Clinical Experience and Learning Style of Flight Nurse and Aeromedical Evacuation Technician Students

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BACKGROUND: The clinical experience and preferred learning style of U.S. Air Force flight nurses and aeromedical evacuation technicians are unknown.

METHODS: Using a cross-sectional survey design, we gathered data regarding the clinical experience, level of comfort providing clinical care, and preferred learning style of 77 active duty (AD), Air Force Reserve (AFR), and Air National Guard (ANG) nurses enrolled in the U.S. Air Force School of Aerospace Medicine Flight Nurse course, and 121 AD, AFR, and ANG medical technicians enrolled in the Aeromedical Evacuation Technician course.

RESULTS: Nurses and medical technicians reported 7.6 $\pm$ 5.5 and 3.9 $\pm$ 4.5 yr of experience, respectively. AD, AFR, and ANG nurses had comparable years of experience: 5.8 $\pm$ 3.2, 8.3 $\pm$ 6.6, and 7.9 $\pm$ 4.2 yr, respectively; however, AD medical technicians had more years of experience (5.6 $\pm$ 4.4 yr) than AFR (3.1 $\pm$ 4.8 yr) and ANG (1.9 $\pm$ 2.8 yr) medical technicians. Both nurses and medical technicians reported infrequently caring for patients with various disease processes and managing equipment or devices that they will routinely encounter when transporting patients as an aeromedical evacuation clinician. Nurses and medical technicians preferred a kinesthetic learning style or a multimodal learning style that included kinesthetic learning. Nearly all (99%) nurses and 97% of medical technicians identified simulation as their preferred teaching method.

DISCUSSION: These findings confirm faculty concerns regarding the clinical experience of flight nurse and aerospace evacuation technician students.

KEYWORDS: Clinical skills, training, patient transport.

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Since September 2001, United States Air Force Flight Nurses (FN) and Aeromedical Evacuation Technicians (AET) have provided comprehensive nursing care while transporting more than 187,000 combat casualties and other patients from numerous countries such as Iraq, Afghanistan, Liberia, Japan, and Guam, located throughout United States Central Command (CENTCOM), Africa Command (AFRICOM), and Pacific Command (PACOM). In addition, patients are transported within the United States. Military medical evacuation capabilities have never been better.[2] Global en route care (ERC) of severely injured casualties has been identified as a military medical revolution.[1] Specific ERC innovations include, but are not limited to, spinal immobilization, epidural analgesia and peripheral nerve blocks, battlefield acupuncture, and physiological monitoring.[10] Deaths during medical evacuation are rare, contributing to the lowest died of wounds rate in history.[7,8]

Military medical clinicians with various skill sets provide ERC during medical evacuation of casualties from the point of injury to aid stations and hospitals near the battlefield. Special Operations Forces may be required to evacuate casualties from austere or kinetic environments. Medical personnel trained in anesthesia and intensive care transport critically ill patients.[14] This system of ERC providers is needed to maximize patient outcomes. The focus of this paper, however, is the FNs and AETs who provide medical care during fixed-wing intertheater strategic aeromedical evacuation of noncritical

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patients on-board military cargo aircraft during flights lasting up to 12 h. These teams consist of two FNs and three AETs with the ability to augment the crews if needed due to patient acuity or anticipated flight duration.

Air Force nurses and medical technicians must successfully complete a rigorous series of Air Force courses before they earn their wings, be awarded the FN or AET Air Force Specialty Code, and qualify for flying duty. The courses include the 4-d Evasion Conduct After Capture Course; the 2-d Water Survival Course; the 20-d FN or AET Course; the 22-d Aeromedical Evacuation Initial Qualification Course, and Aeromedical Evacuation (AE) squadron-specific training.

Over the past 25 yr, the number of inpatient beds at Air Force Medical Treatment Facilities (MTFs) has decreased from 4917 to 579 with an average daily census of 223. Although another 721 inpatient beds are available at joint facilities such as the San Antonio Military Medical Center, Air Force ERC leaders and FN and AET course faculty at the United States Air Force School of Aerospace Medicine (USAFSAM) have perceived a steady decline in the clinical experience of FN and AET students. Faculty have observed that some students lack solid fundamental nursing knowledge and experience, including use of ordinary medical equipment and devices. The trend of limited clinical experience is likely to persist given fewer opportunities for nurses and medical technicians to provide direct acute patient care while deployed and in-garrison due to diminished military inpatient MTF availability and the shift to outpatient care.

In today's formal military education and technical school environments, qualified instructors predominantly teach using the lecture method. When providing feedback about courses, students commonly describe monotonous "death by Power Point" lectures with limited time for student-centered instructional approaches such as hands-on learning exercises, role play, and simulation activities that align with their preferred way to learn.

A review of the literature suggests no research regarding the clinical experience and preferred learning style of FNs and AETs has been conducted. Additional information is needed to determine whether changes to FN and AET eligibility criteria, development of new training initiatives, and curriculum modifications or enhancements are warranted. Therefore, the purposes of the study were to describe the clinical experience and identify the preferred learning style of students entering the USAFSAM FN or AET course.

METHODS

We used a cross-sectional survey design. This design is appropriate when using a questionnaire to gather self-report data regarding clinical experience, level of comfort providing clinical care, and preferred learning style from a target population.

Subjects

We conducted the study at USAFSAM. We invited all United States Air Force active duty (AD), Air Force Reserve (AFR), and Air National Guard (ANG) Air Force members age 18 yr and older who were enrolled in either the FN or AET course to complete a survey. A total of 198 students participated: 77 nurses and 121 medical technicians.

Procedure

We developed a paper-based, anonymous survey that included demographic, clinical experience, and learning style questions. The Chief Consultant to the Air Force Surgeon General for AE and other subject matter experts reviewed the survey and suggested minor changes, which were made. Subjects answered demographic questions regarding military service component and rank, type of healthcare organization where employed, level of education, and specialty certification; and clinical experience questions concerning years of experience, number of months they provided direct patient care in a clinical position, and number of hours worked per week. Further, using a Likert scale (1-5), subjects reported the frequency with which they cared for 18 types of patients and managed 18 types of medical equipment or devices (1 = less than once a month, 2 = once a month, 3 = once every 2 wk, 4 = 1–3 d a week, 5 = 4 or more days a week).

The investigators selected the types of patients, equipment, and devices based on results of an official Occupational Survey Review for FNs and AETs, and guidance found in Air Force Instruction 41-307, "Aeromedical Evacuation Patient Considerations and Standards of Care," and Air Force Instruction 10-2909, "Aeromedical Evacuation Equipment Standards," which guide curriculum development for each course. Similarly, and for the same types of patients, equipment, and devices, subjects used another 5-point Likert scale to rate their level of comfort independently performing the care or managing the equipment and device (1 = have never done, 2 = very uncomfortable, 3 = a little uncomfortable, 4 = somewhat comfortable, 5 = very comfortable). Finally, subjects answered questions about how much they enjoy (1 = very enjoyable, 2 = somewhat enjoyable, 3 = indifferent, 4 = not enjoyable, 5 = have never experienced) lecture, computer-based, simulation, gaming, problem-based, video, and distance learning teaching methods.

Learning style is the way learners most efficiently and effectively perceive, process, store, and recall what they attempt to learn. We purchased and subjects answered the 16-item VARK (Visual, Aural, Read/Write, Kinesthetic) Questionnaire, Version 7.0, which assesses how individuals like to receive and deliver information.[6] Subjects could choose more than one answer per item, facilitating a multimodal approach to categorization that accounts for the contextual variation in life and learning.

The in-residence FN and AET courses were held concurrently and started monthly from January to June 2014. On the first class day, outside of class hours, we informed students about the nature and purpose of the research, sponsors of the research, and the disposition of survey results, emphasizing that no adverse action would be taken against any who chose not to participate. Nonmilitary personnel administered and collected the surveys. Completion of the survey implied consent to participate. On average, subjects completed the survey in 25 min. All responses were self-reported. The 711th Human Performance Wing Institutional Review Board approved the

study protocol before the investigators began the research. Subjects were not compensated but received a pastry item.

Statistical Analyses

We analyzed demographic, clinical experience, and learning style data using frequencies and means with standard deviations. Separately for nurses and medical technicians, we examined differences in years of clinical experience among AD, AFR, and ANG subjects using Kruskal-Wallis tests and permutation-based post hoc tests. We considered differences with a probability of $P < 0.05$ as statistically significant, and conducted all analyses using SAS version 9.4, (SAS Institute, Cary, NC).

RESULTS

Characteristics of the sample are summarized in **Table I**. Given the response rate of 93% for nurses and 90% for medical technicians, the sample represents the population well. The majority held the military rank of Lieutenant, Senior Airman, or Airman First Class (65.6%); completed technical training as their highest level of education (56.3%); and worked 36 or more hours per week in a hospital or clinic (74.2%). There were 30 (39%) nurses who were certified in specialties such as medical-surgical, critical care, pediatric, and perianesthesia nursing.

Nurses and medical technicians reported 7.6 ± 5.5 and 3.9 ± 4.5 yr of experience, respectively. Although AD, AFR, and ANG nurses had comparable years of experience, 5.8 ± 3.2, 8.3 ± 6.6, and 7.9 ± 4.2 yr, respectively [X^2 (2, $N = 76$) = 2.07, $P = 0.36$], AD medical technicians had more years of experience (5.6 ± 4.4 yr) than AFR (3.1 ± 4.8 yr, $P < 0.02$) and ANG (1.9 ± 2.8 yr, $P < 0.02$) medical technicians [X^2 (2, $N = 119$) = 34.84, $P < 0.001$].

Nearly one-third or more nurses reported caring for patients with various disorders or using standard medical equipment or devices every 2 wk or less (see **Table II**). Of these, AD nurses cared for patients with shock [X^2 (2, $N = 75$) = 9.37, $P = 0.01$] and managed nasogastric tubes [X^2 (2, $N = 75$) = 18.22, $P < 0.001$], portable suction units [X^2 (2, $N = 74$) = 7.35, $P = 0.03$], and chest drainage units [X^2 (2, $N = 75$) = 13.16, $P = 0.001$] less often than AFR and ANG nurses. Further, AD and ANG nurses cared for patients with a neurological disorder [X^2 (2, $N = 75$) = 11.23, $P = 0.003$] and administered blood [X^2 (2, $N = 75$) = 9.15, $P = 0.01$] less often than AFR nurses. In addition, AFR and ANG nurses cared for patients with endocrine disorders [X^2 (2, $N = 74$) = 7.28, $P = 0.04$] and managed manual resuscitators [X^2 (2, $N = 73$) = 13.91, $P < 0.001$], central lines [X^2 (2, $N = 75$) = 8.82, $P = 0.02$], ventilators [X^2 (2, $N = 74$) = 14.74, $P < 0.001$], and restraints [X^2 (2, $N = 74$) = 14.68, $P < 0.001$] more often than AD nurses.

Nurses who cared for certain types of patients or managed particular medical equipment or devices at least 1–3 d a week reported greater comfort independently caring for patients and managing equipment or devices than nurses who cared for patients or managed equipment or devices less frequently. Further, and as shown in **Table III**, nearly all nurses who routinely provided direct patient care reported high levels of comfort in doing so.

Table II shows that half or more medical technicians reported caring for patients with various disorders or using standard medical equipment or devices every 2 wk or less. Of these, AD medical technicians managed intravenous therapy/medications [X^2 (2, $N = 111$) = 19.25, $P < 0.001$], ventilators [X^2 (2, $N = 109$) = 7.72, $P < 0.02$], and restraints [X^2 (2, $N = 109$) = 6.52, $P = 0.03$], and administered supplemental oxygen [X^2 (2, $N = 113$) = 12.89, $P = 0.002$] less often than AFR and ANG

Table I. Characteristics of the Sample.

	ENTIRE SAMPLE (*N* = 198) *N* (%)	ACTIVE DUTY (*N* = 70) *N* (%)	AIR FORCE RESERVE (*N* = 86) *N* (%)	AIR NATIONAL GUARD (*N* = 42) *N* (%)
Military Rank				
Lieutenant Colonel	1 (0.5)	0 (0.0)	1 (1.2)	0 (0.0)
Major	3 (1.5)	1 (1.4)	2 (2.3)	0 (0.0)
Captain	21 (10.6)	7 (10.0)	11 (12.8)	3 (7.1)
First Lieutenant	25 (12.6)	10 (14.3)	9 (10.5)	6 (14.3)
Second Lieutenant	27 (13.6)	0 (0.0)	18 (20.9)	9 (21.4)
Master Sergeant	2 (1.0)	1 (1.4)	1 (1.2)	0 (0.0)
Technical Sergeant	4 (2.0)	1 (1.4)	2 (2.3)	1 (2.4)
Staff Sergeant	21 (10.6)	11 (15.7)	7 (8.1)	3 (7.1)
Senior Airman	38 (19.2)	23 (32.9)	13 (15.1)	2 (4.8)
Airman First Class	40 (20.2)	16 (22.9)	15 (17.4)	9 (21.4)
Airman	14 (7.1)	0 (0.0)	6 (7.0)	8 (19.0)
Airman Basic	2 (1.0)	0 (0.0)	1 (1.2)	1 (2.4)
Highest Education				
Technical Training	108 (56.3)	46 (68.7)	39 (46.4)	23 (56.1)
Associate's Degree	10 (5.2)	3 (4.5)	5 (6.0)	2 (4.9)
Bachelor's Degree	63 (32.8)	17 (25.4)	31 (36.9)	15 (36.6)
Master's Degree	11 (5.7)	1 (1.5)	9 (10.7)	1 (2.4)
Type Organization Employed				
Hospital	82 (41.6)	21 (30.0)	41 (48.2)	20 (47.6)
Clinic	32 (16.2)	28 (40.0)	3 (3.5)	1 (2.4)
Military Institution	38 (19.3)	18 (25.7)	15 (17.6)	5 (11.9)
Transport Agency	7 (3.6)	1 (1.4)	3 (3.5)	3 (7.1)
Other	22 (11.2)	2 (2.9)	13 (15.3)	7 (16.7)
None	16 (8.1)	0 (0.0)	10 (11.8)	6 (14.3)
Hours Per Week Worked				
≥ 36 h/wk	144 (74.2)	66 (94.3)	49 (59.0)	29 (70.7)
20-35 h/wk	19 (9.8)	3 (4.3)	11 (13.3)	5 (12.2)
8-19 h/wk	12 (6.2)	0 (0.0)	8 (9.6)	4 (9.8)
< 8 h/wk	19 (9.8)	1 (1.4)	15 (18.1)	3 (7.3)

Numbers may not equal sample size due to missing data. Percentages may not equal 100% due to rounding.

Table II. Self-Reported Clinical Practice of Nurses and Medical Technicians.

TYPE OF PATIENT, EQUIPMENT, OR DEVICE	CARED FOR TYPES OF PATIENTS OR MANAGED EQUIPMENT OR DEVICE EVERY 2 WEEKS OR LESS	
	NURSES ($N = 77$) N (%)	MEDICAL TECHNICIANS ($N = 121$) N (%)
Blood Transfusion	29 (38)	94 (87)
Burn Injury	66 (88)	99 (92)
Central Venous Line	18 (24)	84 (77)
Chest Drainage Unit	39 (52)	90 (82)
Complex Wounds	34 (45)	75 (69)
Endocrine Disorder	17 (23)	88 (81)
Eye/Ear/Nose/Throat Disorder	35 (47)	70 (64)
Gastrointestinal Disorder	17 (23)	66 (61)
Genitourinary Disorder	25 (33)	79 (75)
Heart Monitor/Defibrillator	23 (31)	68 (62)
Hematological Disorder	29 (39)	83 (78)
Infectious Disorder	7 (9)	56 (50)
Infusion Pump	8 (11)	68 (61)
Manual Resuscitator	42 (58)	96 (90)
Mental Health Disorder	30 (41)	71 (65)
Nasogastric Tube	27 (36)	89 (81)
Negative Pressure Wound Therapy System	48 (64)	95 (86)
Neurological Disorder	25 (33)	77 (73)
Portable Suction Unit	33 (45)	87 (79)
Portable Therapeutic Liquid Oxygen Unit	57 (80)	96 (91)
Restraints	41 (55)	95 (87)
Shock	31 (41)	88 (81)
Spinal Stabilization Device	45 (61)	82 (75)
Urinary Catheter	11 (15)	61 (55)
Ventilator	37 (50)	88 (81)

medical technicians. Further, ANG medical technicians managed complex wounds [X^2 (2, $N = 109$) = 10.44, $P = 0.005$], urinary catheters [X^2 (2, $N = 111$) = 17.81, $P < 0.001$], and heart monitors/defibrillators [X^2 (2, $N = 110$) = 14.37, $P < 0.001$] more often than AD medical technicians but less often than AFR medical technicians.

Medical technicians who cared for certain types of patients or managed particular medical equipment or devices at least 1–3 d per week reported greater comfort independently caring for patients and managing equipment or devices than medical technicians who cared for patients or managed equipment or devices less frequently (Table III). This relationship was noted for nearly all patient types, equipment, and devices studied. Nonetheless, medical technicians who routinely provided direct patient care reported varying degrees of comfort in doing so.

Both nurse and medical technician students reported a clear preference for the kinesthetic or a multimodal learning style that includes kinesthetic learning (**Fig. 1**). Individuals who favor a mix of more than one learning style are categorized as multimodal.[5] Nearly one-third (31%) of medical technicians and 18% of nurses endorsed the kinesthetic learning style, while 31% and 21%, respectively, reported nearly equal preferences for visual, aural, read/write, and kinesthetic learning styles.

Most students prefer that instructors use more than one teaching method. Nearly all (99%) nurses and 97% of medical technicians identified simulation as their preferred teaching method. Most nurses reported enjoying lecture (78%), problem-based (77%), and video (68%) teaching methods, while medical technicians reported enjoying video (64%), problem-based (63%), and gaming teaching methods (62%). Nearly a third (30%) of nurses and 22% of medical technicians had never experienced learning by gaming. The least preferred teaching methods for both nurses and medical technicians were computer-based training (46% and 54%, respectively) and distance learning (24% and 19%, respectively).

DISCUSSION

These findings confirm faculty concerns regarding the clinical experience of FN and AET students. The clinical experience of study subjects varied among service components. Although differences in years of experience did not differ significantly among AD, AFR, and ANG nurses, AD nurses self-reported significantly less experience with various types of patients, equipment, and devices than their AFR and ANG counterparts. Active duty medical technicians, however, had significantly more years of experience but less self-reported experience caring for various types of patients or managing standard medical equipment or devices than their AFR and ANG counterparts. This could be accounted for by the type of organization in which study subjects were employed. Of the AD study subjects, 40% reported working in a clinic, whereas only 3.5% of AFR and 2.4% of ANG study subjects reported working in a clinic. One expects fewer opportunities in the clinic to work with patients with various disease processes, equipment, or devices as compared to an inpatient environment.

Both nurses and medical technicians reported infrequently caring for patients with various disease processes and managing equipment or devices that they will routinely encounter when transporting patients as an AE clinician. Of nurse subjects, nearly one-third or more reported caring for 19 types of patients or managing equipment or devices every 2 wk or less. For 8 of the 19, 50–88% of nurses endorsed the every 2 wk or less frequency of care, whereas 50% or more medical technicians reported caring for 25 types of patients or managing equipment or devices every 2 wk or less. For 16 of the 25, 75% or more medical technicians endorsed the every 2 wk or less frequency of care. Nurses and medical technicians who lack recent clinical assessment may benefit from attending the USAFSAM Sustained Medical Airman Readiness Trained (SMART) course before beginning the FN or AET course. The SMART course curriculum provides an

Table III. Relationship Between Frequency of Patient Care and Perceived Level of Comfort.

TYPE OF PATIENT, EQUIPMENT, OR DEVICE	HIGH FREQUENCY AND HIGH COMFORT	LOW FREQUENCY AND HIGH COMFORT	X^2 (*P*-VALUE)
		NURSES	
Burn Injury (*N* = 74)	100%	41.5%	10.82 (< 0.001)
Central Venous Line (*N* = 74)	100%	77.8%	13.16 (0.003)
Chest Drainage Unit (*N* = 74)	100%	76.9%	9.20 (0.003)
Complex Wounds (*N* = 74)	97.5%	70.6%	10.52 (0.002)
Eye/Ear/Nose/Throat Disorder (*N* = 73)	100%	70.6%	13.29 (< 0.001)
Gastrointestinal Disorder (*N* = 74)	100%	76.5%	14.18 (0.002)
Genitourinary Disorder (*N* = 74)	100%	72.0%	15.15 (< 0.001)
Heart Monitor/Defibrillator (*N* = 73)	100%	76.2%	13.29 (0.001)
Hematological Disorder (*N* = 73)	97.8%	82.1%	5.59 (0.03)
Infusion Pump (*N* = 74)	100%	75.0%	17.00 (0.01)
Manual Resuscitator (*N* = 72)	100%	61.0%	15.55 (< 0.001)
Mental Health Disorder (*N* = 73)	88.6%	51.7%	12.37 (< 0.001)
Musculoskeletal Disorder (*N* = 74)	100%	81.8%	9.99 (0.006)
Negative Pressure Wound Therapy System (*N* = 74)	96.2%	72.9%	5.94 (0.01)
Neurological Disorder (*N* = 74)	95.9%	80.0%	4.90 (0.04)
Portable Suction Unit (*N* = 72)	100%	78.1%	9.69 (0.002)
Portable Therapeutic Liquid Oxygen Unit (*N* = 70)	100%	26.8%	24.74 (< 0.001)
Respiratory Disorder (*N* = 74)	100%	40.0%	43.15 (< 0.001)
Restraints (*N* = 73)	100%	82.5%	6.39 (0.01)
Shock (*N* = 74)	95.5%	63.3%	12.71 (< 0.001)
Spinal Stabilization Device (*N* = 73)	100%	59.1%	15.75 (< 0.001)
Ventilator (*N* = 73)	94.4%	35.1%	28.00 (< 0.001)
		MEDICAL TECHNICIANS	
Blood Transfusion (*N* = 104)	61.5%	22.0%	9.05 (0.006)
Burn Injury (*N* = 103)	88.9%	47.9%	5.53 (0.032)
Central Venous Line (*N* = 103)	78.3%	22.5%	24.43 (< 0.001)
Chest Drainage Unit (*N* = 103)	94.1%	31.4%	23.00 (< 0.001)
Complex Wounds (*N* = 105)	72.7%	47.2%	5.95 (0.02)
Endocrine Disorder (*N* = 103)	68.4%	21.4%	16.26 (< 0.001)
Eye/Ear/Nose/Throat Disorder (*N* = 104)	84.2%	50.0%	12.04 (0.001)
Gastrointestinal Disorder (*N* = 104)	78.6%	46.8%	10.51 (0.001)
Genitourinary Disorder (*N* = 102)	80.0%	29.9%	19.45 (< 0.001)
Heart Monitor/Defibrillator (*N* = 106)	90.5%	64.1%	9.32 (0.003)
Hematological Disorder (*N* = 103)	73.9%	18.8%	25.38 (< 0.001)
Infectious Disorder (*N* = 105)	87.0%	51.0%	16.09 (< 0.001)
Infusion Pump (*N* = 104)	90.2%	36.5%	29.38 (< 0.001)
Manual Resuscitator (*N* = 102)	90.0%	41.3%	8.61 (0.005)
Mental Health Disorder (*N* = 106)	81.1%	46.4%	11.95 (0.001)
Musculoskeletal Disorder (*N* = 105)	90.6%	55.8%	16.25 (< 0.001)
Nasogastric Tube (*N* = 105)	90.0%	49.4%	10.89 (0.001)
Negative Pressure Wound Therapy System (*N* = 105)	92.9%	27.5%	22.46 (< 0.001)
Neurological Disorder (*N* = 101)	60.7%	34.3%	5.84 (0.024)
Pain (*N* = 105)	97.5%	72.0%	15.80 (< 0.001)
Portable Therapeutic Liquid Oxygen Unit (*N* = 101)	66.7%	17.4%	11.68 (0.003)
Respiratory Disorder (*N* = 105)	78.1%	51.2%	8.26 (0.006)
Shock (*N* = 103)	95.0%	57.8%	9.79 (0.001)
Spinal Stabilization Device (*N* = 105)	96.2%	57.0%	13.52 (< 0.001)
Supplemental Oxygen (*N* = 107)	96.9%	83.3%	6.12 (0.027)
Urinary Catheter (*N* = 107)	93.9%	65.5%	12.66 (< 0.001)
Ventilator (*N* = 102)	65.0%	34.2%	6.37 (0.021)

Degrees of freedom for all X^2 Tests were 1.

avenue for nurses and medical technicians to obtain clinical experience by caring for patients at a high-volume and high-acuity Level I trauma center. Further, education leaders within all AD and many AFR and ANG AE squadrons have launched education programs that feature human patient simulators and cargo compartment trainers to reinforce content learned during the FN and AET courses. They also deliver unit-based ground and upgrade training, and provide realistic sustainment training for FNs and AETs.

Although these training opportunities help FNs and AETs maintain clinical competency, limited training time and competing requirements, especially for some AFR and ANG members, contribute to variations in clinical sustainment training among AE squadrons. Given the differences in clinical experience among AD, AFR, and ANG nurses and medical technicians that we identified during this study, we recommend periodic reassessment of clinical competency for FNs and AETs. Unit-based leaders can then consider learning style preferences of their members and tailor education initiatives to sustain clinical competency.

The Career Field Managers for FNs and AETs and USAFSAM education leaders periodically conduct a Utilization and Training Workshop for the FN and AET courses. AE subject matter experts will use the findings from this study as they consider what clinical experience should be required before nurses and medical technicians are permitted to enroll in the FN or AET course, the nature of the curriculum for each course, and approach to competency assessment.

Flight nurses and AETs independently transport patients over long distances with little opportunity to consult others for guidance performing patient care or managing equipment and devices. Not unexpectedly, we found a positive relationship between frequency of caring for patients or managing medical equipment or devices and level of comfort. When technicians and nurses reported caring for patients with different conditions or managing equipment or devices 1–3 d a week, more nurses than technicians consistently rated themselves at a higher comfort level. Likewise, when nurses and technicians had even less experience, more nurses than technicians consistently rated themselves at a higher level of comfort.

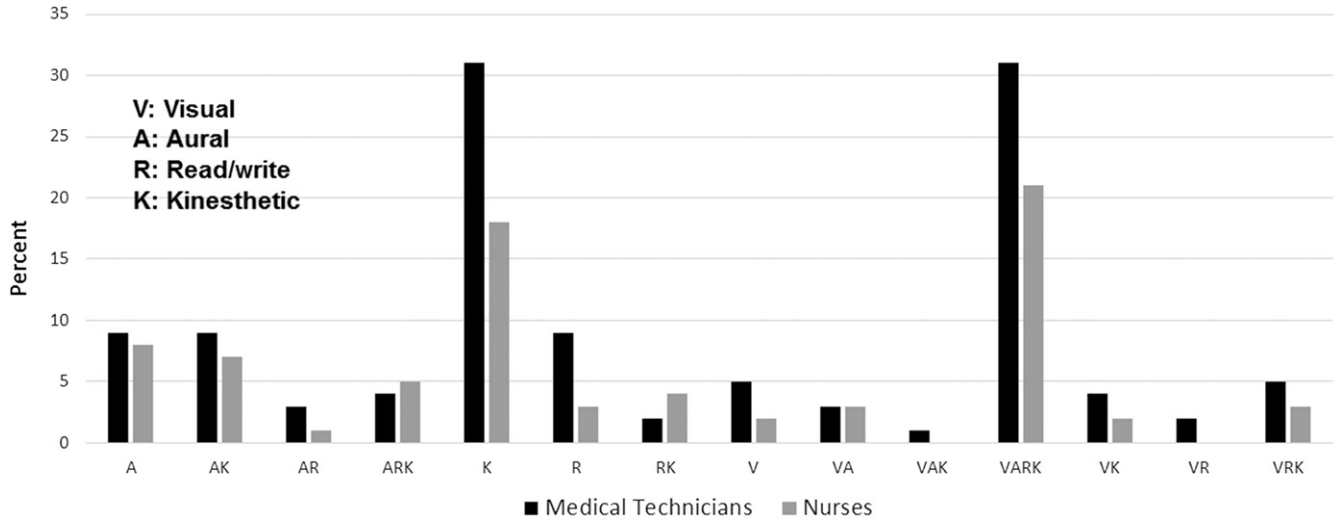

Fig. 1. Learning styles of nurse and medical technician students.

A possible explanation is that nurses had substantially more years of experience and perhaps gained confidence during a previous assignment to a high-volume and/or high-acuity unit in which they honed foundational clinical skills.

Subjects clearly preferred the kinesthetic learning style or a multimodal learning style that encompasses kinesthetic learning, a finding that is consistent with other recently-reported research with allied health and nursing students and surgical residents.[9,12,15] In our study, although both nurses and medical technicians preferred simulation, they provided support for gaming, lecture, video, and problem-based teaching methods. It is challenging for instructors to teach all course content using methods that align with the learning style of a diverse group of students. Yet, when instructors demonstrate flexibility by using teaching methodologies and tools related to individual learning styles, learning is more likely to occur.[13]

The differences among students who attend the FN and AET courses highlight the need for tailored educational initiatives. Currently, the curricula focus on teaching clinical care at altitude. Instructors primarily teach using lecture, and students must pass knowledge examinations at the end of each block of instruction. In addition, instructors demonstrate use of medical equipment, and following hands-on practice, students must demonstrate proficiency using and troubleshooting all standard AE equipment. Lastly, students complete 3 d of simulated missions in static aircraft trainers, enabling them to "put it all together."

Based on students' preferred learning style evident in this study, we recommend incorporating simulation throughout the course. Daily, for example, instructors could use human patient simulator scenarios plus demonstrations, videos, case studies, and/or hands-on practice to reinforce learning objectives and key didactic content in a way that appeals to the varied learning styles of nurse and medical technician students. Evidence supports using a combination of didactics and simulation as a means of increasing retention in the short-term; simulation enhances retention over the long term.[4] Further, this approach supports Air Force Education and Training Command principles of learning that include promoting an adaptable learning environment, using interactive instruction when possible, and leveraging technology to facilitate an innovative learning environment.[16]

In a recent pilot study, Dufour employed a hybrid educational method using multimodal didactics and simulation in specific intervals to teach trauma assessment skills to Air Force nurses and assess their knowledge and skill retention over 1 yr. Didactics involving voice-over slides and video demonstration were integrated with a moderate fidelity ALS® human patient simulator provided by Laerdal™ (Stavanger, Norway). Subjects who received the intervention doubled task completion accuracy at the end of the study as compared to their initial trauma assessment performance. Further, they maintained knowledge and skill proficiency at least 3% higher than the set 70% proficiency threshold even without additional live exposure to trauma.[4]

The primary limitation of this study is that nurses and medical technicians completed a survey to anonymously self-report their data at one point in time. We did not interact with the subjects or otherwise verify the accuracy of their data. Although the results reflect a substantial degree of clinical inexperience and discomfort caring for various types of patients and managing medical equipment or devices, conceivably nurses and medical technicians may have tended to overestimate clinical experience consistent with social desirability bias. Finally, for this initial study, we did not collect data regarding the subjects' course grades, graduation rates, or clinical performance during their first assignment at an AE squadron.

Simulation technology is associated with positive knowledge, skills, and behavior learner outcomes for medical personnel, including nurses, emergency medical technicians, and military medics.[3] Although we assume that clinicians can transfer knowledge, skills, and behavior taught using simulation to actual patient care, contributing to improved patient outcomes, the evidence is inconsistent and suggests that this is not always the case.[18] Further research is required to determine transferability of knowledge, skills, and behavior to practice, cost-effectiveness of

simulation training, the correct "dose" of simulation training, and the effect on patient safety, satisfaction, and outcomes.

In order to effectively measure knowledge and skill obtainment and sustainment, the evaluation process must include objective measures. In the Standards of Best Practice for Simulation series by the International Nursing Association of Clinical Simulation and Learning, Sando and colleagues described the importance of objectively measuring subjects' performance during simulation.[17] Objective measures must meet the unique needs of the situation to eliminate biased assessments. Few research reports, however, contain information about the consistent use of valid and reliable objective measurement tools used in simulation. These tools must be developed and tested in future studies.

Lastly, further research based on the Predictive Performance Optimizer (PPO) model may produce findings regarding how to best promote knowledge acquisition and skills retention for nurses and medical technicians who must rapidly master complex knowledge and tasks and then apply such in the challenging aeromedical evacuation environment.[11] Given that students begin the FN or AET course with different clinical skill sets, their learning and decay curves will vary. Although unfeasible to develop individualized training plans for up to 30 students per class, it may be possible to generate evidence-based "training profiles" and assign individual students to prescribed training groups based on an assessment of their baseline knowledge and skills and preferred learning style on the first day of class.

Air Force FNs and AETs provide comprehensive nursing care during transport of combat casualties and other patients. To our knowledge, we are the first to study the clinical experience and preferred learning style of students who attend the FN or AET course at USAFSAM. Our findings confirm faculty concerns regarding the clinical experience of FN and AET students. The clinical experience of study subjects varied among service components. Both nurses and medical technicians infrequently cared for patients and used and managed equipment or devices that they will routinely encounter when transporting patients as an AE clinician. Given the preferred learning styles of students, we recommend teaching strategies, such as simulation, that align with the kinesthetic learning style.

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