The Cost and Impact of Intermediate Care Technicians Employed in Emergency Departments in the Veterans Health Administration

Nell J. Marshall

Kristina Snell

Theodore Warsavage

Tracey Urech

Anita Vashi

VA Palo Alto, Center for Innovation to Implementation

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Introduction

The population of former military medics and corpsmen leaving the service has grown 60% over the last three years. Currently, 16,253 former military medics and corpsmen separate from Active Duty, National Guard, and Reserves with no clear civilian pathway to employment. At the same time, there are significant staffing needs within the Veteran's Health Administration (VHA) suitable for former military medics and corpsmen. In 2018, VHA Office of Inspector General (OIG) Occupational Staffing reported staff shortages at 46 facilities, specifically for nurse and nursing assistant positions, while 22 additional facilities reported shortages for health aids and technicians.

Intermediate Care Technicians (ICT) employed by the VA are a viable solution to both VHA's staff shortage and employment for former military medics and corpsmen. Because ICTs have a similar but more advanced scope of practice than a traditional VA Emergency Department (ED) Health Technician, mirroring their military education, experience, and service, ICTs were initially employed within VA EDs. Utilizing their clinical skills, patient navigation and care coordination, the ICT works as a force multiplier, increasing access to care, enhancing nursing and medicine productivity, and increasing patient satisfaction.

Between 2011 and 2019, the ICT program expanded from four to 24 medical centers across the nation. As part an evaluation of the innovators network at the VA, we conducted a return on investment (ROI) analysis of the ICT program to calculate the financial gains and losses while accounting for the resources invested into the ICT program. In addition, we compared the cost offsets of the ICT program (from increased throughput, reduced costs) to the investment required.

Methods

Site selection

ICT sites introduced in 2015 or later were included in the evaluation based on availability of data using the Emergency Department Information System (EDIS). EDIS was introduced into VA EDs in 2014 and provided a dataset with business and quality improvement rules applied to reported measures. As a result, nine ICT invention sites and nine matched control sites were selected for the analysis based on geographic location, size, and level of acuity.

Analysis

The perspective of the cost analysis is that of the VA, generalizable to the "payer." The time horizon was 1-year (12 months). The intervention for the ICT program was defined at the hiring and integration of an ICT into the workflow of the ED. The patient population was all patients seen in the ED.

While an intervention often leads to better work flows and patient health, and thus reduced healthcare utilization in the future, then intervention often requires more care in the short term. To analyze the consequent healthcare utilization following the intervention, a comparison of cost in healthcare utilization before and after the intervention was conducted.

For the ICT program, we examined six EDIS times as a proxy for utilization to measure the impact of having ICTs working in the ED. The six measures included Door to Doc, Door to Triage, Discharged Patient Length of Stay, Admitted Patient Length of Stay, Left Without Being Seen (LWBS), and Total Count (patient volume). We included a control group and used a regression adjusted difference-in-differences approach to account for pre-intervention differences between the intervention and control sites. For each outcome measure, we collected data 12-months pre- and 12-months post-intervention, with the intervention defined as a start-up period of 3 months. In order to calculate the difference-in-differences, the difference between the intervention and control sites before the intervention (pre) is subtracted from the difference between the intervention and control sites after the intervention (post). The relative differences between the intervention and the control sites, or the differences in the changes over time will be examined.

To account for underlying assumptions of longitudinally structured data, a linear mixed-effect model will be used to examine the differences in outcome measures between pre-intervention and post-intervention periods at intervention versus control sites.

Cost identification

Using the micro-costing method, we measured costs associated with implementation and startup of the intervention. Implementation costs included labor associated with the ICT clinical orientation, clinical rotations and competency sign offs, and labor plus the cost of capital for to conduct the skills labs and simulation labs. Labor was estimated by calculating an hourly rate plus 30% benefits based annual and salary divided by 2087 working hours per year. Salaries were based on 2019 Nurse Pay Schedules https://vaww.va.gov/OHRM/Pay/Pay_Charts/2019/LPS/538_554.pdf, Title 38, U.S.C. Sec. 7404 Salary Table Nurse Schedule for PA's & EFDA's, and Title 38, U.S.C. Sec 7431 Physician and Dentist Annual Pay Ranges. The cost of capital for the use of the simulation and skills lab was calculated using a prorated formula [(Purchase Amount/Life Span)*% ICT], to estimate the capital cost associated with the ICTs annual use of the simulation lab.

Training. ICT training was conducted in two phases, a formal didactic orientation and a series of clinical training rotations and competency sign-offs.

Phase 1- Formal didactic orientation with a nursing orientation, a skills lab, and a simulation lab. The simulation lab is for hands-on skills done and covers three labs: procedural, medication management, and arthrocentesis.

Phase 2- A series of clinical training rotations and competency sign-offs.

BLOCK A: Triage-ESI testing, EDIS, Fast Track, CPRS-Computer Documentation, BCMA Charting, Fast Track Procedures, Supply Carts/Stocking, and Discharging.

Competencies: Phlebotomy (Order of Draw), IV Placement-Blood Cultures, External Jugular Vein Access (EJs), Arterial Blood Gas (ABGs), Arthrocentesis, Visual Acuity, Incision & Drainage, Suturing/Stapling and Removal, Digital Blocks, Dermabond, Steri-Strip Placement, Cautery, Splinting, and Ear Lavage.

BLOCK B: Acute ED, Waiting Room Lab Draws, CODE Responsibilities and Rapid Response Team (Stretcher). Competency Sign-Off/ Skills Refreshers.

Competencies: ECG-Lead Placement, IM/SubQ Injections, I/O Insertion, NG Tube Placement, Foley Insertion, Eye Lavage, Anterior Nasal Packing, Bladder Scanning, Soft Restraints, Patient Suctioning, Wall Oxygen & RM Air Oxygen Administration, and Wet-to-Dry Dressings.

Point of Care Lab Testing. POC Lab Testing is a requirement for all ICTs. The Point of Care Lab Department is responsible for the guidance, training, and evaluation of all ICTs approved to preform POC Lab testing. The POC Lab Department coordinates an annual rodeo every new fiscal year (October) to provide staff an opportunity to demonstrate proficiency with POC labs. POC training is scheduled as soon as possible into Phase 2 training in coordination with POC lab.

Lecture Topics/ Demonstrations. Women's GYN Exam Set-Up, Medication Administration, Immunizations, Adverse Drug Reactions, Sepsis, Stroke, Urinary Retention, Diabetes, COPD Exacerbation, and ED Documentation.

Results

Facility characteristics

Table 1 summarizes the characteristics of the four intervention and matched control ED facilities in our study. In the sites we examined, the number of ICTs assigned to the ED varied from one to nine, however all functioned in one of six types of roles within the ED, including:

Clinical Greeter or Waiting Room ICT. ICTs worked outside the ED to act as a liaison for veterans waiting to be seen by the medical team and to help patients navigate the Medical Center by giving directions. ICTs were an extension of the "Nurse First" or triage nurse evaluating sick patient's coming into ED, reevaluating vital signs, processing provider in triage orders, and informing patients about ED operations/wait times.

Triage. In triage ICTs can secondary triage perform screenings (SI/HI), take vital signs, perform EKGs, accomplish point of care testing and room patients.

Patient Health Screenings. ICTs can evaluate patients and perform a verity of health screenings at any point during the veterans visit to the ER. i.e. SI/HI secondary triage screens, geriatric syndrome screens, and evaluate patients on the acute side while filling out the ED nurse note template.

Physician in Triage (PIT). ICTs assigned to PIT are paired up a physician/provider to help increase access to care for veterans in the waiting room. The ICT carries out the providers orders in true time i.e. lab draw, IV placement, facilitate imaging completion. They also coordinate with the charge nurse to expedite care to veterans who have a pressing/urgent medical issue.

Fast Track. In fast track ICTs perform a wide variety of procedures (i.e. Suturing/Splinting, Incision & Drainage, Joint Injections, Splinting). They room patients and get them ready for exam, administer medications and/or treatments, and perform point of care testing.

Acute-Main ED. ICTs can perform phlebotomy, place patient on the monitor, start the beside evaluation, run POC lab tests, place NG tubes, place Foleys and perform a wide variety of procedures (i.e. Suturing/Splinting, Incision & Drainage, Joint Injections, Splinting). ICTs are often assigned to boarding patients. ICTs can transport patients monitored and unmonitored. ICTs also play a role within the CODE team performing CPR.

Measured Outcomes

In the group analysis of combined intervention versus combined control sites, (Figure 1) the "Door to Triage" time for intervention sites decreased 2.45 minutes after the implementing ICTs from 7.56 to 5.1, compared with 0.67 minutes from 10.18 to 9.52 in the control sites. Regression-adjusted difference-in-differences estimates for "Door to Triage" showed a statistically significant reduction in time at intervention sites versus compared to control sites (1.79 minutes, CI 3.2 – 0.36, p=0.14.) Additional analysis of "Door to Doc", "Discharged Patient Length of Stay", "Admitted Patient Length of Stay", "Left Without being Seen (LWOBS)", and "Total Count", did not show statistically significant reductions in time between intervention and control sites for the group analysis.

Certain measures showed small but statistically significant results at individual intervention sites when compared to matched control pairs. Regression-adjusted difference-in-differences estimates for “Left Without being Seen” (LWOBS) showed small yet statistically significant reduction in times in Asheville (0.004 minutes, CI 0.0002-0.009, p=0.04), (Figure 2) Augusta (0.006 minutes, CI 0.01-0.0001, p=0.05) (Figure 4), and Fresno (0.01 minutes, CI 0.003 – 0.02, p=0.01), (Figure 5),when compared to the matched control sites. Similarly, “Admitted Patient Length of Stay” (LOS) showed small yet statistically significant reduction in times in Asheville (26.5 minutes, CI 11.34-41.82, p=0.001, (Figure 2) and Augusta (21.47 minutes, CI 42.48-.040, p=0.05). (Figure 4) And finally, “Discharged Patient Length of Stay” (LOS) showed small yet statistically significant results in Atlanta (15.5 minutes, CI 30.73-0.27 p=0.05). (Figure 3)

Cost of Implementation and Training

Total cost of ICT training. The cost of conducting ICT training, including labor, capital costs for use of a simulation lab, and the cost of consumables, was ranged from a low of $3,091 for an individually trained ICT, to a high of $14,557 for ICTs trained in a group of five. (Table 2) Labor costs accounted for the difference since the time required for medical staff to conduct clinical rotations, skills labs, and simulation labs was the same for one individual up to a group of five, sites that are able to onboard and train ICTs in groups of five can do so at a lower per ICT cost. In addition to labor, consumables used in training were estimated to cost $500 per ICT. In addition to the cost of labor and consumables, the capital cost for use of the simulation lab was an annual rate of $2,625/year; a cost that would be distributed across the total number of ICTs trained in a year in order to reach a final per ICT training cost.

Clinical rotation, skills labs, and simulation lab labor. A breakdown of the total labor cost for training ICTs is shown in table 3. ICT orientation and training were conducted and overseen by a team of medical and nursing staff and conducted in groups with a ratio of up to 5 ICT:1 staff. With this ratio, the estimated amount of time to conduct and oversee a skills lab, preceptors signoffs, and simulation lab point of care testing was the same for 5 ICTs or 1 ICT. Therefore, if ICTs were trained in groups of five, the labor cost per ICT was $2,591. However, if an ICT is trained individually the labor cost would be as high as $12,957.

Simulation lab. A detailed account of the equipment used in the simulation lab and the annual cost attributed to use by the ICT program was estimated at $2,625 per year**.** (Figure 4) Medical simulation labs which consist of realistic looking clinical sim lab rooms, manikins, and equipment, allow trainees to practice and development clinical expertise without any risk of patient harm. Finally, consumable items associated with training in the lab such as sutures, dressings, and needles were estimated at $500 per ICT**.** (Figure 5)

Conclusion

The analysis of ICT intervention sites when compared to matched controls, did not indicate a strong impact on EDIS measures for the time period included in the analysis. Small reductions in EDIS measures may suggest that ICT have a positive impact in the ED, but further analysis is needed to better quantify the impact.

There are several limitations in this study that may account for the limited results. First, our analysis was limited to a small sample of four pairs of ICT-non ICT sites where the matched controls were selected on only a few high-level characteristics. A larger sample where matched pairs are evaluated on additional measures to ensure better comparability would support a better analysis. In addition, while the ICTs at intervention facilities functioned in “full scope” roles, there remains a high variability in daily ICT functions, within and across sites.

Anecdotal evidence of improved patient satisfaction suggests that when ICTs are adopted into a medical center ecosystem, ICTs have made an impact with patients, patient family members, and employees. Because ICTs are veterans themselves, they are uniquely qualified to deeply relate to patient's needs and offer a greater level of support helping patients navigate VAs complex system of care.

Figures 1-5

See PDF files:

ICT Group_report_011720

Site_report_011720_Salis_Ashb

Site_report_011720_tampa_atlanta

Site_report_011720_BayPines_Augusta

Site_report_011720_Reno_Fresno

Tables

Table 1. Emergency department intervention and matched control facility characteristics (N=3 pairs)

Facility	Complexity	# ICTs	2019 ED Volume	UC Census Region	Urban/Rural	ED Role
Asheville, NC	1c	4		South	Urban	Full scope
Salisbury, NC	1c	-		South	Urban	-
Atlanta, GA	1a	9	43,233	South	Urban	Full scope
Tampa, FL	1a	-	43,651	South	Urban	-
Augusta, GA	1a	1	24,136	South	Urban	Full scope
Bay Pines, FL	1a	-	26,035	South	Urban	-
Fresno, CA	1c	6	17,085	West	Urban	Full scope
Reno, NV	1c	-	18,132	West	Urban	-

*Full scope = acute-main ED and fast track

Table 2. Total Cost of ICT Training ($)

Cost Category	Unit Cost	#	Total	Unit Cost	#	Total
Labor	2,591	1	2,591	2,591	5	12,957
Simulation Lab Consumables	500	1	500	500	5	2,500
			3,091			14,457
Simulation Lab equipment (annual)						2,625

Table 3. 2019 Labor Cost per ICT ($)

Activity	Staff title and level	Hourly rate + benefits	# Hrs	Cost
ICT Nurse Skills Lab[1]	Clinical Nurse Spec[2] Nurse educator	69	5	344
Medicine Skills Lab[3]	Physician educator[6]	141	5	704
Clinical Training Rotations				
ED preceptor	ICT	38	28	1,059
ED preceptor	Nurse[4]	61	24	1,463
ED preceptor	PA/NP[5]	65	24	1,565
ED preceptor	Physician[6]	141	4	563
Sign off: suturing/stapling	Physician or PA/NP	103	5	515
Sign off: splinting	Physician or PA/NP	103	5	515
Sign off: incision and drainage	Physician or PA/NP	103	5	515
Sign off: arthrocentesis	Physician or PA/NP	103	5	515
Sign off: arterial blood gas, eternal jugular	Physician or PA/NP	103	5	515
Simulation (SIM) Lab - Point of Care Testing [7]				
Lab draw, processing	Lab technician (GS9, Step 5)	38	4	151
Basic patient care manikin	Physician[6]	141	3	422
Basic patient care manikin	Nurse[4]	61	3	183
Flat skin pad	Physician[6]	141	3	422
IV torso	Physician[6]	141	3	422
Sim man 3G	Physician[6]	141	3	422
TB testing arms	Nurse[4]	61	3	183
Venipuncture Arms	Nurse[4]	61	3	183
Arterial Puncture Wrist	Physician[6]	141	3	422
Ear exam trainer	Physician[6]	141	3	422
Joints for injections hand & wrist	Physician[6]	141	3	422
Joints for injections shoulder	Physician[6]	141	3	422
Arthrocentesis Task Trainer	Physician[6]	141	3	422
Nasogastric Feeding Tube model	Nurse[4]	61	3	183
Total Cost (Labor)				12,957

1 Med admin, NG, trach care, IV therapy, drawing labs, cultures, competency + education checklist used

2 ICTs under Cleveland are under medicine, Clin nurse scope of practice is multidisciplinary and therefore can work with medicine. (Sch ND08, grade 3, step 5)

3 Education and reviewing indications and procedures; splint, x-ray, etc.

4 Nurse Pay Schedules https://vaww.va.gov/OHRM/Pay/Pay_Charts/2019/LPS/538_554.pdf; grade 3, step 4

5 Title 38, U.S.C. Sec. 7404 Salary Table NURSE SCHEDULE for PA's & EFDA's; Chief, step 5

6 Title 38, U.S.C. Sec 7431, Physician and Dentist Annual Pay Ranges, Pay Table 3 Clinical Specialty, Tier 1 midpoint

7 Includes time for set-up, tear down of lab stations

Table 4. Simulation lab annual equipment cost ($)

Equipment Name	Description	Formula*	Cost
Basic Patient Care Mannikin	Irrigation of eyes Irrigation of ears Diabetic foot – gangrenous great toe, heel pressure ulcer Pressure ulcers – sacrum, heel, great trochanter Stump care and bandaging Multiple wounds for wound care practice Abdominal surgical site Laceration to upper arm Ostomy care	(2645/5)*.5	265
IV Torso	Practice of IV access to external jugular vein, internal jugular vein (via anterior, central, and posterior approach), subclavian vein, and femoral vein Pulse bulb to create a palpable pulse in manikin's arteries Pre-filled with simulated blood	(1014/5)*.5	101
SimMan 3G	High fidelity manikin with the ability to provide: Breath with chest rise and fall Two-way voice communication Heart, lung and bowel sounds Cardiac rhythms Pulses – radial, brachial, femoral, carotid, popliteal, pedal and dorsal pedal Blinking eyes with pupillary reaction Intubation Chest tube Administration of medications, fluids I/O, IV Catheterization CPR with feedback Defib	(84,86/7)*.25	303
TB testing Arms	Allows learner to practice intradermal injections	(175/3)*.5	29
Advanced Venipuncture Arms	Venipuncture IV cannulation Realistic blood flash – simulated blood Palpable veins	(960/8)*.5	60

Arterial Puncture Wrist	Palpable arterial pulsation Realistic resistance of tissue and artery wall “Flash” of artificial blood into needle can be observed Arterial blood sampling and radial line placement can be done	(3168/5)*.75	475
Ear Examination Trainer	Ear examination with real otoscope Ear wax and foreign body removal Cases Normal Serous otitis media Mucoid otitis media Chronic otitis media with perforation Acute suppurative otitis media Cholesteatoma Tympanosclerosis Traumatic perforations Cerumen block	(2784/5)*1	557
Joints for Injection:	Hand & Wrist: Relevance of digital movement for presentation of injection sites Injection in 4 specific areas: carpal tunnel trigger finger/tendon sheath injection de Quervains sheath first metacarpal joint Precise placement of needle to avoid median nerve	(1791/5)*.75	269
Joints for Injection:	Shoulder: Relevance of digital movement for presentation of injection sites Injection in 4 specific areas: carpal tunnel trigger finger/tendon sheath injection de Quervains sheath first metacarpal joint Precise placement of needle to avoid median nerve	(2670/5)*.75	401
Nasogastric Feeding Tube model	Molded cast of anatomy of the nose, mouth, pharynx, trachea, esophagus, and stomach Using nose or mouth, can place plastic feeding tube or catheters into the esophagus and to stomach	(114/4)*.75	21

Arthrocentesis Task Trainer	Ultrasound compatible Highly durable replaceable tissue for multiple uses Realistic tactile feedback includes: Sensation of bony contact if needle hits the patella Sensation of bony contact if needle hits the femur Inability to aspirate the syringe while the needle tip is in the soft tissue superficial to the join capsule Easy aspiration of joint fluid into the syringe once entry has been achieved Fluid can be left clear or be colored if desired Ability to increase or decrease size of effusion with up to 60 cc of fluid Injection practice	(1442/5)*.5	144
Total equipment cost allocation per ICT:			2625

Formula: (Purchase Price/Life Span)% ICT

Table 5. Simulation lab consumables

Item
Flat skin pad (Epidermis, dermis and subcutaneous layer, Basic suturing, stapling placement and removal, Dermabond)
Aerosol treatment set up (trach, nebulizer)
IM, SQ and intradermal injections (Manikin for injection sites)
Blood tubes
Blood culture bottles
I/O equipment
Peripheral Ivs
Peripheral IV dressing kit
NG tube spray
Salem Sump tubing
Central line kit (training kit) $20 each/person
Central line dressing
ABG kits
Dermabond
Sutures
Staples
Staple gun
Suture removal kit
Suture kits
Sterile gloves
I&D equipment
Orth glass
Stockinette roll
Ace wrap
Cast padding
Morgan lens
Anterior packing (rapid rhino)
Laceration tray
#11 blade
Sterile saline for irrigation
Staple removal kit
Strip gauze packing
Needles for injections
3ml, 5ml, 10ml syringes
Kerlix dressing