators facilitate debriefings has been shown to be highly variable.[41] Debrief facilitation also appears to be influenced by the professional background and style of the facilitators. In their exploratory investigation, van Soeren *et al.*[12] described how some facilitators assumed the role of an interprofessional guide whereas others assumed the role of teacher, tending to impart their knowledge. This variability in facilitation is an important consideration for assessing needs, in that if the facilitator were to have a style more strongly connected with teaching, then needs may not be readily uncovered. As simulation instructors interact with participants in collecting data for the NA, their role must be considered as meaning is actively co-constructed.[42] In addition, the skill level of MBS and VPS may be different (i.e., higher level/more experienced) than that of a facilitator collecting data in a more traditional qualitative manner.

Strengths of our study include highlighting the efficiency in using MBS and VPS simulation as a timely and potentially cost-efficient alternative to employing traditional (interviews and focus groups) methods albeit under certain assumptions (i.e., the research team had access to a simulation center with pre-developed simulation scenarios for both the MBS and VPS sessions). This finding is interconnected to the issue of the breadth and depth in data coverage. That is, the results of this study demonstrate similarities in breadth of themes using traditional methods and simulation debrief with the notable difference in terms of depth. Undeniably, the qualitative interviews and focus groups were able to provide more depth and richness in the data as opposed to the simulation techniques which were considerably shorter in terms of transcript coverage. However, simulation offers the added benefit of providing quantitative performance data which can serve as a baseline and to triangulate with the debrief data.

This was an exploratory study, which included secondary analysis of an existing dataset. Where secondary analysis has been recognized as an important, underutilized research approach, there are limitations to this method. The quality of the secondary data analysis rests on the quality of the existing dataset.[17] It is important to highlight that, as described, our earlier study was performed with a rigorous methodology with numerous methods in place to ensure high quality and credibility of our findings. One concern noted in the literature is the potential '*problem of data fit.*'[18] In the current study, the data was not originally collected for the current research objective, however, the available data was well positioned to answer the current research questions in an exploratory manner. In addition, '*the problem of not having been there*' has been cited as a concern, in that challenges exist when the secondary researcher was not involved in the original data collection.[18] Limitations of this study include the relatively small sample size and the focus on a single center. Furthermore, while the results are comparable in terms of frequency of mention they cannot be taken as absolutely equivalent, given the qualitative approach employed in this study. Further research is required to better understand the utility of simulation as a NA tool, the design features for NA, and type of needs best identified using this approach. Moreover, it will be imperative that various stakeholder groups participate in each type of data collection methods so as to make more definitive conclusions.

In conclusion, this investigation provides support for the use of simulation debriefs as a NA method, to explore needs at the system, team and individual levels. Qualitative data collected during debriefs may be a suitable substitute to the typical interviews and/or focus groups. Simulation debriefs promote a participatory, collaborative, approach with the educative function built in. Given current fiscal realities, the dual benefit of being both educative whilst identifying needs is appealing albeit under certain

conditions. While simulation is an innovative and effective method to conduct NAs, it is important to recognize that there are trade-offs with selection of methods requiring careful scenario design and debriefing.

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Contributions

Aimee J Sarti contributed to the study planning and conceptualization, and led data collection, data interpretation/analysis, manuscript development and review. Rola Ajjawi contributed to the study planning and conceptualization, interpretation/data analysis, manuscript development and review. Stephanie Sutherland contributed to the study conceptualization, interpretation/data analysis, manuscript development and review. Angele Landriault contributed to data collection, manuscript development and review. John Kim contributed to the study planning and conceptualization, data collection, manuscript preparation and review. Pierre Cardinal contributed to the study planning and conceptualization, data collection, manuscript development and review.

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Competing interests None declared.

Ethics approval Ottawa Hospital Research Ethics Board.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing agreement No additional data are available.

Online Supplement A: Qualitative data display comparing the frequency of themes across the various data collection tools

	Data Collection Tools			
Themes	**Earlier NA (interviews and focus groups)**	**Debrief after HFS**	**Debrief after VPS**	**Total HFS + VPS**
Community Hospital				
Knowledge, Skills and Abilities	104	53	74	127
Roles	100	36	83	119
Communication	92	13	21	34
Patient Flow	95	2	35	37
Resources - Human	80	32	32	64
Resources - Physical	44	13	24	37
Confidence/Comfort	49	25	16	41
Team	35	26	16	42
Palliative/EOLC	27	0	0	0
Leadership	23	6	4	10
Inter-hospital Interaction				
Transfer	200	3	21	24
Communication	192	13	21	34
Patients post referral hospital	49	0	0	0
Relationship	51	10	7	17
Lack of understanding	47	0	0	0
Additional Themes				
Solutions	193	28	29	57
Education/Training	182	13	10	23
Vision	40	0	0	0
Family and patient thoughts	31	0	0	0
Night/Weekend	48	5	22	27

Online supplement B: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after HFS**	**Debrief after VPS**	**Total HFS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

Online supplement C: Qualitative data display comparing the frequency of themes simulation specific themes

	Data Collection Tools		
Themes	**Debrief after MBS**	**Debrief after VPS**	**Total MBS + VPS**
Fidelity			
- Environment	27	5	32
- Equipment	15	1	16
- Psychological	4	1	5
Teaching	46	29	75
Reflection	50	75	125
Interruption	8	0	8
Learning Style	4	1	5

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed

		Case-control study—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

STROBE Statement Checklist

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1. Title and abstract

(*a*) Indicate the study's design with a commonly used term in the title or the abstract

The title has been revised to, "A comparison of simulation debriefs with traditional needs assessment methods: A **qualitative exploratory study** in a critical care community setting" (see page 1).

(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found

The abstract contains a clear objective and the design provides a balanced summary of what was done. The results provide a summary of what was found (see page 1).

Introduction

2. Background/rationale - Explain the scientific background and rationale for the investigation being reported

Prior research and experience have shown that conducting a Needs Assessment (NA) using traditional qualitative methods, is an effective method to collect and analyze information so as to examine a target group/program gap between the current and desired condition. We felt that simulation can be used to conduct NAs, however the empirical use is limited. Thus, we want to add to the empirical literature that simulation can be used as an NA method (see page 3).

3. Objectives – State specific objectives, including any prespecified hypotheses

The objective of this study is to better understand the potential using a NA approach using simulation (MBS and VPS) debrief session data to explore both critical care team members as well as individual needs (see pages 4-5). The guiding researcher questions are as follows: 1) How do the needs identified through simulation compare with those identified using traditional methods of NA data collection? 2) Can similar data be captured more efficiently in the simulation debrief session compared to lengthier traditional methods? and 3) what are the strengths and limitations of utilizing simulation in NA? (see page 4).

Methods

4. Study design - Present key elements of study design early in the paper

We have now added a key descriptor of the study design to the title of the paper "qualitative exploratory study" (see page 1). Also, the abstract (Design) outlines how the study data was analyzed (see again page 1). We have also added the qualitative exploratory design descriptor to the first sentence of the methods section (see page 5).

Comment [S1]: Do this

5. Setting - Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection

Comment [S2]: We didn't list a date for the secondary analysis – should we?

The first mention of the setting occurs in the abstract (setting) (see page 1). The location is described in the methods section (see Design and Analysis – Original study data collection and analysis) in Eastern Ontario. The relevant dates for the original study (see again Design and Analysis – Original study data collection and analysis) are January 2011 and February 2012. All recruitment and data collection occurred between January 2011 and February 2012 (see page 5).

Comment [S3]: Add in paper?

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6. Participants - (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up. *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls. *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants

Participant information is detailed on pages 8-9. Specifically, the eligibility criteria included being employed at either the referral hospital or the community hospital within the critical care department. Staff included in this study held the following roles: physician, nurse, respiratory therapist. In addition, we wanted the leadership perspective and included individuals in leadership positions from the community hospital, the referral hospital, and from the regional leadership. Complete participant demographics are listed in Table 1 (see page 9). We used a purposive sampling strategy to select participants.

Comment [S4]: I wonder if I should add this construct to Results (Participants) on page 8 (bottom) of the paper?

7. Variables - Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable

Comment [S5]: Ok?

Not applicable as this is a qualitative exploratory study

8. Data sources/measurement - For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group

Data Sources	Measurement
Interviews/focus groups	Qualitative constant comparative method
VPS	Qualitative constant comparative method
MBS	Qualitative constant comparative method

Comment [S6]: Add page numbers

9. Bias - Describe any efforts to address potential sources of bias

Unlike facilitators conducting interviews/focus groups who must remain neutral during data collection, simulation facilitators do not remain neutral as they must at times interrupt, and redirect the conversation as they provide information and education. In this study, very experienced master instructors facilitated the debriefs. As such, the quality of the debriefs may be linked to this, in that someone of lesser experience may not have been able to uncover gaps (needs), while providing skilled education (see page 21).

10.Study size - Explain how the study size was arrived at

The study sample was obtained through a purposive strategy. As such, there was an explicit attempt to recruit similar numbers of participants from both the referral and community hospitals. In a qualitative study the sample size is most dependent on achieving saturation in the data set. That is, analyses of study data continue until no new themes emerge. We were able to lachieve saturation.

11.Quantitative variables - Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why

Not applicable as this is a qualitative exploratory study.

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12.Statistical methods

Not applicable as this was a qualitative exploratory study.

Results

13.Participants - (a) Report numbers of individuals at each stage of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed, (b) Give reasons for non-participation at each stage and (c) Consider use of a flow diagram

The number of individuals remained constant throughout the study. In total there were 31 participants in the focus groups (13 from the community hospital, 11 from the referral hospital and 7 in an inter-hospital focus group; this included 12 physicians, 14 nurses, 5 respiratory therapist (RTs) and 22 participants in the interviews (2 regional leaders, 2 community hospital leaders and 13 referral hospital leaders). In the simulations, there were 13 participants from the community hospital (6 physicians, 6 nurses, and 1 RT) (see pages 8-9). There was no non-participation at any stage of the study.

14.Descriptive data - (a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders, (b) Indicate number of participants with missing data for each variable of interest and (c) *Cohort study*—Summarise follow-up time (e.g., average and total amount)

The only participant descriptor utilized is the role the individual occupies, e.g., leaders from the region (LIN), referral hospital and community hospital, and staff (physicians, nurses, and respiratory therapists) from both the referral and community hospital. Participant demographics are provided in Table 1 (see page 9).

15.Outcome data - *Cross-sectional study*—Report numbers of outcome events or summary measures

Not applicable as this is a qualitative exploratory study.

16.Main results - (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included, (*b*) Report category boundaries when continuous variables were categorized, (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

Not applicable as this is a qualitative exploratory study.

17.Other analyses - Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses

Not applicable as this is a qualitative exploratory study.

Discussion

18.Key results - Summarise key results with reference to study objectives

Study Objectives	**Key Results**
1.How do the needs identified through simulation compare with those identified using traditional methods of NA data	-Even with substantially less time spent in the simulation debriefs, the majority of themes were identified in the simulation debriefs compared to the interviews/focus groups (see page 18). A

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collection?	complete comparative data display can be found in Table 3 (see pages 16-17).
2.Can similar data be captured more efficiently in the simulation debrief session compared to lengthier traditional methods?	-With respect to time, the simulation debriefs yielded a considerably shorter length of audio recording (76% less time than the interview/focus groups), as such the costs specifically required for the NA were significantly lower for the simulations compared to the interviews and focus groups. It is important to note that cost analysis did not include the initial investment costs or maintenance of a simulation program. Hence, if there were not a program in place, the cost of simulation would be increased (see page 17). Table 2 contains all numerical values related to time and cost (see pages 10-11).
3.What are the strengths and limitations of utilizing simulation in NA?	-Strengths of our study include highlighting the efficiency in using MBS and VPS simulation as a timely and potentially cost-efficient alternative to employing traditional (interview/focus groups) methods albeit under certain assumptions (e.g., our research team had access to a simulation center with pre-developed simulation scenarios for the MBS and VPS sessions). Also, we were able to demonstrate similarities in breadth of themes using traditional methods and simulation debrief with the notable difference in depth of coverage (see page 22). -Limitations of this study include a relatively small sample size and a primary focus on a single site. Also, while the results are comparable in terms of frequency of mention they cannot be taken as absolutely equivalent given the qualitative approach employed in this study. Finally, not all individuals participated in every type of data collection thus making it difficult to draw definitive conclusions (see page 22).

19.Limitations - Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias

Limitations of this study include a relatively small sample size and a primary focus on a single site. Also, while the results are comparable in terms of frequency of mention they cannot be taken as absolutely equivalent given the qualitative approach employed in this study. Finally, not all individuals participated in every type of data collection thus making it difficult to draw definitive conclusions (see page 22).

20.Interpretation - Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence

This study explored the potential use of MBS and VPS debriefs as NA tools and revealed that simulation debriefs may be more efficient under certain circumstances, in terms of time and cost at capturing similar needs contrasted to traditional methods of data collection (interviews/focus groups). Our investigation has also highlighted various trade offs which exist with selecting simulation as a NA method.

21.Generalisability - Discuss the generalisability (external validity) of the study results

Comment [S7]: I need more here

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The results of this study could be generalizable to other contexts, and we feel our exploratory study has provided an innovative area of inquiry for researchers to further investigate our findings.

Other information

22.Funding - Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

The funding source for the original study on which the present article is based comes from a The Ottawa Hospital ….Medical ….(TOHAMO) grant.

Comment [S8]: Spell out – not sure what it is?