

Analyzing Student Experiences and Career Pathways for Healthcare Student Volunteers Participating in a Disaster Response Drill: A Mixed-Methods Study

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Abstract

The NSF-funded CareDEX Team, in conjunction with a partner Senior Living Community (SLC), University of California Irvine student volunteers, and several local First Responder agencies, conducted a disaster response exercise and experiment. In this study, the participating volunteer students were surveyed regarding their drill experience and the efficacy of that experience related to their chosen career path. A qualitative and quantitative analysis of this questionnaire data is presented. The results of the experiment and coded response data indicate that the participants, overall, viewed the exercise as a positive learning and career experience; specifically, they noted gaining an appreciation for the challenges older adults face with technology use and disaster response.

Introduction

On July 22, 2022, the CareDEX researchers performed a live disaster response exercise at The University of California, Irvine (UCI) with participation from local first responders and a Senior Living Community in Anaheim, California. This drill aimed to test and evaluate a technology called CareDEX in the context of an earthquake-induced fire and evacuation while recording anonymized volunteer health professional student data pertaining to ideas, experiences, and deeper career themes related to the disaster response exercise. At UCI, a mock SLC (Sunnyvale Homes) was deployed on the 2nd floor of the Bren Hall building. Sunnyvale Homes was based upon a partner, real SLC in Anaheim CA where the CareDEX team previously conducted disaster response experiments. Volunteer student participants served as actors and casualties in the drill. This research article provides insight into these students' experience as it relates to future career directions and employment.

Purpose and Methodologies

The purpose of this mixed-methods (triangulation) study is to describe and understand surveyed healthcare professional students' attitudes and experiences in the context of volunteering for a disaster response drill involving older adult residents in a simulated skilled nursing facility. In the quantitative portion of this study, a survey instrument and descriptive design are used. The descriptive statistics and frequencies of healthcare students' experiences will be presented. In the qualitative portion, the emerging themes of healthcare students' attitudes and perspectives will be presented based on open-ended questions included in the survey tool. A phenomenological design is used in the qualitative portion of this study.

Literature Review for Career Pathways in Disaster Response for Healthcare Students***Health-related Disaster Response at SLCs***

Disaster preparedness and recovery in senior living facilities are high-demand practices due to the increasing vulnerabilities of elderly residents during emergencies (Kenary, 2023). With the most frail and medically complex older adult population often residing in senior living facilities, ensuring their safety and well-being during natural disasters, medical emergencies, and other crises is critical. This literature review explores the existing drills and procedures that SLCs practice and the laws and regulations in place to safeguard the residents.

Involving student volunteers and future health professionals in actual disaster drills within senior living communities offers a dual benefit. First, it provides valuable hands-on experience for these aspiring healthcare workers, allowing them to apply this knowledge in real-world scenarios. Second, the presence of skilled individuals during these drills enhances emergency preparedness and recovery strategies within senior living facilities. By practicing these health-related disaster responses, student volunteers and future health professionals gain practical and useful skills, while the SLCs receive expert assistance during these mock situations, ultimately ensuring that during the real disasters, better care and safety for the elderly in the SLC are enhanced significantly.

Having a set of rules and regulations that are in place and used frequently in an SLC is a crucial step toward ensuring the safety of the elderly. For the state of California, "the need for formal emergency preparedness in Residential Care Facilities for the Elderly (RCFEs) was addressed by AB 749, which was signed into law in 2008 and added Section 1569.695 to the California Health and Safety Code" (California Assisted Living Association (n.d.), para 2).

Section 1569.695 states that RCFEs must have an emergency plan that includes evacuation procedures, plans for the community to be self-reliant for at least 72 hours immediately following any emergency disaster, transportation needs, and evacuation procedures to ensure that the facility can communicate with emergency response personnel or can access the information necessary to check the emergency routes to be used at the time of evacuation and relocation. A contact information list that includes emergency response personnel and the responsible party and physician for each resident, a resident medication list for each resident, plus more is also required as stated in Section 1569.695 (FindLaw Staff (n.d.)) Section 87212 of Title 22 regulations, which predates section 1569.695 of the Health and Safety Code, "requires each community to have a disaster and mass casualty plan of action in writing and made readily available" (Cal. Code Regs. tit. 22 § 87212. Section 8721).

As stated in the *State of California - Health and Human Services Agency Department of Social Services*, which became effective on July 1, 2019, Assembly Bill No. 3098 added additional requirements for emergency and disaster preparedness in RCFEs and licensed RCFEs operating as Continuing Care Retirement Communities (CCRCs). These requirements include that the licensees must “provide training on the emergency and disaster plan to all staff upon hire and annually thereafter and this training must include the staff responsibilities during an emergency or disaster” (Dickfoss, 2018, p.1)). The law also required that the licensees must conduct a drill at least quarterly for each shift. The term “drill” is defined as “a type of operations-based exercise that is a coordinated, supervised activity usually employed to test a single specific operation or function in a single agency. (FEMA Glossary. (n.d.), para. 47). Drills are commonly used because they promote emergency preparedness, ensure residents' safety, and enable staff to practice and refine their response procedures during critical situations.

In this study, the researchers sought to conduct a trial drill of an SLC deploying student volunteers to act as residents from a synthetic resident database. The aims were 1) to help create a scenario-driven disaster drill toolkit for SLCs; 2) to test the CareDEX platform in a drill involving first responders interfacing with the platform in a simulated disaster; and 3) to engage health professional students to act as SLC residents from the synthetic resident database, so students would use this drill as a unique learning opportunity in older adult disaster preparedness and resilience.

Employment Possibilities for Disaster Response

According to the U.S. Bureau of Labor Statistics (2018) disaster relief work can be split into four phases, (1) preparedness, (2) response, (3) recovery, and (4) mitigation (Torpey, 2018). Each of these four phases works together to create emergency management agencies' primary responsibility of providing disaster relief within a community. Looking to the second category of response, occupations like Emergency Medical Technician, Paramedic, Firefighter, Medical Assistant, and Registered Nurse are possibilities for employment.

Emergency Medical Technicians (EMTs) and Paramedics are typically responsible for providing medical assistance and transport to individuals in need in the field (U.S Bureau of Labor Statistics, 2018). The main difference between these occupations is that paramedics have the ability to provide more pre-hospital care and administer a large range of emergency medications (U.S Bureau of Labor Statistics, 2018). With personal emergencies happening every day, EMTs and Paramedics are valuable occupations that help others in need. According to the U.S. Bureau of Labor Statistics, the overall employment of EMTs and Paramedics is expected to grow by 7% from 2021 to 2031.

Firefighters are responsible for responding to fire-related emergencies and aiding in identifying and evacuating individuals in an emergency situation (U.S Bureau of Labor Statistics, 2019a). When responding to an emergency, Firefighters may be expected to provide medical care to individuals on the scene. The Firefighting occupation is only expected to grow by 4% from 2021 to 2031 (U.S Bureau of Labor Statistics, 2019a).

ER and RN Career Pathways.

Emergency and Trauma Registered Nurses (RNs) assume a critical role in disaster response, delivering specialized medical care and aid to those impacted by emergencies. Their proficiency in managing critical injuries, orchestrating patient care, and collaborating within interdisciplinary teams ensures the efficacy of response and recovery endeavors. With their advanced expertise and clinical importance, these RNs play an indispensable role in stabilizing patients, prioritizing treatment, and upholding seamless healthcare provision amidst high-stress scenarios. Anticipated job growth extends across various healthcare settings, encompassing hospitals and outpatient care centers that offer immediate services, such as chemotherapy, rehabilitation, and surgery (U.S. Bureau of Labor Statistics 2022a). Projections indicate around 203,200 annual openings for registered nurses over the decade, largely driven by replacements for workers transitioning to other fields or exiting the workforce, notably due to retirement (U.S. Bureau of Labor Statistics 2022a).

For pre-medical students specializing in Emergency and Trauma Medicine, engaging in disaster response presents a distinctive avenue to acquire practical experience and profound insights into emergency care (Tortum et al., 2023). Amidst the projected growth of 3 percent in overall employment for physicians and surgeons from 2021 to 2031—a pace relatively slower than the average across all professions (U.S. Bureau of Labor Statistics 2022b)—an estimated 23,800 annual openings are foreseen within this decade (U.S. Bureau of Labor Statistics 2022b). This projection reflects the anticipated need to fill positions due to occupational transitions or workforce exits, including retirements.

Pay and Benefits.

As stated earlier, disaster relief work can be split into four phases, (1) preparedness, (2) response, (3) recovery, and (4) mitigation. Understanding that these four phases must work together to provide and produce the complete responsibility of providing disaster relief within a community, each phase, employment opportunity, pay, and benefits may differ. According to the U.S. Bureau of Labor Statistics (2018), Disaster Relief Emergency Management Directors produce a median annual wage of \$87,400 as reported in 2017. In contrast, Emergency Medical Technicians, or EMT's make a median annual salary of \$36,930 as reported by the U.S. Bureau of Labor Statistics in 2021 (2018). Referencing other disaster relief careers, Medical Assistants earn an annual median salary of \$37,190 while Physicians earn an estimated \$208,000 and Registered Nurses (RNs) are earning \$77,600 (U.S. Bureau of Labor Statistics, 2019b, 2022a, 2022b).

Job Outlook.

Careers in disaster relief and emergency medicine present a unique blend of challenges and rewards, enabling individuals to directly contribute to the well-being and recovery of communities affected by emergencies. According to the U.S. Bureau of Labor Statistics (2018), the employment prospects for healthcare occupations are projected to grow by 13% from 2021 to 2031, generating over 2 million new jobs. In line with this growth, employment opportunities in emergency and other relief services are expected to rise, contributing to a total of 180,600 jobs for individuals to fill (Torpey, 2018).

In the context of the emergency medicine workforce, a study by Holliman et al. (2008) underscores the complexity of estimating attrition and retirement rates among emergency physicians (EPs). Their research demonstrates that the American Board of Emergency Medicine (ABEM) recertification data indicates a range of attrition rates, potentially exerting significant influence on the workforce over time. It is projected that the number of retiring EPs might surpass the number of new graduates, creating a need for a consistent influx of new EM residency graduates to maintain workforce equilibrium (Holliman et al., 2008).

The study by Holliman et al. (2008) concludes by calling for the acquisition of more dependable and comprehensive information concerning the quantity and distribution of EPs, as well as attrition and retirement rates, to enhance workforce forecasting accuracy. Furthermore, the authors suggest that the field of emergency medicine may experience a staffing shortage, even if the number of EDs decreases due to changes in the healthcare system (Holliman et al., 2008). This research emphasizes the necessity of reliable data for making informed decisions about the future of the emergency medicine workforce as well as highlighting the impending shortage of EPs.

Healthcare Students' Experiences in a Disaster Drill

Overview of the Drill Exercise

The premise of the exercise was an earthquake and subsequent fire at an SLC named Sunnyvale Homes. Sunnyvale Homes was modeled upon an existing SLC partner in Anaheim CA. First responders and other parties such as Facility Operations, and Community Emergency Response Team (CERT), were present during the drill. Student participants were required to act as casualties for this drill.

One of the outcomes of this drill was technology testing. The NSF-funded CareDEX technology that provides local and regional situational awareness was tested during this experiment. The data used in this study was acquired through surveying the individual student volunteer participants (i.e., actors in the drill).

Student participant subjects were assembled at the University site at 0900 hours. Subjects were given an IRB briefing, a Study Information Sheet, and informed that they could opt-out of the drill or survey. They were also informed that they could stop participating in the drill at any time; and were free to not answer or skip any portions of the post-drill survey. Those consenting were provided a resident information card based on the synthetic resident database. They were assigned a resident name, medical profile, location in the SLC, role in the drill, and details regarding any injuries or challenges. For example, ten participants were assigned to the Memory Care Unit, with specific conditions (limited hearing, vision, mobility, and speech) and were given roles to perform (anxiety, refusal to leave the unit, confusion). These volunteers were strategically placed throughout Sunnyvale Homes (e.g., dining room, fitness area, Covid isolation) to model typical SLC resident behavior.

Residents from the actual SLC partner in Anaheim were brought to the simulated Emergency Operations Center (EOC) and invited to observe the drill. These participants were surveyed specifically on the CareDEX technology and those results will be published in a future research article. In the EOC, a projector displayed the CareDEX Regional View (Orange County

California and the surrounding area) that provided information on the fire, smoke, and air quality as well as information regarding local mutual-aid facilities such as hospitals and other care facilities. A second projector displayed the local view of the situation which included each floor of the SLC as well as occupancy and resident information (mocked-up, e.g., synthetic data, for privacy preservation but based on a representative sample population of SLCs).

The occupant information at Sunnyvale Homes was based on a Synthetic Resident Database built by the CareDEX team and reviewed by the UCI medical and nursing research team. The partner SLC provided realistic non-identifiable information about the number of visitors, staffing, and residents as well as some general, base-line information for populating the resident table in CareDEX. The CareDEX medical team, based on the drill details, constructed scenarios for the residents grounded on their health challenges and realistic casualty information.

The first part of the Synthetic Resident data included key demographics including age and gender distribution, forming the background for the profiles. Then, health conditions and chronic diseases most commonly found in this population were added (for example, congestive heart failure, oxygen-dependent chronic obstructive pulmonary disease, and dialysis requiring end-stage renal disease). Functional and physical limitations were assigned to the digital residents based on prevalence within this population. Two board-certified geriatricians were consulted and confirmed that realistic medical data was created for each resident based on representative conditions for residents living in the SLC. One geriatrician specializes in SLC-based medical care and was instrumental in this review. COVID-19 prevalence was based on current epidemiologic data for Orange County, and residents were assigned covid-positive or covid-negative status in the database. Random names were generated from a database and then anonymized so as not to have any real personal identification information in the system. From that anonymized starting point, the CareDEX team created casualty cards and assigned them to the student volunteers. The volunteers were then positioned throughout the simulated facility (Sunnyvale Homes), based on the drill scenario.

The Orange County Fire Authority (OCFA) was on hand to run the drill. OCFA provided 1 Engine Company, 1 Truck, and 2 Battalion Chiefs in support of the exercise. The Incident Commander (a Battalion Chief) was brought into the simulated EOC and was provided with all CareDEX situational awareness dashboards. The Chief would radio CareDEX-provided information to the firefighters as the drill progressed.

At the start of the drill, with the volunteers in place, the OCFA first responders deployed. The drill script was an earthquake that precipitated a kitchen fire at Sunnyvale Homes. There were two casualties that required evacuation and the student volunteers were all residents requiring evacuation to the assembly area. The OCFA first knocked down the fire and then evacuated the facility, tending to casualties as required. At the end of the exercise, the various groups were provided separate de-briefings.

Methods

In this section, the authors will discuss the data collection and analysis methodology used in this research study. In the quantitative, descriptive research design portion of this section, the authors will present and discuss the descriptive statistics that resulted from the quantitative

portion of the survey. Then, the qualitative methodology will be described and the results will be presented.

Instrument

The instrument used to survey the students consisted of four quantitative questions on a Likert scale and two qualitative questions that were open-ended and allowed for a free-form written response. The four quantitative questions are presented in this article's Discussion section.

When analyzing the quantitative data, the data was re-coded into discrete, ordinal values. Coding for the above question set is as follows: Great/Strongly Agree = 5, Good/Agree = 4, Neutral/Neutral = 3, Poor/Disagree = 2, Very Poor/Strongly Disagree = 1. This re-coding into a numeric Likert Scale allows for statistical analysis. The authors employed IBM's SPSS software package for this analysis.

For the qualitative analysis, two broad open-ended questions were included on the instrument to elicit participant's experiences and perspectives:

1. Please share any specific lessons that you learned.
2. Provide any additional comments or suggestions.

Ample writing space and time was provided for the open-ended written responses. Authors JR and CP conducted a thematic analysis of the response data. The team based initial themes on the comments and structured open-ended questions, while also recording emergent themes. The research team met to discuss their initial findings and received feedback from the team. Based on the research team's input, they developed a more comprehensive thematic guide, and again reviewed and coded the data to reach consensus on final themes.

Subject Recruitment, Sampling and Sample Set

Student volunteers were recruited through the UCI research team's contacts. The social network of professors and faculty scientists provided enough marketing inertia to bring in sufficient volunteers. The volunteers were asked to serve as casualties during the disaster response exercise. The casualties were given casualty cards that contained their synthetic (i.e., mock) medical information and any injuries they sustained, based on a medically representative synthetic resident database in CareDEX. It is important to note that these volunteers were not directly compensated for their participation, and they had no student, professional or personal relationship with any of the researchers on the CareDEX project. The volunteers were a mixture of graduate and undergraduate health sciences students.

Upon completion of the drill, the students were gathered in a large conference room and given their After Action Review (AAR). Following that discussion, they were given the written Study Information Sheets. The participants were reminded that the surveys were optional, and they could skip any question or stop answering questions at any time. After that, they were provided with a survey instrument and pencils, and given ample time to complete the survey as they wished.

There were 19 total student volunteers and each one provided a completed survey instrument to the research team. These surveys were then anonymized and then, the research team statistically

and qualitatively analyzed the results. The findings from this analysis are provided and described in the next section.

Human Subjects Protection

The human subjects research performed by the CareDEX team is covered under the University of California, Irvine IRB Protocol Number 1005. The research protocol was granted Exempt status (approved: 18 MAR 22) as no personal identification information will be collected or used as part of the CareDEX research.

Results

In this section, the authors will present the results of the data analysis. The authors used the SPSS software package to statistically analyze the data. In general, the results indicate that a Good/Agree (i.e., 4 on the Likert Scale) was the most commonly selected response.

Statistical Analysis

Overall Descriptive Statistics.

The data analysis of the 19 subjects indicates that the overall experience had a central tendency of Good/Agree; that being the most descriptive of the experience (see Tables 1 and 2). The overall Mean of all questions was 4.02. The standard deviations ranged from .964 to .692. There were no missing data values in the entire sample.

Power Analysis.

Descriptive research and statistical analysis of this sort would typically call for a power analysis. Cresswell and Guetterman (2019) define a power analysis as a statistical procedure that determines the appropriate sample size as a subset of the group that is being studied in relation to the desired alpha significance. A power analysis was not performed in this case as the entire population (19 subjects) of the group under study was surveyed.

Table 1

Overall Student Responses

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
OverallExp	19	2	5	4.11	.809
LearnNewInfo	19	3	5	4.05	.780
MorePrepared	19	2	5	3.53	.964
DoMoreDrills	19	3	5	4.42	.692
Valid N (listwise)	19				

Table 2
Overall Student Frequencies

		Statistics			
		OverallExp	LearnNewInfo	MorePrepared	DoMoreDrills
N	Valid	19	19	19	19
	Missing	0	0	0	0
Mean		4.11	4.05	3.53	4.42
Median		4.00	4.00	4.00	5.00
Mode		4	4	4	5
Std. Deviation		.809	.780	.964	.692
Variance		.655	.608	.930	.480
Minimum		2	3	2	3
Maximum		5	5	5	5

Discussion

In this section, the authors will discuss the results of the data analysis. Implications for healthcare student employment will be considered as well.

Overall Experience

The first question on the instrument asked the students to rate their overall experience in participating in the CareDEX drill. The responses were quantified on a five-point Likert scale from Great to Very Poor with Neutral in the middle.

The majority of students responded that their experience was good or great. As indicated in Table 3, 84% of the students fell into that range. Only 1 student reported a Poor experience. This would indicate that participating in a disaster response drill was of value to the healthcare students.

Table 3
Overall Student Experience

		OverallExp			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	5.3	5.3	5.3
	3	2	10.5	10.5	15.8
	4	10	52.6	52.6	68.4
	5	6	31.6	31.6	100.0
	Total	19	100.0	100.0	

Implications for Healthcare Student Employment

Learning New Information

The second question on the instrument pertained to the learning experiences of the healthcare students. The question asked if the students learned new information regarding disaster response and the unique challenges that seniors face in such an event. The responses were quantified on a five-point Likert scale from Strongly Agree to Strongly Disagree with Neutral in the middle.

Within the sampled population of healthcare students, 73% responded that they agreed or strongly agreed that the exercises did provide them with new information on the subject. There were no students selecting Disagree or Strongly Disagree on the survey instrument (see Table 4). The implication is that the drill scenario did provide a learning experience for the participating healthcare students.

Table 4***Learning New Information on Disaster Response and Senior Challenges***

LearnNewInfo					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	5	26.3	26.3	26.3
	4	8	42.1	42.1	68.4
	5	6	31.6	31.6	100.0
	Total	19	100.0	100.0	

More Prepared to Assist Learning New Information

The third question on the instrument asked the healthcare students if they felt more prepared to assist at-risk communities during crisis response events as a result of participating in the CareDEX drill. The responses were quantified on a five-point Likert scale from Strongly Agree to Strongly Disagree with Neutral in the middle.

The results of the survey instrument indicated that over half of the respondents do feel more prepared to assist at-risk communities during an emergency response event. While there were several Neutral answers (approximately 30% of the subjects) there were only 2 Disagree and 0 Strongly Disagree responses (see Table 5). Of all the responses on the instrument, this question appears to have the least amount of impact on the surveyed population. It is not clear, based on this question, if the students feel more prepared in this area.

Table 5***Students Feel more Prepared to Assist At-Risk Communities during a Crisis***

		MorePrepared			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	3	15.8	15.8	15.8
	3	6	31.6	31.6	47.4
	4	7	36.8	36.8	84.2
	5	3	15.8	15.8	100.0
	Total	19	100.0	100.0	

Interest in Further Participating in Future Drills

The final quantitative question on the instrument asked the healthcare students if they would be interested in participating in future drills/exercises with the research team. The responses were quantified on a five-point Likert scale from Strongly Agree to Strongly Disagree with Neutral in the middle.

The results of this question indicate a large interest in future participation among the healthcare student volunteers. Close to 90% of the students Agree or Strongly Agree that they have an interest in participating in future CareDEX drills. For this question, there were no Disagree or Strongly Disagree responses (see Table 6).

Table 6***Students' Interest in Future Drill Participation***

		DoMoreDrills			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	2	10.5	10.5	10.5
	4	7	36.8	36.8	47.4
	5	10	52.6	52.6	100.0
	Total	19	100.0	100.0	

In general, the healthcare student responses to the drill were positive. The healthcare students that participated in the CareDEX disaster response drill appear to receive value for their time and efforts committed to the event. Most students report having a good experience, learning new information, and would participate in future drills with the research team.

Qualitative Data Analysis

In analyzing the qualitative data through comments and remarks provided by the volunteer participants, some consistent themes emerged. Following their participation in the drill, participants were directly asked on the survey tool to provide any insights they gained from the experience and to write down any additional comments or suggestions regarding the drill.

Participants reported that they gained a better understanding that the elderly are disproportionately impacted by natural disasters and their insights clustered into the following themes: difficulties in logistics in evacuating; accessibility and mobility barriers; impact of the chronic health conditions on evacuation and relocation; and challenges for older adults and technology. Participants identified how health factors and disabilities complicate the process of evacuation and disaster preparedness for older adults. These themes are congruent with the statistical analysis and support the statistical results in this study such as learning new information and many students being better prepared to assist the elderly in evacuation and emergency response.

Volunteer participants discussed the way health conditions contributed to older adults' and communities' response during natural disasters. One volunteer noted, "Older communities face a much wider array of challenges due largely to the vast amount of health conditions they face." In their assigned roles as older adults with assigned health challenges, a participant stated: "I learned how people with chronic illnesses (dementia, arthritis, etc.) may have limitations when having to follow directions and being able to safely evacuate during an emergency." The need for health-dependent specific resources for older adults was consistently discussed throughout the data. Several participants described learning the importance of knowing patient information from diagnoses, medications, to required treatments when responding to a disaster. One pre-health volunteer described, "I didn't realize that certain populations wouldn't have access to needed medications in [disaster] situations." Against the backdrop of the COVID-19 Pandemic, one participant astutely identified the problem of "keeping COVID positive and negative residents separate" during evacuations. Participants reported gaining a greater understanding of the importance of accounting and tracking those who are oxygen dependent, and require timely medications or specific treatments, such as dialysis in re-locating individuals.

Many described having had no prior experience with older adults and having gained an awareness of the disabilities and physical limitations found in this population. A volunteer described their surprise in considering how the presence of service animals used by some to manage physical disabilities might impact evacuations. Volunteering as older adults living in an Assisted Living facility, some gained an understanding of the problems of accessibility and how this impacts safety in an evacuation. Participants noted that specific conditions in disasters exacerbated older adults' ability to evacuate, describing how stairs and crowds were difficult for those with mobility limitations; how visibility limitations with fire and smoke would further challenge those with visual impairments; or how loud sounds and directions would challenge those with hearing loss.

Participants specifically highlighted the complications in evacuating those with dementia or other cognitive challenges due to their reduced ability to follow directions and the dangers of wandering in hazardous conditions. Through assuming the role and profile on the Memory Care unit of Sunnyvale Homes, one participant shared an understanding of how "the cognitive incapacities can prohibit the efficiency" of evacuations. Another shared more specific lessons: "I learned that dementia patients have to leave in a group, walk slowly, and wander if left alone, and it might be hard to convince them to leave the room." Having to assume the role of a person with dementia, one participant learned "how overwhelming these sorts of situations are for the elderly, especially if they are dealing with conditions like dementia or hearing loss." One

volunteer recognized the risks of agitation and panic attacks for those with cognitive challenges when routines were disrupted, and stress increased during disaster situations. In sum, the qualitative analysis indicates the student volunteers gained valuable insights into disaster preparedness and resilience for older adults. This triangulates well with the findings from the quantitative analysis.

Another theme in the participants' remarks centered around the adoption and implementation of technology in older adult populations. Some highlighted the limitations in technology use among older adults, and others described the difficulty of older adults having the skills to use available technologies. One volunteer explained, "I'm not sure how realistic using Apple Watches is on elderly" given that older adults struggle with technology. They explained that some older adults may take watches and wearables off during an evacuation and others might be sensitive to having devices on their wrists.

Additional comments on the survey were centralized around the theme of desiring to learn more and to engage in further drill participation, which exemplifies and supports the statistical analysis and results. A participant described the drill as "A fun yet informative drill that should be duplicated in many other places." One enthusiastically remarked, "It was a very awesome experience," and another wished it had been a longer drill. One described learning how older adults are at increased risk during emergencies, and thus, felt "glad I got to participate in a drill to help." Participants expressed their willingness to be involved in further drills as well as other research opportunities involved with CareDEX. Several remarked that they wished to help reduce the high casualty rate of older adults in disasters and to use technology to reduce this disparity. One stated, "I learned that the older community is more at risk in natural disasters, and how there are not many people out there to care for them." In witnessing the paramedics and firefighters in the drill, participants gained an appreciation of "the challenges faced by first responders." These remarks reinforce the outcome of the statistical analysis regarding the students' experiences and desire to participate in future drills (Table 3 and Table 6).

Through participating in a multi-faceted, real-time disaster drill, the volunteer students gained insights into older adults living in Assisted Living facilities and Memory Care Units. They had an immersive experience in physical limitations, chronic medical conditions, and how these factors directly impact older adults during evacuations. Engaging in disaster preparedness and resilience technology design, the volunteers directly faced the need for efforts to reduce the dire outcomes seen across disasters for older adult populations. The research team hopes the drill experience will inspire future health professionals and computer/information scientists to contribute to CareDEX and the urgent need to improve older adults' safety and preparedness during disasters.

Study Limitations

The study was conducted in Southern California using graduate and undergraduate healthcare student volunteers from the University of California, Irvine. The sample size was relatively small and a convenience sample. As such, the statistical generalizability to larger groups, such as engineering majors or students outside of the geographical area is limited. In addition, data was collected from a single disaster drill and the data would be more robust with multiple drills in several sites.

Conclusion

The escalating demand for healthcare professionals paves a promising path toward emergency response occupations, drawing the attention of both students and aspiring workers. With the expanding scope of healthcare needs, specialized training becomes imperative to excel in this field, often involving the pursuit of a bachelor's degree in fields like nursing, public health, and pre-medicine. Within these areas, diverse subcategories await those seeking healthcare-related emergency response roles, spanning from 911 operators who manage critical calls to multifaceted positions like emergency medical technicians and paramedics who provide life-saving aid on the ground.

The field of disaster response medicine offers ample room for skill diversification, allowing individuals to broaden their horizons through cross-training initiatives. These initiatives encompass a spectrum of roles, ranging from managing teams coordinating disaster response protocol to assuming positions of leadership and guidance in allopathic or osteopathic medicine. Amidst this landscape of opportunities, the fusion of healthcare expertise and disaster response unveils a compelling trajectory for future professionals to contribute to a community of safety and well-being as well as meeting the demand for skilled public safety professionals (Bureau of Labor Statistics, 2022) as outlined in the literature review.

Concomitant with disaster response training is the concept of immersive learning through drills and exercises. In this research article, 19 healthcare student volunteers were part of a large-scale emergency response scenario that included an SLC, first responders, and other response professionals. These students served as actors who portrayed residents and casualties during the exercise. The students were surveyed after the exercise on their experience.

The majority of the students felt the experience was a positive experience and that they learned more about the needs of seniors during a crisis event. Most students felt that they were more prepared to assist older adults during a disaster as a result of participating in the drill. They gained an increased interest in geriatric care and awareness of the challenges of caring for complex older adults with chronic diseases and physical limitations. Almost all students expressed a clear desire to participate in more drills with the CareDEX research team.

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References

- California Assisted Living Association. (n.d.). Emergency Preparedness in Assisted Living. https://caassistedliving.org/pdf/resources/NV-Disaster_Preparedness.pdf
- Cal. Code Regs. tit. 22 § 87212. Section 87212 - Emergency Disaster Plan. (n.d.). <https://casetext.com/regulation/california-code-of-regulations/title-22-social-security/division-6-licensing-of-community-care-facilities/chapter-8-residential-care->

- [facilities-for-the-elderly-rcfe/article-4-operating-requirements/section-87212-emergency-disaster-plan](#)
- Creswell, J.W., & Guetterman, T.C. (2019). Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research (6th ed.). Pearson Education.
- Dickfoss, P. (2018, December 13). *Residential care facilities for the elderly: emergency and disaster plans*. 2018 CHAPTERED LEGISLATION AFFECTING RESIDENTIAL CARE FACILITIES FOR THE ELDERLY AND CONTINUING CARE RETIREMENT COMMUNITIES.
- [https://caassistedliving.org/pdf/implementationplans/18implementationplans.pdf](#)
- FEMA Glossary. (n.d.). [https://training.fema.gov/programs/emischool/el361toolkit/glossary.htm](#)
- FindLaw Staff. (n.d.). *California Code, Health and Safety Code - HSC § 1569.695 - findlaw*. California Code, Health and Safety Code - HSC § 1569.695.
- [https://codes.findlaw.com/ca/health-and-safety-code/hsc-sect-1569-695/](#)
- Holliman, C. J., Wuerz, R. C., Hirshberg, A. J., & Task Force, S. W. (2008). Analysis of Factors Affecting U.S. Emergency Physician Workforce Projections. *Academic Emergency Medicine*, 4(7), 731-735. [https://doi.org/10.1111/j.1553-2712.1997.tb03769.](#)
- Kenary, J. (2023). Supporting the Emergency Management Pipeline: How Institutions of Higher Education can Increase the Emergency Management Career Goal for Students to Enhance Disaster Preparedness and Response Globally. *Prehospital and Disaster Medicine*, 38(S1), s153-s153.
- Mansikka, H., Harris, D., & Virtanen, K. (2023). Accuracy and similarity of team situation awareness in simulated air combat. *Aerospace medicine and human performance*, 94(6), 429-436.
- Minnesota Department of Health - Health and Preparedness Program. (2023, February). Long Term Care Preparedness Toolkit.
- [https://www.health.state.mn.us/communities/ep/ltc/baseplan.pdf](#)
- Torpey, E. (2018). *Careers in disaster relief: Career Outlook: U.S. Bureau of Labor Statistics*. Www.bls.gov. [https://www.bls.gov/careeroutlook/2018/article/disaster-relief-careers.htm](#)
- Tortum, F., Bayramoglu, A., Tasci, H. K., & Kasali, K. (2023). Evaluation of the development of emergency response skills of intern doctors after emergency medicine internship: A prospective cross-sectional study. *Journal of Research in Clinical Medicine*, 11(1), 13-13.
- U.S Bureau of Labor Statistics. (2018, April 13). *EMTs and Paramedics: Occupational Outlook Handbook: U.S. Bureau of Labor Statistics*. Bls.gov.
- [https://www.bls.gov/ooh/healthcare/emts-and-paramedics.htm#tab-2](#)
- U.S Bureau of Labor Statistics. (2019a, September 4). *Firefighters: Occupational Outlook Handbook: U.S. Bureau of Labor Statistics*. Bls.gov. [https://www.bls.gov/ooh/protective-service/firefighters.htm#tab-2](#)
- U.S Bureau of Labor Statistics. (2019b, September 4). *Medical Assistants: Occupational Outlook Handbook: : U.S. Bureau of Labor Statistics*. Bls.gov.
- [https://www.bls.gov/ooh/healthcare/medical-assistants.htm#tab-2](#)
- U.S. Bureau of Labor Statistics. (2022a, April 18). *Registered Nurses: Occupational Outlook Handbook: U.S. Bureau of Labor Statistics*. Bls.gov.
- [https://www.bls.gov/ooh/healthcare/registered-nurses.htm](#)

U.S. Bureau of Labor Statistics (2022b, September 8). *Healthcare Occupations: Occupational Outlook Handbook, Physicians and Surgeons*. Bls.gov.
<https://www.bls.gov/ooh/healthcare/physicians-and-surgeons.htm>