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Brief Report

COLLECTING UNUSED MEDICAL SUPPLIES IN EMERGENCY DEPARTMENTS FOR RESPONSIBLE REDISTRIBUTION

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☐ **Abstract—Background: Medical supplies and equipment are unevenly distributed throughout the world. Objective: Our aim was to describe, quantify, and monetize unused supplies suitable for recovery produced from two urban emergency departments (EDs). Methods: We trained ED staff to place opened, unused, uncontaminated medical supplies in strategically located bins located in two urban EDs for 30 days. We sorted and quantified collected supplies, then used hospital-specific supply catalogs to determine the total cost of recovered medical supplies during the 30-day study period. We extrapolated the amount of collected medical supplies and associated costs to yearly estimates. Results: We recovered 39.9 kg ($6,096) from the trauma center and 3.4 kg ($539) from the academic center during the 30-day study period. The most commonly collected supplies included open but unused procedure kits ($1,776), catheter needles ($1,009), and sutures ($698). We estimated that the trauma center produces $73,158 of unused medical supplies per year and the academic center produces $6,467 of unused medical supplies per year. Conclusions: We present a novel approach to decreasing waste and recovering usable medical supplies, in which we found that substantial, valuable medical supplies can be recovered in two urban EDs.**

☐ **Keywords—emergency department; medical supplies; global health care**

INTRODUCTION

Medical supplies and equipment are unevenly and inequitably distributed throughout the world. Poor access to medical supplies in low- to middle-income countries (LMICs) may impair the ability to deliver adequate health care (1). Lack of medical equipment can be particularly problematic in the context of life-threatening emergencies, when immediate access to resuscitation equipment and universal precautions are vital to the timely and safe provision of care (2,3). For example, clinicians in sub-Saharan African countries have limited access to fluid-resistant barrier garments and eye projection, putting them at risk of dangerous blood exposures (4). Many factors contribute to the lack of proper equipment in low-resource settings, including high production and transportation costs, distance from manufacturing sites, difficulties getting spare parts, and inadequate standardization of medical devices (1).

In the United States, the health care sector is the second largest contributor to solid waste production, with more than 4 billion pounds of waste produced annually (5). Medical supplies and equipment that are open but unused are generally discarded due to federal regulations, hospital protocols, and procedural excess in the United States (6). Most of these supplies are incinerated and

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never recycled. Much of this discarded material is viable for use and, if recovered and redistributed in a socially and ethically responsible manner, could serve dual functions of providing needed supplies to LMICs and decreasing the burden of medical waste.

To promote supply recovery, we began a pilot program in 2004, in which we collected unused medical supplies from the operating room and hospital floors of an urban hospital for redistribution to underserved communities globally based on identified need (6). In the summer of 2017, we expanded this collection system to two urban, academic emergency departments (EDs) and began a pilot study in which we sought to catalog, describe, and monetize our collections during a 1-month period. These data, when extrapolated to a larger time period, allow for estimation of the impact of unused medical supply collection for redistribution.

Our program only donates supplies based on identified need. No supplies can be transported unless they have been requested by recipient clinics and projects. Therefore, the recipient clinic should have the need and expertise to use such supplies. Items such as surgical instruments are sorted and packaged without being resterilized, but the recipients are aware and they take it upon themselves to get those items sterilized. Many of the places where supplies are donated do not have access to even basic materials, such as suture equipment.

METHODS

We conducted this study at two urban EDs in San Francisco, California: a tertiary academic center with approximately 44,000 patients annually, and a Level I county trauma center that serves approximately 77,000 patients per year. We obtained approval from our Committee on Human Research prior to the study.

Unused Supply Collection Protocol

We trained ED staff to place eligible open, unused, clean medical supplies in strategically located bins throughout the trauma center and academic hospital EDs. Medical waste was defined as medical supplies and equipment in which the outer packaging was opened but internal equipment remained unused and clean (e.g., unused, clean supplies that cannot be restocked from procedure kits that were opened). Examples of items included scissors, forceps, surgical equipment, bandages, wraps, gauze, tape, suturing supplies, gloves, sealed syringes and needles, stethoscopes, gowns, drapes, towels, alcohol swabs, i.v. supplies, masks, and catheters. Open sharps were not collected due to the risk of needle-stick injuries, but protected unused sharps were collected. Medications, liquids, and expired supplies were not collected.

After engagement and approval from each ED's site leadership, we placed designated bins strategically throughout the EDs, and informed ED staff of their location and purpose. At the trauma center, we were able to place five supply collection bins located in each dirty supply room. There were four medium-sized bins (15.8 × 11.7 × 23 inches) and one large bin (21.2 × 19.8 × 37.5 inches). At the academic center, due to space restrictions, only one bin (22.2 × 10.9 × 29.9 inches) was placed in the doctor's charting room. Bins were emptied weekly and stored in a separate unit for categorization.

At each hospital, we posted signs in the break rooms, sent staff e-mails leading up to and during the start of the collection period, and made announcements at change-of-shift meetings advertising the program. We collected supplies from each site weekly for 30 days (January 8, 2018 to February 6, 2018).

Determination of Supply Value

We sorted and performed a comprehensive inventory of collected supplies, which were logged in a spreadsheet (Microsoft Excel, version 12; Microsoft, Redmond, WA), noting reference numbers or lot numbers when available. We then derived the value of supplies from costs listed in hospital-specific supply catalogs. When we could not find the cost of the exact item in a catalog, we used the cost of the item at the alternate hospital or excluded the item from the tabulation. We tabulated, multiplied, and summed these values to determine total value of recovered medical waste during the 30-day study period. Using these data, we extrapolated the total amounts of medical supplies that could be collected in a year with its associated value.

Organization, Collection, and Distribution of Supplies

We weighed and organized collected supplies on a weekly basis and stored them for distribution to local health organizations and individuals who were partaking in international medical trips. All items were distributed based on identified need of recipient health care organization. See Figure 1 for the supply collection and donation workflow.

RESULTS

From January 8, 2018 to February 6, 2018, we recovered 2,028 items (39.9 kg) from the trauma center and 129 items (3.4 kg) from the academic center (Figures 2A and 2B). The most common items that we recovered were catheter needles (n = 746); i.v. start supplies (n = 308); and cleansing supplies, such as alcohol preparation pads (n = 149).

The items of greatest value were procedure-related supplies (items from opened but unused procedure kits)

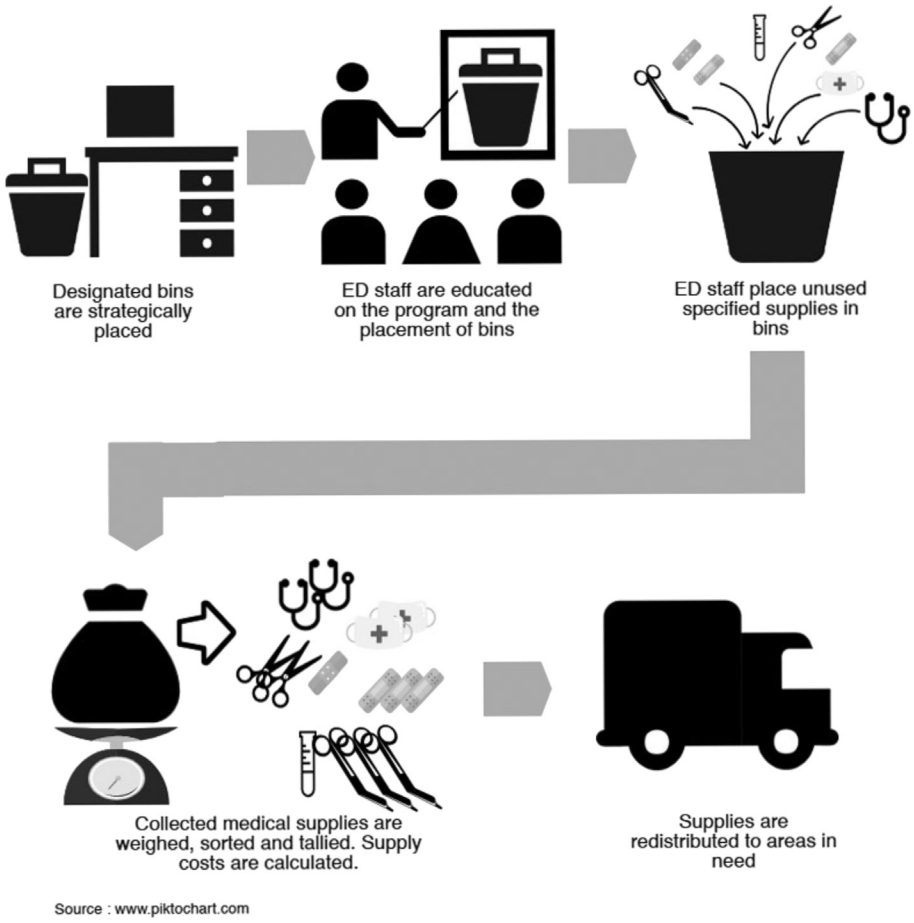

Figure 1. Supply collection and donation workflow. ED = emergency department.

and nursing supplies (such as i.v. start supplies) (Figures 2C and 2D). Considerably less value was attributed to personal protective equipment, such as gloves, gowns, eye protection, masks, and towels. See Table 1 for a listing of the specific items collected, the categorization of those items, and their associated value (see Supplementary Tables 1 and 2 for more granular details).

Extrapolating these monthly totals to one year, we determined that we could recover a total of 519.6 kg of usable supplies per year from the two EDs combined. In one year, the supplies collected from the trauma center are worth $73,158, and the supplies collected from the academic center are worth $6,467.

DISCUSSION

Two well-known facts led to this novel, utilitarian program and study: the United States produces an abundance of medical supplies that are unused and discarded, and LMICs have a great need for these supplies. In this study, we described our findings from a simple pilot program in which we prospectively collected, categorized, and monetized clean, unused medical supplies from two urban, academic EDs for redistribution to LMICs. We found that during a one-month study period, we recovered a total of 43.3 kg of unused medical supplies worth approximately $6,635 for donation. To our knowledge, this study represents the first analysis of unused medical supplies suitable for recovery produced in the ED setting.

This study demonstrates that there is a large variation in the amount and value of preventable waste at the two study sites. We collected 12.7 times more materials in the trauma center ED than the academic ED in a one-month period. We believe that this discrepancy is partially accounted for by the greater number of procedures performed at the trauma center, with more supply kits that are opened and potentially unused, or have materials within them that are unused. In addition, our collection methods varied between the two hospitals and we believe this also contributed to the discrepancy in collected supply volume. There were more supply collection bins at the trauma center, which were placed in more accessible locations. Bins at the trauma center are in every dirty supply room, making it easier to deposit

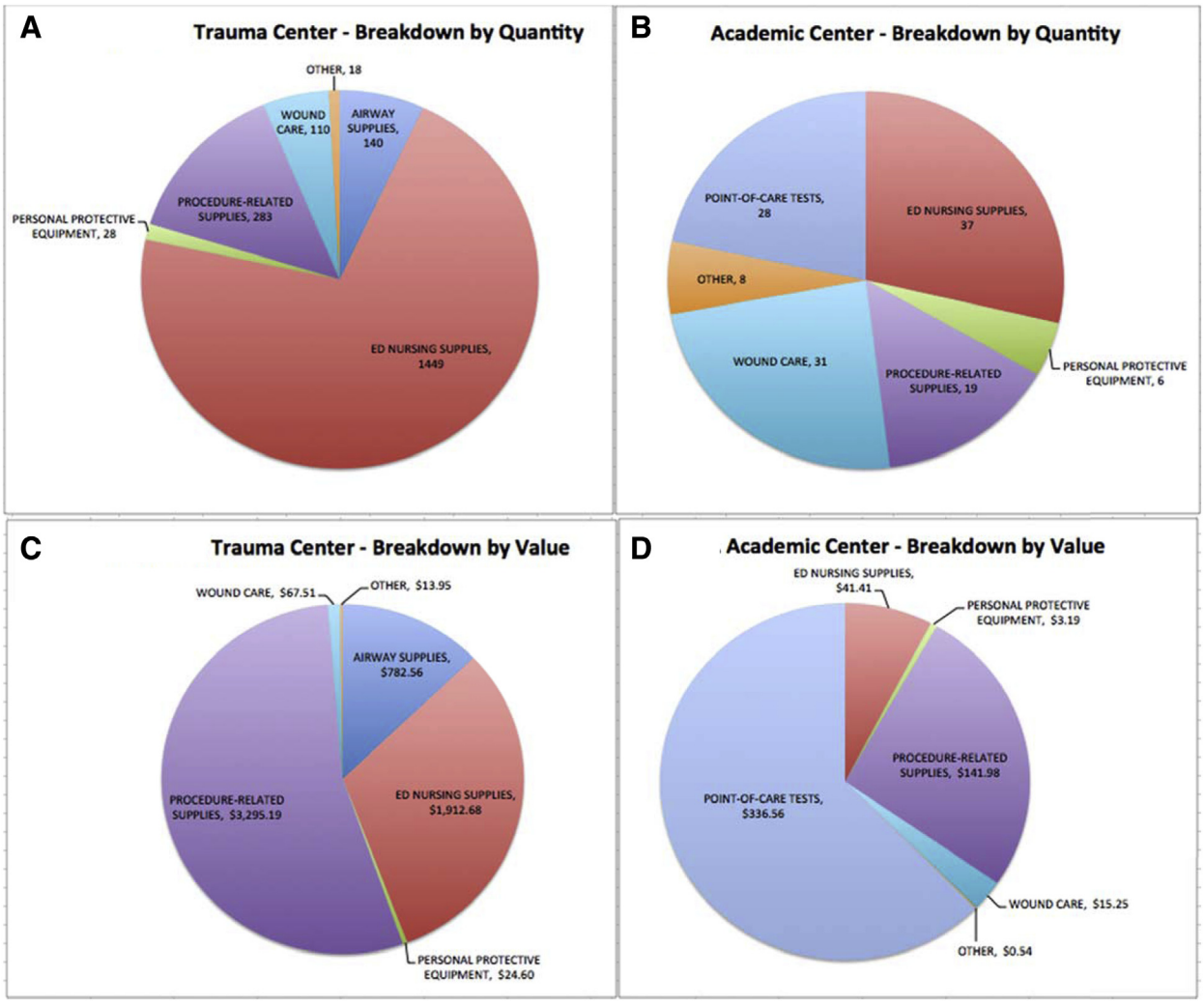

Figure 2. Breakdown of supply items by quantity and value at each hospital, trauma center, and academic center. (A) Trauma center: breakdown by quantity. (B) Academic center: breakdown by quantity. (C) Trauma center: breakdown by value. (D) Academic center: breakdown by value. Quantity and value for "Points-of-care-tests" equals 0 for trauma center (excluded from A and C); quantity and value for "Airway supplies" equals 0 for academic center (excluded from B and D).

supplies after a procedure. At the academic center, due to space limitations, there was only one bin placed in the doctor's charting room and therefore less convinient to access by other ED staff.

It is important to note that potential negative impacts of donating medical supplies to LMICs exist. There can be a mismatch between the types of supplies that are useful and those that are received, or sufficient financing and operation of some supplies or equipment cannot be sustained on a longer-term basis in some LMICs (7). Appropriate donations of supplies that hospitals in LMICs can manage and maintain are essential, as outlined in the World Health Organization guidelines for medical equipment donations (8,9). The strength of our program is that it donates to clinics based on their predefined needs to reduce the aforementioned barriers, highlighting the importance of LMIC involvement and partnership.

Limitations

The primary limitation of this work is our small sample size in terms of study duration and number of study sites. Additionally, both sites were urban EDs and involved resident trainees, which may preclude generalizability to nonteaching, rural hospitals. Another limitation is that we measured the output over only one month of collection after immediate implementation of a new program. With further familiarization of staff and use of established protocols, we likely would collect a greater amount of these materials per month.

Table 1. Supply Type and Total Value of Supplies in the 1-Month Period at Each Hospital, Trauma Center, and Academic Center

Supply Type	Total Supply Values During 30-day Study Period, $	
	Trauma Center	Academic Center
Airway supplies		
Atomizer devices	528.28	—
Endotracheal tubes	26.86	—
Masks (face masks, non-rebreather, bag-valve)	193.88	—
Nasal cannula	0.58	—
Nasopharyngeal airway	3.24	—
Nebulizers	9.03	—
Suction supplies	2.35	—
Tracheostomy ties	18.34	—
ED nursing supplies		
Catheter needles	998.44	10.34
Cleansing supplies	81.04	1.55
GI supplies	50.92	5.99
i.v. supplies	602.45	18.79
Phlebotomy tubes	15.38	—
Specimen collection	5.48	—
Syringes	16.25	4.32
Urology supplies	92.40	0.42
Vital sign equipment	50.31	—
Personal protective equipment		
Eye protection	5.25	—
Gloves	11.92	2.64
Gowns	2.55	—
Masks	3.22	—
Towels	1.66	0.55
Procedure-related supplies		
Nasal speculums	371.28	—
Procedure kits	1,658.00	117.93
Pelvic examination supplies	39.74	—
Scissors, clamps, forceps, scalpels	485.87	10.63
Spinal needles	7.48	2.84
Sutures	698.21	—
Tape	34.61	10.58
Testing		
Point-of-care testing	—	336.56
Wound care		
Gauze	7.14	0.48
Splinting/casting	42.47	1.08
Suture removal	—	1.76
Wound dressing	17.90	11.93
Other		
Other supplies	13.95	0.54
Total	6,096.48	538.93

ED = emergency department; GI = gastrointestinal.
We collected 241 different items, with 3% (7 items) where the cost was obtained from a supply catalog from the alternate hospital and 5% (12 items) were excluded because the cost could not be determined.

Our collection figures likely underestimate the amount of unused supplies that were actually wasted. Some of the reasons for this underestimate are related to pre-established workflows. Staff working in different parts of the ED have systems of cleanup in place that previously did not incorporate the separation and donation of unused medical supplies. Moreover, with 470 staff working at the two sites, widespread awareness of the newly implemented program was a challenge.

CONCLUSIONS

We presented a novel approach to decrease waste and found that substantial, usable medical supplies can be recovered in two urban EDs. With the limited workforce required for such a program, similar systems may be developed at other hospitals to reduce access to medical supply disparities, medical waste, and disposal costs.

Future studies at our institution will focus on exploring methods to reduce waste and procedural excess, particularly at trauma centers. For example, we plan to educate emergency medicine and trauma surgery staff to not open procedure kits until there is a high possibility that the procedure will happen and the items in the kit will be used. We also plan to do more frequent department-wide education on the importance of unused supply collection and to ease the workflow burdens. Finally, to evaluate more advanced outcomes, we plan to assess the on-the-ground impact of unused medical supply redistribution to under-resourced communities.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jemermed.2019.02.009.

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ARTICLE SUMMARY

1. Why is this topic important?

Medical supplies and equipment are unevenly distributed globally. Collection of discarded unused medical supplies in the United States can serve dual functions of providing needed supplies to low-resource communities and decreasing the burden of medical waste.

2. What does this study attempt to show?

This study presents a novel approach to decrease emergency department (ED) waste and recover usable medical supplies to redistribute to other health care facilities based on identified need.

3. What are the key findings?

We recovered 39.9 kg ($6,096) from the trauma center and 3.4 kg ($539) from the academic center during the 30-day study period. The most commonly collected supplies included open but unused procedure kits ($1,776), catheter needles ($1,009), and sutures ($698).

4. How is patient care impacted?

If unused medical supplies are recovered and redistributed in a socially and ethically responsible manner, this program can serve dual functions of providing needed supplies to low- to middle-income countries (LMICs) and decreasing the burden of medical waste. Many LMICs cannot afford even basic medical supplies and this program increases access to needed resources.