Applying the New Institute for Healthcare Improvement Inpatient Waste Tool to Identify "Waste" in the Intensive Care Unit

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Abstract: Healthcare waste—the inappropriate use of healthcare resources that provides no benefit to patients yet contributes to cost and even harm—is a potentially significant contributor to high healthcare costs. This project aimed to apply a new locally modified Institute for Healthcare Improvement (IHI)–developed waste identification tool to measure the prevalence of and reason for the inappropriate use of intensive care unit (ICU) beds, one type of potential waste. Unnecessary days (i.e., waste) and their causes in a 16-bed "closed" medical ICU (MICU) and a 10-bed "semi-closed" transplant surgical ICU (TSICU) were identified by physicians over a 3-month period. Data on 513 patients admitted to both ICUs for a total of 1,631 patient-days demonstrated that 15% of MICU days and 25.8% of TSICU days were unnecessary. Although causes of waste in each ICU differed, delays in transfer of patients out of the ICU, end-of-life decision-making, and delays in procedures were among the commonest. Determination of waste also varied among physicians, ranging from 4.5% to 27.7% in the MICU and 0%–37.5% in the TSICU. This study found that the IHI waste tool can be effectively used to identify waste in the ICU, which is common and varies based on the ICU type and physician perceptions.

Introduction

The annual cost of healthcare in the United States approached $2.9 trillion in 2013, accounting for 17.4% of the gross domestic product (Anonymous, 2014a). ICU care, in particular, is costly in the United States, totaling $81.7 billion in 2005 and accounting for 13.4% of hospital costs and 4.1% of the national health expenditure (Halpern and Pastores, 2010). A plethora of high-technology interventions, monitoring services, and clinician expertise are offered in the modern ICU and contribute to the high costs of this type of care. These high costs, however, do not reflect the quality of care expected of the most expensive healthcare system in the world, despite boasting tremendous resources, technology, and expertise. Although reasons for this poor value for money are manifold, a major contributor is the inappropriate use of resources—overuse, underuse, and misuse—that provides no benefit yet contributes to cost and even potential harm. It has been estimated that this "waste" in our healthcare system accounts for 30%–50% of all healthcare expenditures (Anonymous, 2014b; Reid et al., 2005; Savary and Crawford-Mason, 2006).

Healthcare waste due to duplication or unnecessary testing, treatments, or hospitalizations has been receiving increasing attention. Partnerships between national health organizations and business such as the Leapfrog Group have developed priorities and goals to confront healthcare waste and make healthcare more affordable (Leapfrog). Similarly, the Choosing Wisely campaign is an initiative of the American Board of Internal Medicine Foundation and represents a major effort by all the medical and surgical specialties and colleges to address wasteful practices (Choosing Wisely). In Choosing Wisely, each specialty guides its clinicians to reduce waste by identifying five specific targets often deemed unnecessary in their practice. Unfortunately, such attempts to reduce healthcare waste have been slow, infrequent, and largely unsuccessful. Reasons for this include lack of effective tools and expertise, inability to recognize waste by clinicians, a paucity of studies and evidence to guide interventions, and a potential conflict with the revenue stream in our largely fee-for-service system (Choosing Wisely; IOM, 2012; IHI, 2005).

Major reasons (categories) that contribute to this "waste" in healthcare include:

Keywords
waste
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overuse of clinical resources, adverse events and complications of care, inappropriate use of clinical resources or expertise, poor coordination and communication of care, delays, unwarranted variation, and simple process inefficiency (Resar et al., 2011). Despite the availability of many white papers, statements, and reports on this topic from organizations, such as the Institute for Healthcare Improvement (IHI), National Quality Forum, Institute of Medicine, and Agency for Healthcare Research and Quality (IHI, 2005; IOM, 2012; NQF, 2009), few large, robust studies have reported reductions of clinical waste using these resources. The availability of a simple and practical tool to be used by frontline clinicians could potentially significantly facilitate efforts to identify and mitigate waste at the point of care.

The Hospital Inpatient Waste Identification Tool was developed by the IHI to help clinicians and hospitals identify clinical and operational waste from the perspective of the frontline staff (Resar et al., 2011). It was designed based on literature review, consultations, and pilot testing by selected experts and hospitals. The tool consists of five modules that qualitatively identify potential waste based on the target area, service, or individual: ward, patient, patient care, diagnosis, and treatment. The simple design of the tool reflected the original intent to create a tool that is easy and quick to use, is applicable at the bedside by clinicians, and minimizes time and effort by its users. Using a modified version of the ward module of this IHI tool applicable to the ICU setting, this project sought to determine the prevalence of and reasons for inappropriate use of ICU beds (i.e., one type of waste) in our institution. The working hypothesis is that a significant proportion of hospital ICU beds are inappropriately used and contribute to potential waste, and that the reasons for this misuse are multifactorial and vary among different ICUs.

Material and Methods

This mixed-methods, descriptive, single-center study was performed using a locally modified version of the IHI Hospital Inpatient Waste Identification Tool (Ward Module, Innovation Series, 2011, Table 1). The tool was adapted in collaboration with the IHI to focus on inappropriate ICU stay using the ICU patient-day as the metric to measure potential waste. Each ICU day listed as waste was then categorized by the type/reason of waste. The modified tool was then tested over a 1-week period in two ICUs. Feedback was obtained from the clinicians involved, and changes were made as appropriate.

The main project data were then collected over a 3-month period from two different ICUs to determine the prevalence of pre-defined waste: a medical ICU (MICU) and transplant surgical ICU (TSICU). Table 1 summarizes the demographics of each ICU. These were selected to identify potential differences in waste among different types of ICUs: medical versus surgical and closed versus semi-closed. A wasted ICU patient-day was defined as 1 ICU day of patient stay that does not require the ICU-level of care (inappropriately occupied), as determined by the attending physician. This determination of a wasted ICU patient-day was based on the modified IHI tool that categorized reasons for inappropriate stay (Table 2). The proportion of waste is defined as the total number of beds inappropriately occupied divided by the total number of beds occupied in the ICU for that day. The main categories of waste contributing to potential wasted patient-days were identified and defined from sources in the literature, the original IHI inpatient waste tool, and information learned from the 1-week pilot test phase. This information was then incorporated into the modified tool. This 1-week test period also helped determine the optimal approach to collect these data on a daily basis and the need for physician guidance on definitions of waste that have ultimately been incorporated into this modified tool (Table 2).

The attending critical care physicians staffing each ICU were asked to complete the tool for each day in the ICU for all their patients. These physicians were

Table 1. Modified Institute for Healthcare Improvement (IHI) Intensive Care Unit (ICU) Waste Identification Tool

Date	Faculty name		Consider previous 24 hours. Please indicate if any of the following reasons contributed to an extra patient-day in the ICU or inappropriate utilization of resources.								Comments:	
Bed	ICU type MICU or TSICU	VAP, HAP, BSI, UTI, Wound Infection C. Diff.	Delay to Extubation	Adverse Drug Event or Oversedation	Procedure Complication or Safety Event	End-of-Life Decision	Awaiting Procedure	Awaiting Imaging	Awaiting Other Test or Results	Awaiting Consult	Pending Transfer (Downgraded, LTAC, Hospice, Home)	Other delays ≥24 hr
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
14												
15												
16												

General instructions for completion:

1. The objective of this data collection form is to identify causes for delays in patient discharges from the ICU that lead to added "wasted" cost without benefit and/or increased risk of hospital-acquired complications.
2. Please complete this form with your fellow daily for all patients for your unit after your rounds.
3. When completing, please consider whether the patient could have left the ICU the day before if the delay/complication did not occur. If yes, then the extra ICU day is considered a "wasted" day and the box should be checked. You may check as many boxes as appropriate, as long as the patient meets those criteria. However, if there are >1 boxes checked, please indicate the "primary" reason. Below is a list of criteria for each section.
4. If unsure of a decision to label as a "wasted" day, please discuss with Bela (MICU) or Khalid (TSICU) or make comments in the designated area. This can then be decided later. You should discuss with Bela and Khalid for your respective ICUs daily to ensure accuracy and completion.

Specific criteria for each section:

1. VAP, HAP, BSI, UTI, wound infection, C. diff.: If a patient develops a hospital acquired infection (VAP, HAP, BSI, Wound Infection, C. diff., etc.) and that infection added the day to the ICU stay, check the box to count the day. Example: If a BSI cased sepsis and the patient stayed in the ICU for an additional 3 days, all 3 days should be counted.

2. Delay to extubation: If a patient could have been extubated yesterday but was not for any reason (miscommunication, not getting a procedure on time, etc) the day should be counted.
3. Adverse drug event or oversedation: If a patient had an adverse drug event, including oversedation, and that caused an increase in ICU LOS, (example-acute renal failure from antibiotics, not able to extubate from oversedation, etc.), the day should be counted.
4. Procedure complication or safety event: If there is a complication (bleeding, pneumothorax, laceration, etc.) from a procedure or a safety event (fall, wrong patient receiving intervention, unplanned extubation) or any other event that leads to increased LOS, the day should be counted.
5. End-of-life decision: If the medical team has determined that further aggressive care is futile, the day that decision was made to the day comfort measures was initiated should be counted.
6. Awaiting procedure: If the patient is awaiting procedure that adds to the LOS (tracheotomy, endoscopy, IR procedure, etc.), the day should be counted.
7. Awaiting imaging: If the patient is awaiting an imaging procedure (MRI, CT, tagged scan, etc) and that adds to the LOS, the day should be counted.
8. Awaiting other tests or results: If any pending test or result adds a day or more to the LOS, it should be counted.
9. Awaiting consult: If the consult has not been staffed by the consult attending or a management decision has not been offered that increased ICU LOS, the day should be counted.
10. Pending transfer to the IMU, floor, LTAC, Hospice, or any other area outside of the ICU adds to the ICU LOS, the day should be counted.
11. Other delays >24 hours: If a cause for increased LOS cannot be categorized or if unsure how to categorize, add the day with information to this area.

M = medical; TS = transplant surgical; VAP = ventilator-associate pneumonia; BSI = blood stream infection; UTI = urinary tract infection; LTAC = long term acute care facility.

Table 2. Intensive Care Unit (ICU) Demographics

Demographic	MICU	TSICU
Structure	Closed	Semi-closed[a]
Total licensed beds (#)	16	10
Physician team members	1 Attending 1 Fellow 8 residents	1 Attending 1 Fellow 1 Nurse practitioner
Support staff	1 Pharmacist 2 Respiratory therapists	1 Respiratory therapist
Average monthly admissions for year	121	48
Average ICU length of stay, d	4.0	4.1

[a]Mandatory critical care team consultation for all patients.
MICU = medical ICU; TSICU = transplant surgical ICU.

instructed on the use of the tool before project initiation, and a written summary of the tool and instructions on its completion were provided. Specifically, the physicians were approached by a member of the project team each day and asked, after rounds, to determine which patients in their ICU did not meet the criteria for further ICU stay yet will remain until the next day. They were then asked to identify the most common single reason for that unnecessary stay. These data were then recorded on the waste tool data collection form.

Data were mainly presented in a descriptive format and were summarized using Microsoft Excel 2010. Since no identifiable patient data were collected, patients' medical records were not accessed or involved, and patients were not participants, institutional review was not required; this study met our local institutional criteria for exempt status from a formal institutional review board review. Physicians who participated in this project provided verbal consent. No physician demographic data were collected.

Results

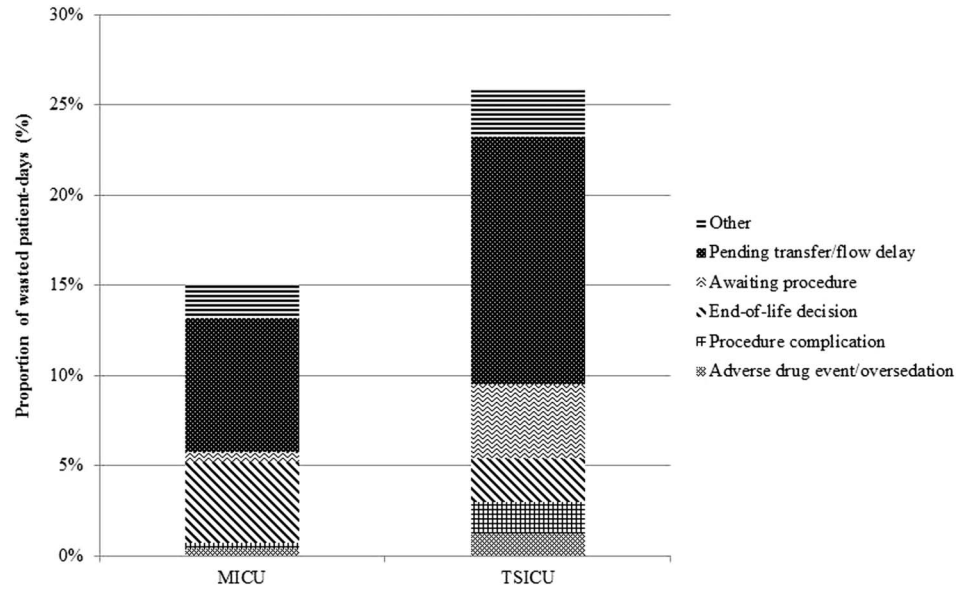
Data for 85 days were collected and analyzed for 513 patients admitted to both ICUs for a total of 1,631 patient-days (MICU: 347 total admissions and 1,170 total patient-days; TSICU: 166 total admissions and 461 total patient-days). Physicians determined that 15.0% (176/1170) of MICU patient-days and 25.8% (119/461) of TSICU patient-days were deemed "waste." Figure 1 illustrates the distribution of types of perceived waste in each ICU. Delays in transfer of patients out of the ICU were the commonest cause of waste in both ICUs, whereas delays in end-of-life decision-making and procedures were common additional causes of waste in the MICU and TSICU, respectively.

Determination of waste also varied among physicians completing the tool (Figures 2 and 3). Perceived "wasted" patient-days by each physician ranged from 4.5% to 27.7% in the MICU (6 physicians) and 0%–37.5% in the TSICU (5 physicians; 3 overlapped in both ICUs). Physicians also reported different proportions of types of waste, and this variation was more pronounced in the TSICU.

Discussion

The IHI Inpatient Waste Tool was designed to support and guide providers in identifying potential waste streams and ultimately to initiate a conversation about our practice. To our knowledge, this is the first report on the use of the IHI Inpatient Waste Tool to quantify waste in the ICU. The results of this project suggest that a significant proportion of ICU days were determined to be waste by physicians and

Figure 1. Distribution of reported potential "wasted" intensive care unit (ICU) patient-days.

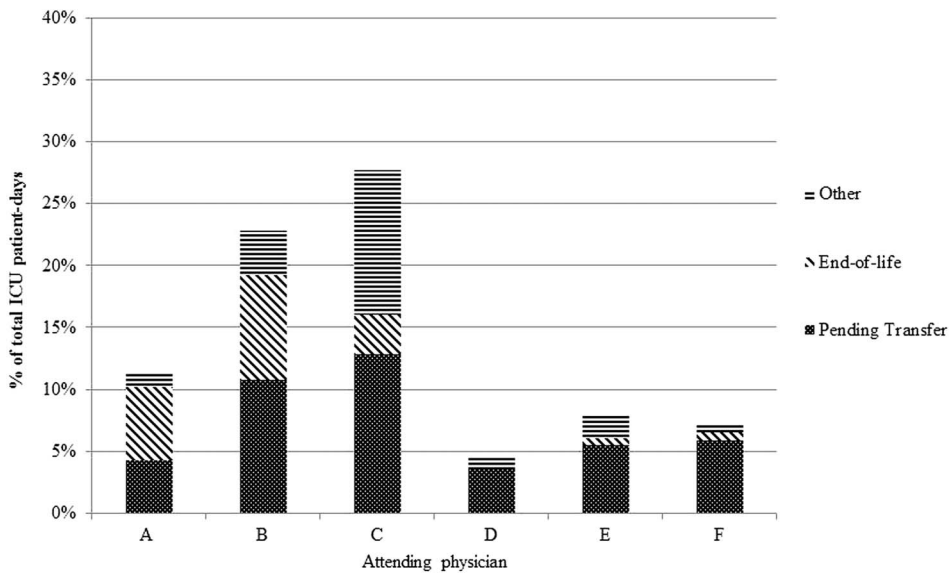


Although delays in transfer of patients out of the ICU were common to both ICUs, other causes of "waste" differed in each unit.
"Other" includes nosocomial infections, delays to extubation, adverse drug event, oversedation, awaiting imaging, awaiting other tests or results, and awaiting consults.
MICU = Medical ICU; TSICU = transplant surgical ICU.

are a potentially significant contributor to high ICU costs. Studying these wasteful practices in more detail may require specific modifications to the waste tool. Other potential waste in the ICU that was not studied in this project include inappropriate admissions to the ICU (Giannini and Consonni, 2006) and "routine" testing (i.e., daily morning lab tests or chest x-rays) that affects patients who remain in the ICU and also exposes them to increased risk of error and ICU-related complications (Solberg et al., 2014).

This project indicated that wasted ICU days are common in two different types of ICUs and varied by category. The MICU, for example, includes many older patients with multiple medical comorbidities, many of whom are in the terminal phase of their illness. End-of-life discussions and decisions would therefore be a core component of their ICU care. The waste tool suggested that the end-of-life management process in the MICU can be improved to benefit both patients (less suffering and more timely decision-making) and the institution (less patient and family dissatisfaction, less unwarranted cost, and better patient flow). A suboptimal end-of-life management process may also contribute to the "delays in transfer" of patients, another common type of waste. In the semi-closed surgical TSICU, patients often required invasive procedures, which was a common reason for waste in that unit. Using this waste tool, we were able to identify which services were involved in these procedures and to initiate a dialogue to expedite these interventions. Furthermore, delays in patient flow in this unit contributed to the decision later that year to "close" the TSICU, where the ICU team in collaboration with its surgical teams decides on patient transfers and discharges. This may have been a significant factor among others contributing to the decrease in ICU length of stay from delays in patient flow that we have seen since (39% decrease in average ICU length of stay).

Figure 2. Potential wasted intensive care unit (ICU) patient-days categorized by physician in MICU.

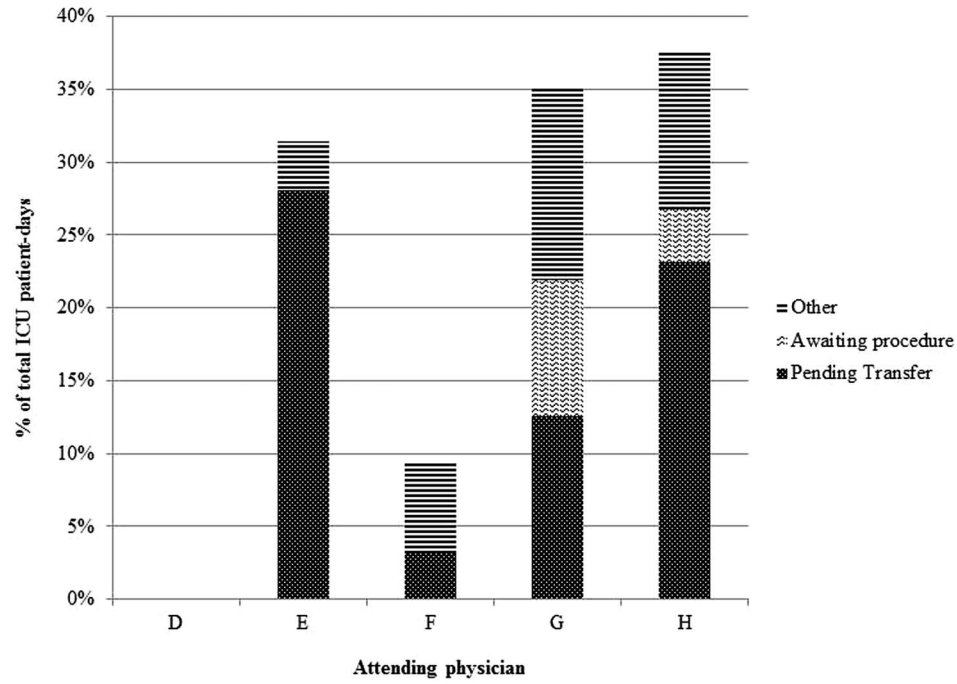


Variations were present among physicians regarding the causes of "waste", despite being instructed on the standard definitions of waste.
"Other" includes awaiting consults, awaiting procedures, and delay to extubation.
MICU = Medical ICU.

Although this modified waste tool clearly delineated categories of waste to guide the clinicians in their determination of waste for this project, there remained significant variation among the clinicians in the determination of what a preventable or unnecessary wasted ICU day was. Some of this variation may be warranted, as these differences in perceived waste could reflect different or changing patient demographics or clinical conditions and needs. We did not measure and therefore did not risk-adjust for the acuity of illness of our population or its needs; this type of analysis was not the intention of the waste tool or our project. Nevertheless, the difference in perceived waste could reflect the concept of "normalized deviance," where current practices and resources objectively deemed to be inappropriate are viewed to be within the "normal practice" due to historical experience and habit. Furthermore, the priorities, practices, and culture within each ICU may also influence the perceptions of waste for that particular ICU; different ICUs have different reasons for waste, and this may also inform variable expectations and therefore perceptions. For example, both ICUs have focused heavily on reducing hospital-acquired infections for years before this study, leading to near-zero rates of ventilator-associated pneumonia and central-line–associated blood stream infections. In units where this was not an area of focus, this category of waste may have a larger contribution.

Other reasons for differences in waste perceptions among physicians include physician training and experience, and the structure of each unit's practice model. The MICU, for example, is a "closed" unit that is managed exclusively by a group of critical care physicians practicing under the same ICU policies and protocols, although have different individual practice styles. By contrast, the TSICU model entails collaboration with surgical and specialty teams where indications and interventions by one team may not be familiar to or understood by the others. Hence, the perception of waste

Figure 3. Potential wasted intensive care unit (ICU) patient-days categorized by physician in transplant surgical ICU (TSICU).



Variations were present among physicians regarding the causes of "waste," despite being instructed on the standard definitions of waste.
Physician D did not identify any waste in the TSICU.
"Other" includes end-of-life decisions, procedure complication, and delay to extubation.

may be underestimated due to lack of familiarity with specialty practice needs and rationale. Furthermore, the absence of clear admission and discharge criteria in both ICUs apart from standard hospital policies and guidelines may further obfuscate the definition of waste among clinicians.

Some contributors to waste may not be evident or even measurable but still attenuated. For example, ICU length of stay for a specific condition may differ among ICUs or hospitals, despite the same severity of illness. This may be due to differences in the implementation of guideline and evidence-based practices. The MICU piloted projects on delirium reduction and early mobility, both of which would reduce length of stay yet not be categorized in the waste tool and therefore difficult to identify. Benchmarking units may expose such "hidden" causes of waste that are due to suboptimal implementation of standard practices.

Limitations

This study's results are descriptive and preliminary and must therefore be interpreted in the context of certain limitations. First, this is the first report on the basic use of this tool at the clinical point of care and should be repeated and confirmed in different settings. Second, a modified version of the tool (ward module) was used; the original IHI tool was developed as a template that could be modified for local use, so our approach was sanctioned. Third, this is a qualitative quantification of waste as determined by clinicians who used it and designated their responses as such. Fourth, the waste categories were developed based

on local practices, and these may differ in different ICUs and institutions. Finally, as stated before, variation in reported waste could reflect patients and illness demographics and burden, which were not measured or incorporated in this study.

Conclusions

The findings of this study can be used as a template for further detailed study of waste in the ICU. For example, since delay in transfer of patients out of the ICU was a common reason for waste in both units, this process could be delineated further, identifying specific patient populations or disposition areas affected. Although some situations, such as the lack of available beds in regular wards, may not be rectified immediately and locally in the ICU, others such as delays in transfers to other healthcare facilities can be, as this may be caused by inefficiencies in the transfer process that starts in the ICU. Based on this study, it is likely that waste is a common occurrence in the ICU and warrants further attention. Different ICUs may have different categories of waste based on their patient population, needs, and practices, and the IHI inpatient waste tool can be used in each ICU to identify local practices that contribute to waste. In addition, the perceptions of waste may differ among staff in the same unit. Although our results were obtained at a snapshot of time, they helped identify areas to focus on for improvement efforts. Finally, identifying areas of waste helped initiate dialogues with collaborative services and even our own clinicians to improve or transform specific processes and practices to improve inefficiency.

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