How Will The Use Of High Fidelity Simulation In A North American Paramedic Curriculum Contribute To High Quality Teaching And Learning?

by

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Table of Content

Abstract........................................................................................................................................4

Acknowledgments..........................................................................................................................5

How Will the Use of High Fidelity Simulation in a North American Paramedic Curriculum Contribute to High Quality Teaching and Learning?.........................6

Chapter One....................................................................................................................................6
  Focus and Framing .......................................................................................................................6
  Research Question .....................................................................................................................11
  Significance of Research Subject .............................................................................................11
  Case Study ................................................................................................................................12
  Target Audience ......................................................................................................................13
  Organization of the Study ..........................................................................................................13

Chapter Two ..................................................................................................................................14
  Literature Review ......................................................................................................................14
  Article Selection Method .........................................................................................................15
  Theory and Simulation ..............................................................................................................15
  Types of Medical Simulation ....................................................................................................16
  Rationale for Use of Medical Simulation ................................................................................18
  Needs Moving Forward ............................................................................................................20
  Debriefing ..................................................................................................................................21
  The Skeptics ..............................................................................................................................22
  Literature Review Conclusion ...................................................................................................24

Chapter Three ...............................................................................................................................26
Methods and Analysis ......................................................................................................... 26
Organizational Support ......................................................................................................... 27
Ethical Considerations .......................................................................................................... 27
Sampling ............................................................................................................................... 28
Data Collection .................................................................................................................... 29

Chapter Four ......................................................................................................................... 35
Research Findings ................................................................................................................. 35
Researcher Bias Disclosure ................................................................................................... 52

Chapter Five ........................................................................................................................ 53
Discussion ............................................................................................................................. 53
Conclusions .......................................................................................................................... 55
Future Research ................................................................................................................... 57
Closing Reflection ................................................................................................................ 59

References ............................................................................................................................ 60

Figures .................................................................................................................................. 69

Appendix A ............................................................................................................................ 78
Appendix B ............................................................................................................................. 81
Appendix C ............................................................................................................................. 83
Appendix D ............................................................................................................................. 84
Appendix E ............................................................................................................................. 85
Abstract

This study has examined an Advanced Care Paramedic (ACP) program, which mandates the use of high fidelity simulation (HFS). Intrinsic case study methodology has been utilized to collect and analyse qualitative and quantitative data. Data includes semi-structured interviews and demographic surveys of program instructors as well as an inventory artifacts used in HFS.

Participants for the study believe that HFS allows students to gain proficiency, build self-confidence and ultimately increase patient safety. They also believe HFS must closely match the conditions in which students learn and work. These factors are encompassed in the theory of operational realities of the paramedic practice environment (ORPPE), which includes, safety, environmental, communication, and patient access. Participants also feel that additional training is required before they can feel comfortable conducting HFS exercises.

Through the Excellence in Higher Education framework, program faculty are well positioned to gain the required support from leadership to successfully implement HFS.
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How Will the Use of High Fidelity Simulation in a North American Paramedic Curriculum Contribute to High Quality Teaching and Learning?

Chapter One

Focus and Framing

The College of the North Atlantic-Qatar (CNA-Q) is a technical college located in the State of Qatar. The State of Qatar is in the Middle East and is located on an oil rich peninsula in the Persian Gulf (Qatar Facts, n.d.). According to the Institute for Economics and Peace, “Qatar is the most peaceful country in the Middle East and one of the most peaceful countries in the world,” ranked 19 out of 162 counties assessed (20 Most Peaceful Countries in the World, 2013, para. 10).

CNA-Q is a Canadian technical college that functions in partnership with College on the North Atlantic (CNA), a public college in the province of Newfoundland and Labrador, Canada and the State of Qatar (College of the North Atlantic-Qatar [CNA-Q], 2013).

CNA-Q is made up of seven schools, one of which is the School of Health Sciences (SHS). The SHS has six departments, of which, the Emergency Medical Science (EMS) department is the focus of this research study (CNA-Q, 2011).

In 2013, the Emergency Medical Science (EMS) department received approval from the President of the College of the North Atlantic (CNA), through the recommendation of Academic Council, to offer an Advanced Care Paramedic (ACP) Diploma at CNA-Q. Academic Council is empowered to recommend, “programs of study and major alterations to existing programs at the certificate and diploma levels as defined by College policy and guidelines [and to] recommend academic standards and requirements for admission to and completion of college programs” (College of the North Atlantic [CNA], 2010, p. 1).
The ACP program replaced a program which was based on an American, Department of Transportation, Emergency Medical Technician – Intermediate (EMT-I) curriculum, which is no longer endorsed by the United States government agency which created it (National Registry of Emergency Medical Technicians, 2012). Likewise the State of Qatar does not recognize the EMT-I credential as a practice level (Gamber, 2013).

The ACP program submission to Academic Council was in response to a request from the School of Health Sciences Emergency Medical Science Program Advisory Committee. The Committee’s responsibilities, as outlined in its Terms of Reference, are “to advise on changes in labour market related to the occupation” (Emergency Medical Science Program Advisory Committee, 2010, p. 1). During the annual committee meeting in January, 2012, the Board identified substantial changes in the job market which negatively impacted graduates’ prospects for employment and meant the EMT-I program was no longer meeting industry's needs (Walsh, 2012). The Advisory Committee therefore requested that a program review be undertaken to “develop a prehospital care program appropriate for the State of Qatar” (Walsh, 2012, p. 8).

The EMS program review is in keeping with CNA-Q strategic plan for 2011-2016 which states in the opening pages, “the State of Qatar recognizes that nations that foster knowledge, innovation, and creativity, and embrace technological advances, lead the world in prosperity” (CNA-Q, 2010, p. 2). The development of the ACP program supports the following strategic goals of the college:

**Strategic Direction-Learners First:**

Goal 1.1 “CNA-Q will strengthen the value of our credentials by continuing to enhance our high-quality, technology-rich programs that meet the needs of our diverse learning community and the State of Qatar” (CNA-Q, 2010, p. 20).
Goal 1.4 Initiative 1.4.3 “Define and provide solutions for credential needs of our learners and industry partners” (CNA-Q, 2010, p. 20).

The ACP program increases the opportunities for Qatari nationals through a defined career pathway into the national ambulance service, which “offers Qatari citizens opportunities to realize their intellectual potential, develop their abilities, and follow their aspirations and interests” (CNA-Q, 2010, p. 2). Without such a pathway for graduates, the paramedic profession has suffered from low interest by local Qataris, evident by low Qatari enrolment into the former EMT-I program (Gamber, 2013).

The ACP program supports the organization’s mission by developing “accessible and responsive technology programs” (CNA-Q, 2013, p. 1). It further supports the vision which states, “College of the North Atlantic – Qatar will be recognized as a world-class educational institution. It will reflect quality and innovation in its programs…its response to current and future needs of…the State, and the region” (CNA-Q, 2013, p. 1). K. MacLeod, President of CNA-Q, was quoted in the opening address of the CNA-Q Academic Calendar: “we pride ourselves on being responsive to changes in our community and the workplace” (CNA-Q, 2013, p. 3).

As part of the program review process, focus groups were convened which included all industry partners, and through that consultation it was agreed to develop the new ACP program based on a Canadian model. The Canadian model was identified as a standard which would meet and exceed the needs of the State of Qatar, while returning the program to the institute’s Canadian roots. A. MacDonald, paramedic faculty lead, explained the competency model selection:
the College’s mandate and the reasons why CNA-Q operates in Qatar, [claim] that Canadian standards in both education and practice are key to the College’s presence in the State. Further, the Canadian credentials being proposed are specifically identified as meeting the education requirements for licensing in the State. Finally, following the Canadian curriculum model provides a direct pathway to external accreditation of the EMS program. (Gamber, 2013, p. 81)

Following a Canadian model would open a pathway for the accreditation of the ACP program through a Canadian accrediting body such as the Canadian Medical Association (CMA), providing an important external validation of the program’s quality and meeting a strategic goal of the SHS (Gamber, 2013). To that end, the ACP program was developed as a three year, nine-semester program, to meet and exceed the requirements of the Paramedic Association of Canada's (PAC) “National Occupancy Competency Profile for Paramedic Practitioners” (NOCP) at the ACP level (Gamber, 2013).

During the program design process, three courses were selected for the mandatory inclusion of HFS due to the course objectives and course placement within the ACP program (A. MacDonald, Personal Communication, September 29, 2013). This requirement was based on an anticipated industry requirement and was highly supported by industry in the focus groups (Gamber, 2013). These three courses, Simulation Lab, Clinical Skills Development I and Clinical Skills Development II, represent courses in the third, seventh and eighth semesters within the nine semester program (CNA-Q, 2013). In the case of Simulation Lab course, HFS is embedded in the semester prior to full-time practical preceptorship (CNA-Q, 2013). Likewise, the Clinical Skills Development I and II courses, were designed as a continuation of a body system approach to patient management, and were effectively a single unit spread between two
semesters. These courses are prerequisite to a full time practicum (CNA-Q, 2013). A practicum is an opportunity for ACP students to practice under supervision in the live setting of an ambulance service.

The ACP program practicum is designed to provide learners with the opportunity to synthesize and apply the knowledge, skills and abilities developed throughout the previous eight semesters. Under the supervision of a qualified preceptor, learners will integrate - as appropriate - the full scope of paramedicine competencies. Throughout the semester, they [learners] will be exposed to a variety of environments and situations typical of the paramedic profession. Learners will attend a variety of shifts including nights and weekends, ensuring that they are exposed to the conditions in which they will be working post-graduation. (CNA-Q, 2013, p. 1)

The description and parameters of HFS in the ACP course outlines listed above were derived from Appendix A in the PAC, NOCP’s (Paramedic Association of Canada, 2011). As an example, the Simulation Lab course outline provides the following course description:

This course is designed to prepare learners for practicum placements through synthesizing and integrating knowledge and skills learned in previous and concurrent courses. Learners will demonstrate proficiency assessing, inferring a differential diagnosis, and providing care to various patient-types in a simulated setting using high fidelity simulation. Using a teamwork approach, learners will simulate the events of a paramedic or clinical response. (CNA-Q, 2013, p. 247)

Further to the course description, the evaluation notes of the course outline include the following requirement:
Where relevant, settings will include the location of the patient, physical movement of the patient from the scene to a paramedic unit, and physical movement from the paramedic unit to a triage or mock hospital setting. Social and interpersonal fidelity, physiological and procedural fidelity, and cognitive fidelity will also be included as part of the simulated scenarios to create an overall experience of sufficient context for functioning in an actual field or clinical environment. Students will work in teams or small groups to simulate the events of a paramedic or clinical response. (A. MacDonald, Personal Communication, September 29, 2013)

Research Question

How will the use of HFS in a North American paramedic curriculum contribute to high quality teaching and learning?

This study aims to explore and understand the following:

What do paramedic instructors perceive to be the benefit of the using of HFS in the delivery of paramedic education?

What do paramedic instructors perceive to be the barriers and challenges in the use of HFS in the delivery of paramedic education?

How does the use of HFS in paramedic education differ from other allied health disciplines?

Significance of Research Subject

HFS is being embraced across medical and allied health disciplines, not only in credentialing and continuing medical education, but also in the initial training of post-secondary college and university students (Bland, Topping and Wood, 2011; Dowie and Phillips, 2011). The creation of the ACP program and its requirement for the use of HFS provided a unique
opportunity to study the thoughts and feelings of paramedic instructors for insight on how a paradigm shift to HFS may impact students.

The rationale for the importance of this research is based on the belief that a new ACP program, which demands the use of HFS in the program delivery, is a unique event. Peate (2011) describes the lack of demand for the use of HFS in paramedic education: “simulation appears to be seen…as an add-on for paramedic training and education as opposed to a compulsory and core part of training” (p. 429). In our institution, however, despite the mandatory use of HFS, there is currently no requirement that staff attain simulation training or participate in seminars as part of their professional development. This lack of mandatory training for instructors is contrary to much of the literature available on the use and implementation of HFS in allied health education, all of which recommends that instructors receive training prior to implementing the use of HFS (Birkhoff and Donner, 2010; Dowie and Phillips, 2011; McGaghie, Issenberg, Petrusa, and Scalese, 2010).

Case Study

The ACP program, along with the context of its requirement for the use of HFS, provided an excellent opportunity to study the thoughts and feelings of instructors involved in the delivery of the ACP program from its onset. A case study methodology is appropriate given that the ACP program is a new program as well as the first program in the College to mandate and clearly define HFS in the context of how it is to be conducted in the delivery and assessment of paramedic competencies. The thoughts and feelings of paramedic instructors on the use of HFS is important to capture; however, these thoughts and feelings are inseparable from the context of the launch of the ACP program, the equipment available to conduct HFS and the programs
requirement for the use of HFS. This context is central to the story of how faculty think and feel about conducting HFS in the delivery of the ACP program.

**Target Audience**

Several groups will find the knowledge that this study produces to be valuable. The ACP program itself will benefit because research about how faculty members feel about HFS, their thoughts on the benefits and challenges, provide the opportunity to address issues emerging from the study. Such knowledge can assist faculty in developing a superior learning experience for students. The results of this research will provide college leadership with direction on how to move forward in supporting instructors with professional development in the area of HFS. Additionally, faculty, leadership and administrative staff at other institutions may find that they relate to this case and therefore find aspects of the results enlightening.

**Organization of the Study**

The presentation of this study has been organized into five chapters. Chapter One provides relevant background setting the frame of the study. Chapter Two provides the reader with a review of the relevant literature relating to HFS. Chapter Three describes the methods used in the research, including data sources, description of participants, and data analysis techniques. In Chapter Four the findings of the analysis are presented. Chapter Five is a discussion of relevant recommendations based on the findings and the available literature, along with areas for future research.
Chapter Two

Literature Review

The use of simulation is not a new or modern human invention; in its simplest form it may have been around since the dawn of humanity. The definition of simulation is “an imitation of some real thing, state of affairs, or process” (Rosen, 2008, p. 157). It is not hard for one to imagine our ancient ancestors using simulation, for example, to improve their aim by substituting a tree trunk to simulate prey, in preparation for a hunt (Littlewood, 2011). As we move forward to a more modern time, simulation becomes more complex; chess, created in the sixteenth century, is considered “one of the earliest examples of military simulation” (Rosen, 2008, p. 157).

Medical simulation has an extensive history going back centuries with early examples including models of anatomy and pathologies, along with descriptions of the signs and symptoms of disease (Rosen, 2008). Meller (cited in Owen, 2012) says that “from antiquity…clay and stone models of humans were used to demonstrate clinical features of disease states” (p. 102). Modern medicine has been relatively slow to embrace simulation in contrast to other professions such as the aviation industry, which introduced its first flight simulator “twenty-five years after the Wright brothers’ first powered flight” (Littlewood, 2011, p. 475). In comparison, it was not until 1958 that Laerdal started working on a mannequin, Rususci-Annie®, which was released in 1960 to aid in the life saving “practice of mouth-to-mouth breathing” (Rosen, 2008, p. 160). Rosen (2008) considered Rususci-Annie® as “one of the first significant events in the history of medical simulation” (p. 160). Owen (2012) challenges this assumption, stating that the medical community has a “collective amnesia about simulation” (p. 113). Owen (2012) emphasizes when he points out that in 1027, during the Song Dynasty, Wang Wei-Yi created two “life sized
bronze statues...for teaching surface anatomy and the location of acupuncture points” (p. 102). The author furthers his opinion regarding collective amnesia in his conclusion where he states that “simulation was embedded in a surgical training program around 2500 years ago, so that students had developed a wide range of skills before commencing clinical practice” (Owen, 2012, p. 112). Owen speculates that even in antiquity, simulation may have been viewed as an issue of patient safety, a point my literature review will revisit.

**Article Selection Method**

A systematic approach was used in the selection of literature for this bibliographical literature review on the current state of knowledge on the use of high fidelity simulation in the health care industry. Royal Roads University, College of the North Atlantic-Qatar, and Journal of Paramedic Practice search engines were utilized to retrieve a selection of literature in the area. An identical key word search was conducted through each search engine using combinations of the following words: simulation, high fidelity, medical, paramedic, medicine, gaming, learning theory, research and education. Those results were further refined based on publication date and relevance to health care education and simulation. Additional literature was identified through discussions with colleagues who, in their own right, are experts in the field of HFS. Furthermore, as the literature review progressed, I identified additional articles through the readings which were incorporated into this bibliographical review.

**Theory and Simulation**

There is some debate in the literature as to which learning theory HFS is based upon. Leigh and Hurst (2008) assert that simulation is “based on the educational theories of constructivism and learner-oriented instruction” (p. 1). Peddle (2011) agrees, stating that “the use of simulation gaming is further supported by constructivist theory where learners create their
own meaning through interaction with the environment” (p.647). Fanning and Gaba (2007) argue that it is adult learning theory which informs the use of simulation: “adult learning provides many challenges not seen in the typical student population. Adults arrive complete with a set of previous life experiences…which drive their actions…[t]hey like their learning to be problem centered and meaningful to their life situation” (p. 115). Several authors look to Kolb’s experiential learning theory to inform the use of simulation in medical education, pointing out that learning takes place through experience, reflection, conceptualization and active experimentation in safe learning environments (Bland, Topping, and Wood, 2011; Johannesson, Silén, Kvist, and Hult, 2013; McGaghie, Issenberg, Petrusa, and Scalese, 2010). Hodges and Kuper (2012) disagree; in their article, “Theory and practice in the design and conduct of graduate medical education,” they argue that educators should first look at educational theory to advise them in the best approach for the use of simulation in achieving specific objectives. They do not think that theory explains the success of simulation in education, but rather that theory is a tool to inform educators how to best structure simulation experiences. The authors point out “the lack of a theoretically informed approach to most simulation training may help to explain emerging findings of failure to learn in simulated environments” (Hodges and Kuper, 2012, p. 29). Where there has been a specific attempt to examine simulation in the context of learning theory there is a consensus that socio-cultural learning theory best describes the nature of learning through the use of simulation (Bleakley, 2006; Hodges and Kuper, 2012).

**Types of Medical Simulation**

In medical education and allied health disciplines there are several forms of simulation technology available. Although not an exhaustive list, this literature review attempts to present an overview of the literature describing different types of simulation being used today. Because
the term “fidelity” is used in many of the descriptors it is useful to agree on a definition of that word. Ellaway and Topps (2009) define fidelity as “the accuracy of the representation when compared to the real world” (p. 82). Low fidelity simulators, also referred to as task trainers, attempt to mimic single body parts and are intended to support the acquisition of procedural skills such as endotracheal intubation in airway management (McGaghie et al., 2010). Mid-fidelity simulations are life size mannequins that are capable of mimicking pulse and breathing and other simple body functions at a fraction of the cost of high fidelity simulations (Rosen, 2008). HFS “represents advanced technology designed to replicate the clinical signs and symptoms seen in real patients” (Stewart, Kennedy, and Cuene-Grandidier, 2010, p. 91). This form of simulation is also referred to as Human Patient Simulation (Rosen, 2008). Simulation facilitators can alter the physiological parameters of high fidelity mannequins using software interface in response to the actions or inactions of students (Stewart et al., 2010).

Virtual reality and gaming technology is also being used in medical simulation. Rosen (2008) highlights the use of Second Life, which is a virtual world where medical simulation has been appearing since 2007 (p. 162). Power (2011) has developed a virtual reality simulation containing a motor vehicle crash where paramedics “manage the scene and provide the appropriate clinical care for the casualties” (p. 447). Ellaway and Topps (2009) assert that “gaming also introduces the key aspect of strategy, the ability to apply one or more knowledge schemas to working through a problem and then adapting them as necessary in response to their success or failure” (p. 83). Aldrich (2004), in his book Simulations and the future of learning: an innovative (and perhaps revolutionary) approach to e-learning states his belief that for anyone who develops educational content…or teaches to it, or has a stake in his or her organization’s learning strategy…understanding the interactivity and production
value of a modern computer game experience is critical...[gaming technology can]

redefine scalable experiences, adding breathtaking interactivity, and can convey

extraordinary amounts of context. (p. 14)

McGaghie et al. (2010) caution, however, “that educational goals must direct decisions

about the acquisition and use of simulation technology for teaching and testing. Effective use of

medical simulation depends on a close match of education goals with simulation tools” (p. 56).

This thinking is reminiscent of Hodges and Kuper (2012) advisement to let the learning objective

inform the selection of learning theory, which in turn guides the simulation activities best suited
to achieve learning.

Rationale for Use of Medical Simulation

Many research articles highlight patient safety as a key advantage in the use of medical

simulation. Both student and practitioner must be competent in managing patients in the clinical

setting, and simulation plays an important role in attaining and maintaining clinical competence

without placing patients at risk as learners practice and work towards competence in a controlled

scenario and in the evaluation of each competency (Berg, 2006; Birkhoff and Donner, 2010;

Brindley, 2009; Dowie and Phillips, 2011; Peate, 2011; Pebble, 2011; Stewart et al., 2010). Berg

(2006) is explicit in the belief that medical simulation goes beyond an issue of patient safety,
calling for “simulation in medical education [as] an ‘ethical imperative’” (p. 206).

There is agreement by many educators and practitioners that simulation supports both

clinical competence and also builds practitioner confidence. Students are able to practice making

clinical decisions in a safe environment, where consequence does not impact human patients.

This type of environment helps learners and novice practitioners increase their confidence in

their own abilities (Birkhoff and Donner, 2010; Dowie and Phillips, 2011; Jones, C., Jones, P.
and Waller, 2011; Moule, Wilford, Sales, and Lockyer, 2008). Birkhoff and Donner (2010) point out that “high-fidelity simulation provides the ultimate training environment in which participants can practice critical assessment and communication skills before engaging in practice, thereby assuring that they have the knowledge and confidence necessary to provide safe and effective care” (Birkhoff and Donner, 2010, p. 421). The authors also comment that “the participant can make mistakes without repercussions and subsequently turn these mistakes into learning opportunities” (Birkhoff and Donner, 2010, p. 421).

Crisis Resource Management (CRM), a concept developed from the aviation industry’s Crew Resource Management (of the same acronym), is a program designed to instill an interdisciplinary team approach in the medical management of critically ill and injured patients (Fritz, Grey and Flanagan, 2008). Fritz et al. (2008) described the use of CRM in situations “requiring rapid decision making in a complex environment using incomplete information when the goals might be unclear. Furthermore, the emergency medicine environment demands effective coordination of team members to accomplish tasks efficiently in a coordinated and time-critical manner” (p. 1). There are several advantages to the use of HFS in CRM programs and these include the following: earlier decision making, team members anticipating the plan, use of information and cross checking, effective communication and decrease in number of errors (Falcone et al., 2008; Fritz et al., 2008).

Willaert, Aggarwal, Van Herzeele, Cheshire and Vermassen (2012) believe there is another potential future benefit for the use of virtual reality (VR) simulation: “if VR simulators evolve and achieve higher levels of fidelity, they could eventually be used for procedure prototyping: acting as “guinea pigs” to test new operative techniques, material, and approaches” (p. 1711).
Needs Moving Forward

It is widely agreed by educators and professionals in the field of simulation that further research is required in the area of medical simulation in order to validate its use in medical education and professional development (Bland et al., 2011; Birkhoff and Donner, 2010; Littlewood, 2011; Pebble, 2011). Littlewood (2011) asks, “can we demonstrate that simulation programmes improve health-care delivery to patients?” (p. 474). Bland et al. (2011) suggest, “the absence of an evidence base may locate simulation peripherally and stagnate without commitment to an evidence base” (p. 664). Birkhoff and Donner (2010) conclude, “with current limitations on research studies, it will be some time before the full effects of either high-fidelity or low-fidelity simulation are known” (p. 423).

It is also evident that effort must be placed on educating the instructors and facilitators who use medical simulation in education (Birkhoff and Donner, 2010; Dowie and Phillips, 2011; McGaghie, et al., 2010). Dowie and Phillips (2011) suggest that “for lecturers to be able to provide sufficient support to students and to ensure high-fidelity simulation is used effectively as an education strategy, they need to be adequately prepared and trained” (p. 37). Birkhoff and Donner (2010) are in agreement, but they also expand this thought to include the validation and evaluation process when they state that “time is needed for educators to learn how to use the highly sophisticated equipment, develop clinical scenarios related to the learning objectives, and conduct research designing and validating standardized, reliable testing methods” (p. 421).

Preparing qualified and competent simulation educators and simulation facilitators has already begun; medical simulator manufacturers, colleges and professional medical associations are increasingly offering simulation instructor courses. There is also a growing acceptance that trained simulation instructors do not need to belong to the discipline for which a simulation
exercise is being conducted. More emphasis is being placed on professional facilitation than on discipline-specific subject matter experts conducting simulation exercises (McGaghie, et al. 2010).

Johannesson et al. (2013) also suggest that dress of the participants in simulation exercises is an important aspect in increasing the level of fidelity, finding that a group of nursing students felt they behaved more professionally wearing nursing uniforms when they participated in a simulation exercise. Although confined to a single study, this question of professional dress affecting deportment during simulation is worth further exploration.

**Debriefing**

Debriefing is a defined process that takes place after the completing of a simulation exercise; the goal of debriefing is the enhancing of the learning experience for students (Fanning and Gaba, 2007). Moule et al. (2008) found that “the simulations allowed interdisciplinary discussions amongst the students which highlighted different aspects of their professional practice. The debriefings that followed each session enabled the critical exploration of care delivery from the different perspectives of adult and child nursing” (p. 794). With the use of debriefing, students are able to explore concepts of the management performed during scenarios that were unclear during the scenario, furthering their understanding through group discussions (Wotton, Davis, Button, and Kelton, 2010). Khan, Patterson, and Sherwood (2011) assert that “without feedback or debriefing simulation does not result in any improvement in performance” (p. 2).

Key elements of the debriefing process include creating a supportive and comfortable environment separate from the simulation environment, facilitated by a person who has an attitude of co-learner rather than one of an authority figure (Fanning and Gaba, 2007). Although
audiovisual technology is embedded in HFS, Leigh and Hurst (2008) comment that it is more important to facilitate in a supportive manner than to playback video of the scenario. Fanning and Gaba (2007) caution that reviewing lengthy video might “detract from the focus of the debriefing session” (p. 122). However, video playback and review of key elements of a simulation scenario is recommended in much of the literature (Berg, 2006; Fritz et al., 2008; Studnek, Fernandez, Shimberg, Garifo, and Correll, 2011; Wang, 2011).

The Skeptics

Surprisingly there is little debate that medical simulation has an important role in the medical system. A significant issue that has been voiced, though, is one of validity. Littlewood (2011) captures this thinking best:

simulation is being integrated into all phases of medical education. It is now, in some cases, a component of credentialing and maintenance of certification. This widespread adoption, however, generally preceded evidence of efficacy. This issue is particularly important considering the extraordinary resources required to implement and sustain robust simulation education programmes in comparison with other educational methods. Simulation education must prove itself, whether compared to traditional curricula or newer, active-learning strategies. (p. 473)

Another issue arising in simulation is that of the already mentioned concept of fidelity. Rosen (2008) concludes that skeptics use the lack of fidelity along with cost to justify delayed implementation of simulation programs in some jurisdictions. Littlewood (2011), although clearly an advocate of the usefulness of HFS, comments that “even devices termed high fidelity would rarely be confused with a real patient, body part or skin” (p. 474). Jones et al. (2011) point out “equipment fidelity may be compromised in prehospital care education by a lack of
life-like mannequins and other simulation equipment... Many learners may feel that the equipment lacks realism because of the inability to replicate real qualities such as skin temperature, texture” (p. 432).

Although there is little debate in general evidenced by the literature regarding the use of HFS across medicine, allied health and paramedic education, there does exist substantive cautionary comments within articles on the use of HFS. Rice (2013) cautions educators in his article “The use of simulation mannequins in education” when he concludes,

any provider of education or training should consider carefully what they wish to address by purchasing mannequins for simulation and how they are able to facilitate effective and realistic simulation that covers the large range of factors pertinent to paramedics. Otherwise we may find ourselves using expensive resources in a futile way when we should, perhaps, be looking at what really matters in paramedic education. (2013, p. 551)

Bligh and Bleakley (2006), in “Distributing menus to hungry learners: can learning by simulation become simulation of learning?” suggested several potential negative effects of HFS. One such effect is surveillance: students perform as though they are “constantly parented rather than allowed to develop and exercise appropriate autonomy and collaboration” (p. 612). The worry is that this behaviour is potentially transferred to the clinical setting. Another issue that is explored in the article is that of simulation scenarios being detached from the real world, not rooted in any reality, Bligh and Bleakley (2006) write,

the simulation community becomes fascinated by the possibilities of technology-driven learning environments...losing touch with the real environments these simulated settings once copied. A symptom of this movement is the appropriation of real-life
events such as interpersonal skills, where the simulation community claims that psychological elements such as clinical teamwork are best learned in simulated settings... students may now also learn to simulate effects such as ‘good communication, and to dissimulate actual difficulties in real-time communication (using the simulated environment as a smokescreen to pretend that such difficulties do not exist). Learning communication skills can become self-parodying, with students expressly over-using eye contact and forward-leaning body posture that is now ‘practised’ and unnatural. More importantly, this may be carried out in an affective vacuum, where it is detached from the realities of a social context and complex cues that normally come to shape an appropriate social response. (p. 610)

Bligh and Bleakley (2006) conclude by asking, “can a new dialogue emerge between learning by simulation- and work-based learning that is evidence based, rigorously theorized and sensitive to current imperatives such as patient safety and the need for integration of learning across the psychological and psychomotor domains?” (p. 612).

**Literature Review Conclusion**

Modern medicine may not have embraced simulation as quickly as other industries. However, once it did, the technology advanced rapidly (Rosen, 2008). Despite a lack of evidence supporting the efficacy of HFS in the health care field, the medical community is embracing high fidelity simulation, apparently seeing its value. Rosen (2008) suggests that “validity will always be elusive and medicine must ultimately accept simulation on the basis of faith or common sense similar to the aviation industry” (p. 159). Such acceptance may be attributable to the need for patient safety, a consistent theme running through writings on simulation (Berg, 2006; Birkhoff and Donner, 2010; Brindley, 2009; Dowie and Phillips, 2011;
Pebble, 2011; Stewart et al., 2010). Brindley (2009) aptly comments that simulation centers can highlight their role in patient safety when he suggested that “medical simulation can…brand itself as a unique ‘patient-safety laboratory’” (p.153).

It is the belief of this author that medical simulation is not a trend, but is here to stay. With the vested interests of so many in the medical community, research is likely to continue enhancing the validity of this methodology. Bligh and Bleakley (2006) concluded, “simulation has its place and is very valuable in medical education but…too much of a good thing can be dangerous…teaching and learning at the bedside, in the clinic and in the home must remain the very heart of medical education” (p. 612).
Chapter Three

Methods and Analysis

This research study was conducted using a qualitative case study approach. Yin (2003) describes qualitative case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 13). Further, this study specifically utilizes an intrinsic case study approach. Stake (2005) explains that the intrinsic case study approach as applicable when the researcher “wants better understanding of this particular case. It is not undertaken primarily because the case represents other cases or because it illustrates a particular trait or problem, but instead because in all its particularity and ordinariness this case in itself is of interest” (p. 445). The uniqueness of the creation of an ACP program that mandates the use of HFS is intrinsically interesting. The thoughts, feelings and beliefs of the paramedic instructors regarding the use of HFS provide insight into what is needed to help ensure a world class, sustainable education experience for students enrolled in the program. Furthermore, Baxter and Jack (2008) point out that the case study approach is recommended when contextual conditions are relevant to the study. Researching at the onset of the ACP program, including what equipment is available to deliver HFS, and what backgrounds paramedic instructors have in the development and delivery of HFS, provides rich context with which to frame the thoughts, feelings and beliefs of the paramedic instructors. Stake (2005) asserts, “we do not choose case study design to optimize generalizations…The real business of case study is particularization, not generalization. We take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what it does. There is emphasis on uniqueness” (1995, p. 8). It is the intent of this study to present sufficient detail and description to provide the reader...
the ability to understand the ACP program and its rationale and reason for being. Jensen (2008) suggests that through purposive sampling, a rich description of context transferability can be increased; rich contextual details are provided here in an attempt to increase the possibility of transferability.

Organizational Support

Although no organizational sponsorship was required for conducting this research study, support and approval was sought from the Dean of the School of Health Sciences on August 29, 2013. The Dean fully supported the research and offered any documentation, equipment, and archives within the school that might be useful in carrying out the research study. The Dean specified one condition: that upon completion of the research I would share my findings with the school leadership team.

Ethical Considerations

Participants in the research study freely provided free and informed consent through reading and signing the research consent forms for both CNA-Q and Royal Roads University (RRU) (Appendix A and B respectively). Additionally, because all participants are colleagues of the primary researcher, attention was paid to disclosing the full nature of the research project prior to their participation. At the commencement of each interview, time was allocated to explain the nature of the research and its implications to the ACP; the importance participants played in the research was reiterated.

Care was taken to ensure that participants were comfortable and that experience in the interview process was a positive one. It was decided that interviews would be conducted in the participants’ individual offices and that the times for the interviews were chosen by the participants (Glene, 2011). Furthermore, during the interview process I was careful to ensure
that the tone and inference of the conversation was relaxed and conversational. Yin (2011) recommends that “the qualitative interview follows a conversational mode, and the interview itself will lead to a social relationship of sorts, with the quality of the relationship individualized to every participant” (p. 134).

Two separate institutional review board (IRB) applications were submitted on October 16, 2013. Yin (2011) stresses,

IRB approval is integrally related to the issues of human ethics…[t]he relevance of such approval starts with a simple principle: All research with human participants (whether they are formally designated as human “subjects” or not) needs to be reviewed and approved from an ethical standpoint. (p. 44)

The research study received an exemption from a full IRB review from the CNA-Q on October 27, 2013. Royal Roads University IRB approval was granted on November 4, 2013.

**Sampling**

Purposive sampling was used in the selection of interview participants. Oliver (2006) describes purposive sampling as

a form of non-probability sampling in which decisions concerning the individuals to be included in the sample are taken by the researcher, based upon a variety of criteria which may include specialist knowledge of the research issue, or capacity and willingness to participate in the research. Some types of research design necessitate researchers taking a decision about the individual participants who would be most likely to contribute appropriate data, both in terms of relevance and depth. (para. 1)

All members of the EMS department who were eligible and/or who were teaching in the ACP program were invited to participate, with one exception, my spouse, who fits the selection
criteria, but would potentially bias the data because of her deep understanding of the research through the support that was offered during the development of the study. Participants were emailed an invitation to participate in the research study on November 12, 2013 (Appendix C). All invitees chose to participate in the research study.

Data Collection

One distinct feature of a case study is its use of multiple data sources (Baxter and Jack, 2008). Three sources of data were used, which included in-depth interviews, an inventory and analysis of physical resource called artifacts, and a demographic survey of the participant paramedic instructors (Yin, 2003).

Interviews. Interviews were scheduled and conducted between November 20, 2013 and December 12, 2013. Each interview was between 20 and 45 minutes in length and was audio recorded using a digital audio recording device.

As primary researcher, I personally conducted the interviews in the privacy of each participant’s office, a place that is comfortable and familiar to each participant (Kalof, Dan and Dietz, 2008). A semi-structured interview approach was utilized and a list of questions was available during the interview to provide consistency in topics covered and to ensure that all areas of interest to the research study were discussed (Appendix D). Given the diversity of experiences within the participant group, a semi-structured approach allowed the flexibility of exploring unanticipated themes or topics that arose during interviews (Ayres, 2008).

Stake (1995), recommends that whenever possible, “trying out the questions in pilot form, at least in mental rehearsal, should be routine. During the actual exchange, the interviewer needs most to listen” (p. 65). Prior to the commencement of the semi-structured interviews, the questions were piloted with my spouse who is also an instructor of the ACP program. The
responses of the piloted questions did not contribute to the data analysis and results of this study. As a novice interviewer, I found the pilot to be a particularly useful exercise. Although the questionnaire did not change, I was able to focus on how each question was perceived. This focus provided me with the opportunity to anticipate clarifications that might be required.

Audio recorded interviews were transcribed verbatim using Rev.com, a professional transcription service. All transcriptions were returned completed on December 17, 2013. Transcriptions were reviewed against the audio recordings for accuracy. Corrections were made with jargon and misinterpretations of some statements. These transcriptions were made available to participants to ensure accurate capture of their thoughts, feelings and opinions, as a valuable process of validation (Bassey, 1999).

**Artifacts.** Equipment was photographed and categorized in an inventory of the physical resources available to paramedic instructors used in HFS. This inventory of equipment included mannequins, moulage, simulation technology and ambulance equipment. The paramedic lab was also photographed and the layout catalogued. This inventory of artifacts provided information and context as to the ACP program’s capacity to conduct HFS. This form of data is referred to as artifacts and although rarely used in case study research provided insight into the physical space and tools available to participants conducting HFS (Yin, 2003). The detail of the ACP program’s simulation inventory is important in building a contextual picture as well as providing a comparative gauge for the reader to draw conclusions on the transferability of the research findings to their own experience. During the process of cataloguing, artifacts were photographed.
Photographs are also a valuable form of data, which can be analysed. Prosser and Schwartz (2004) assert that photographs can actually be analyzed for meaning. The authors point out that they have discovered the valuable contribution photographs can make, both in the practice and presentation of our work. Like our field notes and other forms of empirical data, photographs may not provide us with unbiased objective, documentation of the social and material world, but they can show characteristic attributes of people, objects and events that often elude even the most skilled wordsmith…and demonstrate relationships that may be subtle or easily overlooked. (p. 335)

The photographs collected as part of this research study provided insight into equipment use that may otherwise been overlooked.

However Yin (2005) cautions,

Given the heavy use of photographs in everyday life...today’s audiences have become increasingly perceptive consumers of good photography. Studies that use photographs should therefore set high standards for the quality of the photography...Poor photographs can reflect negatively on a study and on the inferred quality of the rest of the study. (p. 246)

Despite my lack of photographic expertise, I endeavoured to capture high quality photographs of artifacts in use in the paramedic laboratory, by staging equipment, ensuring sufficient lighting and by using a high definition digital camera. Taking many photographs allowed me to include only those with the highest quality.

**Demographic Survey.** A demographic survey was conducted with each participant at the onset of each interview (Appendix E). The demographic survey collected relevant data which
provided contextual details of the participants. This data was crucial in order to provide details to
the reader in conceptualizing participant’s views and beliefs. The demographic survey collected
data on participant’s age, practice experience, teaching experience, and experience with HFS as
an educator.

It should be noted that the demographic survey questions were specifically excluded from
the oral interview due to the concern that asking participants about their credentials might elicit a
defensive response. This concern was based on the fact that specific credentialing requirements
were mandated in the ACP program, such that

Advanced Care Paramedic Instructors…must be a graduate of an accredited Canadian
paramedicine program and have current licensure as a Critical Care Paramedic, or
equivalent scope of practice within the relevant jurisdiction, with five years recent
relevant work experience. Registration, in good standing, with the paramedic licensing
body from a Canadian province is required. (CNA, 2013, pp. 61-62)

This credentialing requirement had raised concerns amongst current paramedic instructors.
Maintaining the principal of a positive interview experience, I chose to collect demographic data
outside of the face-to-face interviews, specifically to avoid eliciting any negative thoughts
regarding experience and credentialing (Glesne, 2011).

Data Analysis

Interview content analysis. The first stage of the data analysis began during the
interviews themselves. During the interview process it was evident that themes were
emerging. Ryan and Bernard (2003) assert that “themes come both from the data (an inductive
approach) and from the investigator’s prior theoretical understanding of the phenomenon under
study” (p. 88). These themes were reinforced during the proofreading of the transcripts. During
the proofreading process, I highlighted relevant sections and notes. Sandelowski (1995) indicate that there is value in underlining key areas of text while proofreading transcriptions. Ryan and Bernard (2003) cite Bogdan and Biklen (1982) who stress the value of reading the transcripts several times during the theme building phase; they believe that researchers should read transcripts a minimum of two times.

After proofreading and underlining key areas of the transcripts, I formulated analytical statements and printed them on flip chart paper. I printed key words on posters and arranged the posters into categories. At the completion of the interview analysis, I further refined the data into themes and analytical statements to answer each of the research sub-questions.

It is worth noting that I analyzed key phrases for analogs and metaphors. Ryan and Bernard (2003), point out that “people often represent their thoughts, behaviors, and experiences with analogies and metaphors. Analysis, then, becomes the search for metaphors in rhetoric and deducing the schemas or underlying themes that might produce those metaphors” (p. 90).

I challenged analytical statements against the data for validity purposes. I printed several copies of the transcripts and highlighted key words, terms and analogies, then cut out and pasted them to note cards. On the reverse side of these note cards, I printed key words. The cards were then catalogued into different theme folders. This process confirmed the original analysis and provided evidence of validity. Ryan and Bernard (2003) describe this process as “cutting and sorting” (pp. 94-95), and categorize it as an informal technique. The authors describe this technique in great detail, providing concrete examples similar to the approach I utilized in this study.

The final stage of the interview analysis included sharing the findings with participants in order to assess whether the analysis accurately reflected their perceptions and beliefs. The
feedback was overwhelmingly positive. Kohlbacher (2006) believes that sharing the findings of the analysis can be an important step in increasing the validity of research; including this step helps solidify findings.

**Artifact.** I reviewed the inventory of artifacts and wrote a descriptive statement for each substantive artifact. These descriptive statements provide insight into the use and usefulness of each artifact. Upon review of the photographs of artifact it became evident to me that meaning could be derived from the layout and storage of equipment within the paramedic laboratory.

**Demographic analysis.** I analyzed demographic surveys and organized them into a collection of charts, graphs and mean averages, including high and low data points. No attempt was made to cross reference demographic results with the interview findings due to the small sample size and lack of generalizability inherent in intrinsic case study.
Chapter Four

Research Findings

The analysis of the data collected during interviews, demographic survey and artifact review revealed a number of themes and provided a detailed contextualization of the case studied. The following chapter will outline the findings of this research.

Interviews. The interviews were conducted between September 15, 2013 and October 13 2013. Interviews were recorded, transcribed, analyzed and during the initial phase of analysis. Several broad themes were evident and included the following:

- HFS in paramedic education requires a specific high level of environmental realism to match the paramedic practice environment.
- HFS requires the ability of mannequins to mimic the physiological state of disease process and have the physiological state change in response to medical treatment delivered during simulation.
- Debriefing is part of the HFS process.
- Paramedic students should be given the opportunity to learn material and practice skills prior to participating in HFS exercises
- HFS should be applied when teaching and evaluating objectives integrating multiple domains of learning and focused on patient management.
- The benefits of HFS include:
  - Patient safety
  - Enhanced level of student self confidence
  - Confirmation of student ability the instructor
- Barriers to the use of HFS include:
▪ Time for the development, delivery and debriefing of HFS
▪ Lack of instructor knowledge on the use of HFS
▪ Lack of ability to mimic all aspects of patient interaction

• Solutions to the barriers identified include:
  ▪ Training in the use of HFS mannequin setup and management
  ▪ Development of HFS scenarios
  ▪ Creation of standards for the development, running, evaluating and debriefing of HFS
  ▪ Creation of resource bank of HFS scenarios
  ▪ Creation of an expert faculty position responsible for HFS
  ▪ Configuration of the Paramedic lab to facilitate the administration and orchestration of HFS

**HFS in paramedic education requires a specific level of environmental fidelity to match real world emergencies.** Participants believed that it is imperative that the environments in which paramedics practice be incorporated into HFS during paramedic education. I have come to consider these operational and environmental considerations as operational realities of the paramedic practice environment (ORPPE). The acronym ORPPE represents the idea participants discussed, as the real life challenges paramedics must overcome in practice outside of the clinical setting. The parameters of ORPPE include considerations such as the hazards paramedics face in reaching and managing patients. Participant 605 pointed out that “the idea of incorporating external hazards, [such as] traffic, and fire, wire, gas and glass” were important factors to include in HFS. These hazards must be considered throughout all aspects and phases of an emergency call. Calland (2000) stresses that
safety requires the ability to avoid both the unplanned and unpremeditated accident that could result in personal injury as well as the planned, premeditated assault. Safe working practice is a technique of anticipating and controlling events so that injuries do not occur. It requires skill, training and appropriate attitudes. (p. 1)

Another ORPPE parameter identified was student communication between family members, bystanders and other emergency personnel, which include fire services and law enforcement. Participant 660 pointed out that “like in real life you’re gonna have to deal with family…traffic cops…you have all kinds of other interference.” Participant 605 stated HFS should include the following:

- collaborating with police and fire, [and the] emotional aspect or empathy [shown to]
- family. So all of those can be built into a scenario, and as a facilitator…can choose to highlight or evaluate those specific competencies or only focus two or three that are important for that students learning on that particular day.

Confined work environment was another ORPPE parameter that emerged during data analysis. It was identified that students should be exposed to the challenges of managing patients in confined spaces for which that they are likely to respond. Participant 605 commented that paramedics are called to “various locations... any possibility imaginable.” Participant 605 went on to list: bathrooms, bedrooms, stairwells and car crashes to name a few of the locations encountered on a frequent bases by paramedic crews.

Somewhat inseparable from patient location is the reality that patients must be moved from the location of the initial contact to a receiving hospital. Participant 605 pointed out that “we're continually changing our working environments or the process of moving a patient from [the] scene to a place of definitive care...and if the ambulance phase of transport could be as
realistic as possible, the size of the compartment, the external influences of sound and movement,” then it would offer a more realistic learning environment. This patient movement requires consideration of a balance between treatment of the patient at the scene and the requirement to transport patients to a hospital. Paramedics must overcome challenges in the physical movement of patients from scenes described above to an ambulance for transport to a receiving medical facility. This process is referred to as extrication, a term often associated with car crashes, but more broadly understood in paramedic jargon as removing patients from difficult locations.

A final ORPPE that participants highlighted as important in incorporating in the development and delivery of HFS was that of environmental encumbrances to patient management such as lighting, noise and temperature extremes. Participant 571 demonstrated this thinking with the comment, “Okay, so imagine it is a snowy day, we will do it up so the [student] thinks they are in that situation...that’s going to make a big difference to me [student]...now I am in the cold and I realize how cold the patient is.” Participant 571 pointed out additional challenges working in extreme temperatures, “Okay now I [student] am out in the snow and I am doing things in my jacket...I may never have done that before,” indicating the encumbrances of working in weather appropriate attire. Participant 842 believes HFS should “mimics all aspects of what the students would see if it was in actual practice; [include] the environmental temperature and ambient light, ambient noise, other interactions with the general public.” Participant 612 also confirmed that if students “senses would be simulated, you could smell it, see it, touch it, hear it, feel it,” and the learning would be enhanced.

During the conception phase of developing ORPPE, I created a mind map using mindomo.com that represents key areas of the concept (Figure 1.).
**HFS requires the ability of mannequins or standardized patients to mimic the physiological state of disease process and alter that physiological state in response to medical treatment delivered during simulation.** Participants expressed the need for HFS to include human patient simulation with the ability to alter physiological states and standardized patient actors who can accurately mimic interaction of a live patient with a student, these tools were deemed essential to successful HFS. Participant 842 pointed out that “practitioners in real life don’t ask how fast a patient is breathing, they count…if the patient doesn’t respond like a patient [in simulation] then it’s not really a high fidelity simulation.”

The need for HFS to have mannequins with responsive physiological parameters is contingent on the objectives being covered. Participant 842 pointed out that “the importance of the human analogue simulators is relative to the importance of the patient interaction to the overall situation. There might be calls they do that it doesn’t matter what the patient looks like...So it would be relative to the call, to the amount of interaction that would exist in real life.”

Participants viewed patient interaction as an important aspect of practice and indicated that the appropriate use of standardized patients was equally important as human patient simulation to the successful use of HFS. Standardised patients are typically trained actors who are cast to play patients and provide consistent scripted, answers and interactions to each student participating in a HFS in which standardised patients are used (Clark, 2014). Participants viewed standardized patients or human patient analogues as tools to be chosen that best simulate the fidelity required of a given scenario and the objectives to be covered. Participant 612 conveyed this feeling by explaining that the “closer that you can get to real life by using actors, by using robotics, by using IT, by using mannequins…then the better learning experience the student’s going to have.”
Participants felt that the use of human patient simulation technology in HFS is more appropriate when humans would be harmed through the course of patient management. Participant 571 captured this thinking in the statement that “mannequin[s] can be used if it's something that we can't realistically simulate, because obviously you can't kill somebody” because there are skills applied that would harm a standardized patient. Participant 851 provided a practical example explaining that “[in] cardiac arrest, we use SimMan® so [students] could actually use electricity” with defibrillation, which when appropriate, is a standard treatment in the management of cardiac arrest. Conversely, standardized patients bring a human interaction element impossible to replace with human patient simulation such as interactions with patients suffering a psychiatric crisis. Participant 842 pointed out that “human interaction is a huge part of the job we do in paramedicine,” and therefore is imperative to utilize in HFS.

**Paramedic students should be given the opportunity to learn material and practice skills prior to partaking in HFS exercises which cover high level integration objectives.**

Participants believed that it is imperative to give students the opportunity to gain competence and confidences before they are exposed to the HFS. Participant 571 stated, “I would like to do almost everything as realistic as possible except for the very first time that a student ever tries a skill. I believe in the first time being very, very safe and then stepping it up as you go along through skill progression.” Students should be given the chance to become comfortable in individual skills and competencies and be exposed to increasingly complex simulations in order to improve their management abilities. Participant 660 pointed out that “you can build on it [HSF] and give them [students] a gradual chance to do it in stages that you can’t do with real life”.
Participants indicated that HFS should be reserved to cover those objectives, which incorporate multiple domains of learning. Objectives that integrate knowledge, skill and the ability to demonstrate critical thinking and that incorporate cognitive, psychomotor and affective domains of learning are suitable for HFS. An example of such an objective is found in the Clinical Skills Development I course, and identifies that learners will “utilize differential diagnosis skills, decision-making skills and psychomotor skills to provide care to patients with conditions involving the neurological system, for all patient groups” (CNA-Q, 2014b).

Participant 571 pointed out that with “some higher level objectives, the only way you're going to reach them, is through high fidelity simulation.” Participant 612 believed that objectives selected for HFS should evaluate “the students ability to adapt, interact, overcome problems, problem solving...[and] critical thinking.” Participant 571 reinforced this thought, pointing out that HFS is “where the real learning begins...[to be] able to equally assess the situation, identify the problem, [and] find a solution to overcome the problem.”

**Benefits of using HFS.** Participants perceived a link between the use of HFS and patient safety. Participant 712 pointed out that HFS is a safe place for students to practice and make mistakes, stating that “it's better than...students messing up on their drug calculations. It's better to do that on the SimMan than it is to do it on their work term or preceptorship. [Students] can make their mistakes and figure out how they made their mistakes by the recordings or by the monitoring capabilities of SimMan 3G® instead of making the error on a live patient.”

Participants also believed that students benefit from the use of HFS by increasing confidence in their own abilities. Participant 605 stated, “It's critical to be able to allow the student to perform invasive skills in a safe environment to give them the competency and confidence to perform that in a field setting in a live situation.” Participant 605 indicated this
increased student confidence is enhanced when ORPPE is incorporated into the HFS exercises and stated, “I believe high fidelity simulations will encourage those things [competence] to be developed within a student much better than a standard lab where you go in and intubate the head and no one is yelling at you and no patients are screaming and nothing else is happening around you. So I think in that regards, it's prepared them more for the environment and more for the interactions that they're going to have with patients, with others, with family.”

Participants believed that a paramedic instructor’s confidence increases in a student’s ability to transition from laboratory to clinical, through the use of HFS, which incorporates ORPPE. This thinking was articulated by participant 842 who stated that “if [HFS] is exactly identical to real life, then if he [student] does well here we know he will do well in real life. The closer we can get to that, the more confident we are of his performance in real life.”

**Barriers to the use of HFS.** Participants felt that there are several challenges to overcome in the use of HFS within the ACP program. These challenges include time constraints; participants feel that there is a lot of information to cover and a short amount of time during the course of a semester. Participant 571 stressed, “t takes a significant amount of time from an instructor's perspective to set it up and consider all the parameters...There’s the equipment...the time it's going to take to debrief... [we] have courses that have so many objectives that you're really confined by time.”

Participants felt that human patient simulator technology cannot completely mimic real patients. They argued that interaction with patients is a large component of paramedic practice and that there still exists a limitation in this interaction with human patient simulation technology. Participant 842 pointed out that “despite how far they’ve come there are still restrictions in the technology available to simulate human interaction...and human interaction is a
huge part of the job we do in paramedicine...I don’t care how good SimMan 3G® is, it’s still not the same as a talking, breathing, living patient, and it’ll be a while before that changes. So I would consider that a limitation.”

Further challenges to use of HFS include the lack of knowledge related to development and delivery of HFS, as well as the technology involved in recording and debriefing HFS. Several participants felt that they lacked the knowledge, comfort level and confidence to adequately use HFS in the laboratory. Participant 660 captured this sentiment in the frank statement, “You don't know, what you don't know,” referring to their limited knowledge of HFS. There was a general willingness to of participants to participate in training and increase their knowledge of HFS.

**Participant’s perceptions of strategies to overcome challenges.** Participants identified several initiatives to assist them in overcoming the challenges previously identified. They indicated that paramedic instructors should receive training in the development and use of HFS. Participant 245 indicated that they would like training and stated that “there needs to be training for the person who's going to run simulations...you have to know...[SimMan®] inside and out or else there's really not a huge benefit to the student.” Participant 571 echoed this desire for training stating, “I want to take the individual training before I actually have to go ahead and step in front of a group of students and try to pull one [HFS] off.”

Participants felt that it would be beneficial to have a standard approach to HFS. They suggested this standard approach could guide the use of HFS across the program and create consistency. The standards should include guidelines on the creation, implementation, and debriefing and evaluation of HFS. Evaluation of scenarios should include standardized rubrics and a standardized process of debriefing HFS. Participant 605 suggested the creation of a
“template or format for everyone creating a scenario in the same manner.” Participant 712 recommended having “proper rubrics for your evaluations [of] high fidelity simulation in order to properly assess” student success and to create consistency and fairness. There was also a recommendation to create a scenario bank that could be searched by competency or objective. Participant 605 envisioned “a scenario book, imagining a binder, or SharePoint [organizations intranet] site with a bunch of folders. Now that I can say I’m looking for a couple of difficult airway scenarios...if I have those key parameters I’d be able to pull from a database, a resource of created scenarios, and I know those competencies are specifically evaluated” using the selected HFS exercise.

Participants believed that it would be worthwhile to create a position for an expert technician proficient in setting up and implementing the technical aspect of HFS. This would allow paramedic instructors time to concentrate on evaluating student performance during the simulation exercise. Participant 612 indicated the benefit of such a person: he would like to see “an individual that is a simulation technologist…responsible for all equipment, for the maintenance of all the equipment, for the technology that’s involved, to make sure it’s running” prior to the start of HFS exercises.

**Demographics.** Demographic information was collected during this research study through the use of a survey. This data was analyzed into simple charts and graphs in order to provide the reader a better understanding of participants’ backgrounds. This data is provided to enrich the context of the case study and provide the reader with sufficient detail to draw comparisons.
Due to the sample size and lack of generalizability, findings from the demographic survey were not analyzed further, and no attempt was made to subdivide the participants by their perceptions and beliefs.

The mean average age of the participant group was 43 years of age, with a low of 25 years of age and high of 52 years of age. There was an equal split between male and female participants. Of the eight participants, seven are Canadian citizens while one is an American citizen. All eight participants had post-secondary education (See Figure 2.)

Given the anticipated broad range of backgrounds and credentialing bodies with which participants may have been affiliated, participants were asked to identify their clinical practice level. The results were compared to the CPA, NOCP scope of practice and participants were divided into Primary Care Paramedic or Advanced Care Paramedic. Of the eight participants, six identified themselves with a credential that mapped to a minimum of the ACP level in the NOCP. Of the remaining two participants, one participant identified himself or herself as maintaining PCP registration, while one identified a credential that would be consistent with Emergency Medical Responder level of practice.

The number of years of experience in EMS, working at current paramedic practice level and teaching was analysed (see Figure 3.). Participants have a mean average experience of 19 years in the EMS industry, with a high data point of 32 years of experience and a low data point of five years’ experience. The mean average experience as paramedic instructors was 11 years, with the highest being 20 years’ experience and the lowest being three years’ experience. The mean average years using HFS in the delivery of paramedic education is five years experience, with a high of 11 years’ experience and low with less than one-year experience.
Artifacts. For the purpose of this research study, a description of relevant artifacts in the form of equipment available to paramedic instructors is being included in order to provide contextual relevance for the reader. This list of equipment and their specifications provide insight into the capability of participant instructors to deliver HSF within the ACP program as they have described it during interviews.

Where applicable, the equipment descriptions include product capabilities relevant to the delivery of HFS. The descriptions are not meant to be exhaustive nor are they meant to endorse any specific product.

SimMan®. SimMan® is a product produced by Laerdal Medical and is a human patient simulation (Figure 4). The mannequin is capable of simulating several vital physiological parameters. These parameters include radial, carotid and femoral pulses as well as respiration with chest wall movement and breath sounds. The airway is anatomically correct and is capable of being manipulated to simulate a difficult airway; this is achieved through pneumatic bladders in the simulated airway. The cardiac system can generate electrocardiograms and can be treated electrically with defibrillation using an external monitor/defibrillator such as a LifePak 15. In conjunction with its touch screen monitor, students are able to monitor a full array of invasive and non-invasive physiological parameters such as non-invasive blood pressure, end tidal carbon dioxide, oxygen saturation and transduced hemodynamics such as arterial, pulmonary artery and central venous pressures (Figure 5.).

Treatments can be performed on the mannequin such as needle thoracotomy, intravenous (IV) catheterization, endotracheal intubation and surgical cricothyrotomy.

Physiological parameters can be adjusted through software and a laptop computer (figure 5.). SimMan® can also be pre-programmed to respond to simulated treatment during HFS. The
software is also capable of capturing video and audio via a webcam with built in microphone. This advanced software and interface between mannequin, student monitor and instructor laptop allows HFS to be run without instructors present (Laerdal, 2006).

**SimMan 3G®.** SimMan 3G® is a wireless mannequin that has all of the original functions of SimMan with increased capability over the original SimMan® wired counterpart. SimMan 3G® has significantly increased capability of simulating human physiology. This increase functionality includes portability, the ability to manipulate airway parameters to the point that it is impossible to intubate the mannequin. SimMan 3G® can now generate urine output, and can have haemorrhaging blood loss with the addition of internal storage containers. Additionally, the mannequin has pupils that can sense and respond to light. Tubing in the mannequin’s forehead and around its eyes simulates diaphoresis (sweating) and tearing. A blue light under its lips generates an appearance of cyanosis, a condition of low oxygen in the blood. SimMan 3G® is now also capable of accurately monitoring the volumes of fluids being injected into its IV catheter, and in conjunction with radio frequency tags attached to syringes it is possible to accurately capture the volumes of medication being injected. This information can be correlated with the medication radio frequency tag attached to a syringe, which then can be used to ensure students have utilized correct medication and dose, and that the mannequin accurately demonstrates the appropriate physiological response (Laerdal, 2013).

**Ruth Lee general purpose training dummies.** The Ruth Lee extrication Mannequin could be considered a low fidelity simulation mannequin, because it does not have the capacity to simulate any physiological parameters. However, such mannequins “have anatomically correct weight distribution and the uncanny ‘feel’ of an unconscious patient. Tough enough to be buried under a concrete slab, have steel lintels, trees or motor vehicles laid upon them, they can
present realistic scenarios for rescuers (Figure 7.) (Ruth Lee Ltd. 2013, p. 3). The paramedic laboratory contains a 70 kilogram adult model as well as a 20 kilogram child model.

**Tuff Kelly®.** Tuff Kelly is a “durable extrication and rescue training system” (Laerdal 2010, p. 6). The weight of this low fidelity mannequin is adjusted with lead shot stored in the chest cavity. It is made of hard, durable plastic making its limbs stiff with a limited range of motion. It also has an eyehook on the top of its head to facilitate positioning in confined spaces. It is not capable of simulating physiological parameters such as pulse or respirations (Laerdal, 2010).

**Noelle S550 maternal and neonatal simulation system.** Noelle birthing mannequin can simulate the birthing process (Figure 8.). The mannequin has an automatic mechanical birthing system, generates infant fetal heart sounds and can simulate serious complication during delivery such as shoulder dystocia. Adjustment to the mannequin requires the presence of an instructor during the simulation due to its wired control unit (Gaumard Scientific Company, 2006).

**Child crisis manikin.** The Child Crisis Manikin is a child size mannequin (Figure 9.); it can be intubated and ventilated using a Bag Valve Mask (BVM). Intraosseous (IO) and IV catheterisation can be performed. A radial pulse and blood pressure is simulated with the use of an attachable blood pressure simulator. The mannequin can be defibrillated and with the use of an external cardiac rhythm generator, an electrocardiogram can be assessed using a cardiac monitor. An instructor is required to be present to adjust all physiological parameters due to its limited wired electronics (Nesco, 1996).

**Infant crisis manikin.** The Infant Crisis Manikin is an infant sized mannequin which can be intubated and ventilated with a BVM, IV’s, IO’s and the umbilical vein can be catheterized on this mannequin. The brachial pulse is simulated manually with a bulb pump and
Electrocardiograms can be simulated with an external cardiac rhythm generator. As with the Child Crisis Manikin, an instructor is required to be present to adjust settings during simulation exercises (Nesco, 1999).

**iSimulate.** This product is a simulated monitor/defibrillator that utilizes two iPads™ to simulate the functions of a cardiac monitor capable of delivering simulated defibrillator without the hazards of live energy (Clark, 2014). The product bridges the gap between the ability of the human patient simulation to adjust to physiologic parameters during patient treatment, and the increased realism of patient interaction seen in standardized patients. Clark (2014), in a case study on the use of iSimulate, pointed out that this product replaces the need for expensive human patient simulation mannequins at a fraction of the cost to purchase, operate and maintain.

**Scotia medical observation and training system (smots™) mobile trolley.** The smots™ mobile trolley is a platform used to record HFS scenarios. Data from video cameras, microphones and student monitors are recorded. More than one video camera can be linked allowing for the recording of multiple perspectives. The smots™ mobile trolley also incorporates software that allows instructors to play back HFS scenarios to facilitate the debriefing process and allow students to see their own actions. The trolley is designed to be lightweight and easy to move and position. The configuration has wireless capability allowing it to follow the course of an HFS from the location of first patient contact through patient management and transport. Instructors can remotely adjust the camera direction, angle, and zoom setting. The smots™ mobile trolley has the optional three-foot removable extension bar, which allows the unit to be placed behind obstructions, to peek over walls and around corners, which makes it less intrusive during HFS exercises (Scotia Medical Observation and Training System [smots™], 2011).
The smots™ mobile trolley is compatible with the SimMan student monitors as well as the iSimulate student device. This compatibility allows playback of the physiological parameters displayed to students during debriefing sessions in synchronized time with the actions they were carrying out during patient management (figure 10.) (smots™, 2011).

**Moulage kits.** Moulage kits contain make-up and prosthetic replicas of traumatic injuries. Instructors can apply make-up to standardized patients to simulate the look of illness or injury. Once make-up is applied it remains relatively constant throughout the duration of HFS exercises. The kits are assessable and the contents well used.

**Paramedic laboratory.** The paramedic laboratory has several wide-open spaces and areas configured to mimic settings that are commonly encountered during ambulance calls, such as bathrooms (Figure 11.) and bedrooms (Figure 12.) The paramedic laboratory also has a dedicated area that mimics the clinical setting of an emergency room or doctor’s office as well as an ambulance patient compartment with lighting, suction and oxygen source (figure 13). The front of the laboratory is configured as a classroom with an overhead projector and a large screen projection television. Both projection devices have audio visual input panels, however are currently not set up for displaying information from the smots™ mobile trolley or the audio/visual recordings from the Laerdal SimMan® software. The paramedic laboratory has two large windows and an open floor plan allowing the paramedic laboratory to be bright with a spacious feel (Figure 14.).

**Ambulance equipment.** Within the paramedic laboratory is a storeroom with several pieces of ambulance equipment available for use during HFS. This equipment includes different models and brands of monitor/defibrillators such as the Physio Control LifePak 12 and Lifepak
15 as well as the Zoll M Series. These devices match local industry standards that paramedic students are likely to encounter in clinical practice.

Equipment bags commonly known in emergency services as jump kits, closely match what can be found in use with the national ambulance service. Airway equipment, mechanical ventilators, intraosseous drills, immobilization boards and stretchers also closely match what can be found in use at the national ambulance service. In general, there are no gaps in the equipment one would expect to encounter in a modern ambulance service.

Consumables such as syringes, needles, IV catheters, endotracheal tubes and oxygen masks are replaced through the central storage room. Attempts are made to ensure the specific brands of consumable products closely match local industry standards.

Analysis of artifacts. It is evident from the collection and interpretation of the artifacts that the paramedic program places importance on the ability to mimic real life. There are a number of mannequins that are capable of mimicking human physiology and the physiologic response to treatment. There are also mannequins that mimic the human body in terms of weight and limb movement, as well as equipment that can optimize the use of actors and standardized patients.

In examining the relevant accessibility of the equipment available, I concluded that the paramedic instructors place a high value on equipment that mimic real life as closely and accurately as currently possible. Mannequins that poorly mimic real life were stored under the ambulance chassis (Figure 15.). This equipment consists of mannequins with stiff limbs and an eyehook in their heads; their placement suggests that they are rarely used. That conclusion, though speculative, is interesting.
It was also evident that paramedic instructors attempt to replicate the configuration of equipment that can be found in an average ambulance service. The ambulance kits are stocked and stored together, readily available for simulation exercises.

The paramedic laboratory is configured with areas mimicking real life settings and stairs have been added to the bedroom area that acts as a transport encumbrance during simulation exercises (See Figure 12.).

**Researcher Bias Disclosure**

I am a member of the paramedic faculty and was involved in the ACP program development and research involving incorporation of HFS in the new ACP program. I acknowledge that participants may, therefore, have altered their responses feeling I was examining them rather than inquiring about their experiences. During two interviews, for example, the participants began answering questions in tones and inflections consistent with answering knowledge-based questions. In these cases, I reiterated the intent of the interview, which was to gain insight into the thoughts and beliefs of the participants, and assured each person that the interview in no way was an assessment of knowledge. This issue was recognized as a potential challenge prior to the commencement of the study; however, I felt that the semi-structured interview approach required an interviewer familiar with HFS and paramedic education who could recognize the need to clarify responses and further explore unanticipated thoughts and ideas.
Chapter Five

Discussion

This research began with the question, how will the use of HFS in a North American paramedic curriculum contribute to a high quality teaching and learning? The aim of the research study was to explore and better understand what paramedic instructors at CNA-Q perceived to be the benefits to the use of HFS in the ACP program at the beginning of its delivery. The research study also aimed at identifying barriers and challenges to the use of HFS in the delivery of a paramedic program, and at conceptualizing initiatives that can support the overcoming those barriers and challenges. Finally, the research study sought to identify perceived differences in the use of HFS in paramedic education compared to other allied health disciplines.

Through case study methodology, the use of semi-structured interviews, a demographic survey and analysis of artifacts, I have reached several conclusions in answering the preceding questions.

In this section, a summary of the themes that emerged during the analysis of the semi-structured interview and findings from the collection and analysis of the artifacts as they relate to each research question will be examined.

What do paramedic instructors perceive to be the benefit of using HFS in the delivery of paramedic education? Participants felt that there were several benefits to the use of HFS in the delivery of paramedic education at CNA-Q. First among these benefits was patient safety. Participants felt that HFS enhances patient safety during the clinical component of paramedic education. This perception is not supported in current literature on the use of HFS. Peate (2011), indicates that “there is little evidence available to confirm assumptions” (p. 429) that improvement through the use of HFS translates into improved patient outcomes. The author
goes on to suggest that despite this lack of evidence that improved patient outcomes remains the goal of HFS.

Participants felt that the use of HFS increases student confidence. When given the opportunity to practice HFS in safe environments, students could make mistakes and learn from their errors building confidence in their ability to safely and effectively manage patients and complex situations in the real world.

Participants also conveyed the belief that HFS allows an instructor to better evaluate a student's competence in integrating classroom and laboratory knowledge into the management of patients in environments such as the clinical sitting. This opportunity to evaluate translates into an instructor's increased confidence in a student’s ability to make critical decisions during the clinical components of their education.

**What do paramedic instructors perceive to be the barriers and challenges in the use of HFS in the delivery of paramedic education?** Several barriers and challenges were identified in both the analysis of semi-structured interviews and the collection and analysis of artifacts.

Concerns regarding time for development delivery and debriefing of HFS, was identified as the number one theme emerging from the analysis of the semi-structured interview. Participants felt that during a busy semester they have a challenge finding an adequate amount of time to prepare, set up, deliver and debrief HFS scenarios for all paramedic students.

Participants identified a lack of knowledge as being a substantial barrier to the use of HFS in the ACP program. Participants conveyed a concern that they felt unprepared to effectively prepare, and conduct HFS in regards to the set up of the technical aspects of the mannequin. Participant 674, who stated an unwillingness to utilise HFS until he/she was trained
in its use highlighted this concern. Although this concern for staff development and training in HFS was a common theme, all participants did not echo it. Some felt prepared and excited at the prospect of gaining further experience in all aspects of HFS.

Mannequin fidelity was also identified as a barrier to the use of HFS. Participants pointed out that although the human patient simulation technology has progressed dramatically, human patient simulation mannequins do not replace real patients. There was a concern that this lack of fidelity hindered the effective use of HFS in paramedic education.

**How does the use of HFS in paramedic education differ from other allied health disciplines.** Participants indicated that the approach, conduct and debriefing of HFS scenarios in paramedic education is conceptually no different than in other allied health disciplines. However participants identified one parameter of HFS in paramedic education as being quite different than other allied health education programs. This difference has been classified as the operational realities of the paramedic practice environment or ORPPE, including factors such as lighting, noise, temperature, safety, multi-faceted communication, patent access and movement.

**Conclusions**

The paramedic instructors of the ACP program at CNA-Q appear well equipped, well prepared and are an extraordinary resource for the development of HFS within the ACP program. If the investment in equipment is a gauge of the willingness for leadership to support the ACP program, it is reasonable to posit that there is willingness to support the department in the area of training, guidelines and processes for the use of HFS within the program.

It will take a team approach to realize the thoughts, perceptions and beliefs of participants surrounding the use of HFS in the ACP program. CNA-Q has a framework in place for developing programs and building teams within the organization. The college is in the process
of understanding and implementing the Excellence in Higher Education (EHE) model. The SHS volunteered to pilot the EHE process and has already embarked on the first stages of the model (I, O’Brien, Personal Communication, September 18, 2013).

In the “Excellence in higher education guide: an integrated approach to assessment, planning, and improvement in colleges and universities,” Ruben (2010) says that EHE is designed to help address many of the challenges confronting higher education—particularly those over which we can exercise some direct influence. The goal of this publication is to offer…a comprehensive guide to the process of review, planning and continuous improvement. (p. 9)

The EHE framework is appropriate for use by all levels of the organization, including program faculty (Ruben, 2010, p.13). Following this framework would allow the ACP instructional team to gather together with the common purpose of developing goals for the development, delivery and debriefing of HFS within the program to create and deliver a world-class experience for students. Furthermore, the process encourages the development of a shared vision: in this case, building a common approach to HFS within the ACP program as mandated in the program curriculum. The EHE process also encourages a collaborative approach, which focuses on mission-critical areas within the team as well as developing an action plan and evaluation of progress (Ruben, 2010).

The excellence in higher education framework consists of a number of questions organized into seven categories, each of which is considered to be a vital component for organization excellence (1) leadership, (2) purposes and plans, (3) beneficiaries and constituencies, (4) programs and services, (5) faculty/staff and workplace, (6) assessment and information use, (7) outcomes and achievements. the questions guide
users through an assessment of each area of organizational performance, and collectively, the answers provide a broad assessment of the strengths and potential areas for improvement. (College of the North Atlantic – Qatar Institutional Research and Planning Department, 2013)

Following a process will facilitate the ACP instructional team to identify the assets available to the program in terms of equipment and instructor expertise. The process will also highlight those resources the program requires to achieve its HFS goals in a prioritized format, which can assist the SHS leadership in decision-making in the area of program support and funding (Rubin, 2010).

**Future Research**

Halliwell, Ryan and Jones (2012) discuss logistical competence in the study “Designing prehospital medical simulation scenarios.” Logistical competence includes such factors as patient and equipment positioning, as well as physiological considerations of patient movement. Halliwell et al. (2012) recommend spending a few minutes reviewing logistics with the students prior to them entering any given training scenario; with a discussion between them and the tutor about all logistical issues before the actual scenario begins using a simple question: can you envisage any logistical problems with this scene? (para. 39).

Halliwell et al. caution “that logistical issues are often used in scenarios to create difficulty, but this can detract from the actual ability of the student to perform the skills that the scenario was actually set up to review” (2012, para. 38). However, participants in this research study felt that it was imperative to include elements of ORPPE into HFS within paramedic education. The theory of ORPPE is not well understood, and as evidenced in the aforementioned
study, there is an argument against the inclusion of logistical issues into HFS. More research is required to understand if it is appropriate to include ORPPE into HFS and, if so, how best to integrate these parameters. Additional research is also required to define the parameters of ORPPE only a few potential parameters were mentioned in this research study.

Culture was not examined in this research study. The case study was focused on the thoughts and perceptions of the paramedic instructors at the onset of the ACP program at CNA-Q. Canadians make up the majority of the paramedic instructors teaching the ACP program; this can be viewed as a single culture. The ACP program is new and students have not yet been exposed to HFS during the delivery of the program, and therefore the student work culture is not yet evident. As the program begins delivering HFS to students, a study focused on delivering paramedic HFS in a multi-cultural student group at a Canadian college in the Middle East would be enlightening. CNA-Q prides itself in educating students from 20 nations (Global Village 2014, 2014). A study examining multi-cultural student responses and performance in HFS would provide insight for those attempting to encourage a diverse paramedic workforce. Emergency services have long been attempting to develop diverse teams that are more representative of the communities that they serve (Avsec, 2013). The ACP program represents an excellent opportunity to better understand how HFS might be best introduced to a broad range of students from diverse cultures and backgrounds. Findings from such a study would be useful to paramedic programs around the globe.

Although not featured as a source of data in this case study, I found it interesting to discover the possible link between where HFS equipment is stored and the level of fidelity that equipment represents. Research is required to better understand this potential phenomenon.
Closing Reflection

Regardless of the rational for mandating the use of HFS in the ACP program at CNA-Q, HFS is a trend in the delivery of paramedic education that seems to be here to stay (Alinier, 2012). Lessons can be learned from other medical education disciplines that have a longer history with the use of HFS; however, more research is required to better understand HFS and what role ORPPE will play in enhancing the educational experience for paramedic students and to better prepare them for the challenges they will face outside of the learning environment in a clinical setting.
References


Terms of Reference. (2010). School of health science emergency medical sciences program advisory committee. Doha, Qatar: College of the North Atlantic-Qatar.


Figure 1. Mind map of the concept creation of operational realities of the paramedic practice environment (ORPPE) including elements described by participants.
Figure 2. Educational background of participant paramedic instructors.

Figure 3. Column display of participant response to work history provided for demographic comparisons.
Figure 4. SimMan® lying in hospital bed in the mock clinical setting within the paramedic laboratory.

Figure 5. Student touch screen monitor displaying a variety of physiological data.
**Figure 6.** Laptop screen with instructor/SimMan® interface and control, allowing for the manipulation of physiologic parameters as well as detection of student treatment and assessment.

**Figure 7.** Ruth Lee general purpose training dummy demonstrating the mannequins ability to simulate body positioning of an unresponsive patient in this case in a wheelchair.
Figure 8. Noelle birthing mannequin with wired control unit.

Figure 9. Child crisis mannequin with vital sign and electrocardiogram simulator.
Figure 10. smots™ laptop screen demonstrating the ability to capture synchronised data from a student monitor and camera for later playback during debriefing.

Figure 11. Mock bathroom in the paramedic laboratory with movable plumbing allowing for adaptation in the bathroom configuration.
Figure 12. Mock bedroom in the paramedic laboratory, note the raised flooring with stairs in the bottom right corner of the photograph.

Figure 13. Ambulance patient compartment.
Figure 14. Paramedic laboratory blueprint, demonstrating the open spaces and options for multiple configurations. Adapted from Paramedic laboratory blueprint, College of the North Atlantic-Qatar, Doha, Qatar: Copyright n.d. by College of the North Atlantic-Qatar. Adapted with permission.
Figure 15. Low fidelity simulation mannequin being stored underneath the ambulance patient compartment.
Appendix A

College of the North Atlantic-Qatar

Informed Consent Form

Study Name: Paramedic Faculty Perceptions of High Fidelity Simulation: A Case Study

Researchers: Jonathan Jaekel Mobile: [REDACTED] Email: [REDACTED]

Purpose of Research: By conducting this research, I hope to gain a better understanding of your thoughts and feelings in regard to the new Advanced Care Paramedic program, particularly where it applies to the use of high fidelity simulation.

What you will be asked to do in the Research: Complete a demographic survey followed by an in-depth interview, it is anticipated the process should require no more than one hour.

Risks and Discomforts: We do not foresee any risks or discomfort from your participation in the research.

Benefits of the Research and Benefits to You: possible benefits of this research include improved understanding of the benefits of high fidelity simulation in paramedic education, increased awareness of the challenges to the use of high fidelity simulation, and potential solutions to any identified challenges.

This research is in partial completion of a Master of Arts in Interdisciplinary Studies at Royal Roads University, Canada

Voluntary Participation: Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the nature of our professional relationship or your relationship with College of the North Atlantic-Qatar either now, or in the future.

You will be given the opportunity to review the transcription to ensure that it accurately captures your thoughts and feelings prior to completion of the study.

With your permission our conversation will be recorded, if you do not consent to audio recording, alternate data collection will include note taking during the interview, and consequently I may request additional time to complete the interview process.

Withdrawal from the Study: You can stop participating in the study at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, the College of the North Atlantic-Qatar. If you do withdraw now or at any point after the interview, all data including notes, transcriptions, and recordings will be destroyed.
Confidentiality: All information you supply during the research will be held in confidence, your name will not appear in any report or publication of the research. Your recording and transcription will be assigned a randomized number; any quotation used in the study will be identified using your assigned number. All hard data including notes will be locked in my work filing cabinet, and your voice recordings will be transferred to my secure office computer which is protected by our IT department, a second copy will be securely kept on my personal laptop, which is password protected. My thesis supervisor, David Halliwell may request to listen to this recording; I may also employ the services of a professional transcriptionist in assisting with the interview transcription. Neither of these individuals will have access to your name; they will only have access to your assigned participant number. Confidentiality will be provided to the fullest extent possible by law.

All interview recordings, transcripts, notes and forms will be kept for three years after the final research findings are submitted to Royal Roads University, and then will be destroyed.

The finding of this research will be provided to participants, Royal Roads University and leadership of the Advanced Care Paramedic program, including the Dean of the School of Health Science.

If you would like a signed copy of this form to keep for your own personal records that can be arranged forthwith.

Questions About the Research?

If you have questions about the research in general or about your role in the study, please feel free to contact Jonathan Jaekel Mobile: [REDACTED] Email: [REDACTED]. This research has been reviewed by the Institutional Review Board, College of the North Atlantic-Qatar and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines and the Supreme Council of Health guidelines for the State of Qatar. If you have any questions about this process, your rights as a participant in the study, or for copies of the results of this study, please contact Dr. Michael Long either by telephone at [REDACTED], or by e-mail [REDACTED]
Legal Rights and Signatures:

I ________________ consent to participate in

Paramedic Faculty Perceptions of High Fidelity Simulation: A Case Study, conducted by Jonathan Jaekel.

I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form.

My signature below indicates my consent.

Participant

Signature ___________________________ Date ___________________________

Principal Investigator

Signature _______ ___________________________ Date ___________________________
Thank you for taking this time to participate in this research study. By conducting this research, I hope to gain a better understanding of your thoughts and feelings in regard to the new Advanced Care Paramedic program, particularly where it applies to the use of high fidelity simulation. I anticipate this interview to last one hour. This research is in partial completion of a Master of Arts in Interdisciplinary Studies at Royal Roads University, Canada.

I do not believe there are any risks associated with this research, possible benefits of this research include improved understanding of the benefits of high fidelity simulation in paramedic education, increased awareness of the challenges to the use of high fidelity simulation, and potential solutions to any identified challenges.

As part of the research I would like you to complete a short demographic survey followed by an in-depth interview.

With your permission our conversation will be recorded and later transcribed. This recorded conversation along with its transcription will remain confidential. For organizational purposes I will assign this interview and subsequent transcript a randomized number, and your identity will be known only to me. I may in the course of completing the research findings use quotes from this interview however you will only be referred to in the case study by your randomly assigned number. All hard data including notes will be locked in my work filing cabinet, and your voice recordings will be transferred to my secure office computer which is protected by our IT department, a second copy will be securely kept on my personal laptop, which is password protected. My thesis supervisor, David Halliwell may request to listen to this recording; I may also employ the services of a professional transcriptionist in assisting with the interview transcription. Neither of these individuals will have access to your name; they will only have access to your assigned participant number.

The recording device used will be overwritten to completely remove interviews from its internal memory after a successful transfer of data to my computer and laptop is complete.

The findings of this research will be made available to all participants including you. It will also be shared with Royal Roads University and the leadership at CNA-Q. The findings
may also be publication in a journal.

If you are uncomfortable answering any question please feel free to skip that question. If at any time during the interview you wish to stop and withdraw from participation in the research please feel free to do so. If you do withdraw now or at any point after the interview, all data including notes, transcriptions, and recordings will be destroyed.

Your participation is completely voluntary. All interview recordings, transcripts and notes will be kept for three years after the final research findings are submitted to Royal Roads University. I intend that this research will take no longer than one year to complete.

If you would like clarification or verification of this research study, please contact David Halliwell who is the thesis advisor for this project. He can be contacted at phone number [redacted] or alternatively contacted via email at [redacted].

By signing this form, you agree that you are over the age of 19 and have read the information contained in this consent form. Your signature states that you are giving your voluntary and informed consent to participate in this research study through completion of the survey and interview process.

☐ I consent to the audio recording of this case study interview.

Note: If you do not consent to audio recording, alternate data collection will include note taking during the interview, consequently I may request additional time to complete the interview process.

☐ I consent to the audio recording being destroyed at the specified time described above.

Name: (Please Print): __________________________________________________

Signed: _______________________________________________________________

Date: ________________________________________________
Appendix C

Email Invitation to Participate

Dear Colleague

I would like to invite you to participate in a research study which is in partial completion of the requirement of Masters of Arts of Interdisciplinary Studies at Royal Roads University.

Your participation is completely voluntary, I am aware that a conflict of interest exists as I am a colleague. In order to mitigate this conflict, I would like to reiterate that this study is voluntary, I am offering no incentives to participate, and I will not be disappointed, nor will I hold it against you either personally or professionally if you decline to participate.

If you would like to participate, I will schedule a one hour block on Outlook for the purpose of having you complete a short survey followed by an in-depth interview on the use of high fidelity simulation in paramedic education.

Kind Regards,

Jonathan Jaekel
Appendix D

Semi-Structured Interview Guide

1. Can you please explain what high fidelity simulation is, in the context of paramedic education, in other words, what would a lay person see if they were to walk in while you were conducting a simulation with students?

2. How do you feel the high fidelity simulation you just described benefits paramedic students?

3. I would like to know if and how the use of high fidelity simulation as you describe it, differs in paramedic education from its use in other allied health education, in other words do paramedic students need something different compared to other health programs, and if so, what is the essence of the difference?

4. How important do you feel human analog technology such as SimMan® is to the use of high fidelity simulation in paramedic education?

5. How do you choose what objectives to assess using high fidelity simulation, and how do you build scenarios to that address those objectives?

6. Can you please tell me what formal or informal training have you received such as seminars or in-services on the development and use of high fidelity simulation?

7. What do you feel are the barriers or challenges to the use of high fidelity simulation in paramedic education?

8. I would love to know what you feel you need in order to help you overcome the barriers or challenges you just described for me.
Appendix E

Demographics Questionnaire

1. What is your age?___________________________________________________

2. What is your gender?_______________________________________________

3. What is your nationality?____________________________________________

4. What is the highest level of education you have completed?
   ____________________________________________________________________

5. What is your current paramedic licensure level?
   ____________________________________________________________________

6. How many years have you worked at your current licensure level? ________

7. How many years have you worked in Emergency Medical Services? ________

8. How many years have you taught in paramedic education? ________________

9. How many years have you utilized high fidelity simulation as a paramedic instructor?
   ____________________________________________________________________