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Does hospital mode of arrival influence women's decisions to participate in research?

The National Institutes of Health recommends that research studies recruit enough subjects to address relevant gender differences [1-3]. Recruiting volunteers for research, however, is a complicated process. Though some work has informed the barriers to and facilitators of research participation amongst women and other minority subjects [4-9], few have focused on how pre-hospital factors, specifically mode of Emergency Department (ED) arrival, may influence the recruitment of female subjects in emergency research settings. Traditionally the point of entry into care, the ED is increasingly becoming the focal point for addressing several public health challenges, such as the growing opioid epidemic, stroke care, and traumatic brain injury. Patients may enter the ED setting via ambulance or walk-in/ambulatory means. Since ambulance use is often associated with higher acuity [10,11], users may be less inclined to engage in voluntary research activities, that may not be immediately related to their clinical care. The present study attempts to address a gap in the literature, by exploring how ED mode of arrival (ambulance vs non-ambulance) affects research participation in women. We hypothesized that women arriving via ambulance will be less willing to participate in research, compared with those arriving as walk-in/ambulatory patients.

We approached women presenting for care in the ED of a Level 1 Trauma Center in the context of an IRB-approved study examining the association between mild traumatic brain injury and reproductive function. Participants were eligible if they were between the ages of 18 and 45, and had a chief complaint and/or injury mechanism that was suggestive of a concussion or isolated musculoskeletal extremity injury (injury groups for parent study). All subjects were required to have a Glasgow Coma Scale (GCS) score of ≥13 and/or deemed capable of providing informed consent (following standard protocol and/or provider approval). As determined by the parent study, subjects were excluded if they were pregnant, <3 months post-partum, post-menopausal or had full hysterectomies. Eligible subjects were identified by trained and experienced Emergency Department Research Associates (EDRA's) [12] using the chief complaints noted in the medical records.

We compared refusals to consented study participants based on the following variables abstracted from the electronic medical record, and readily available for both groups (Table 1): age at ED visit, injury type, time since injury, mode of ED arrival and injury mechanism. Comparisons were made between groups using 2-tailed independent *t*-tests or $\chi 2$ tests, as appropriate. Logistic regression models were fit in crude and adjusted models, to estimate the odds of refusing research participation. We used $p < 0.05$ to determine statistical significance.

Between January 9th and July 8th 2017, we approached 383 women (Table 1), 21.9% (n = 84) declined to participate in the parent research study. The majority (78.1%, n = 299) agreed, and were consented. Participants' reasons for refusal varied, and included (data not shown): disinterest in research (29.8%), time constraints (22.6%), pain/fatigue (21.43%), discomfort with the consent process/nature of the research study (10.7%) and family pressure (7.1%). There were no statistically significant differences between the groups with regards to age ($p = 0.28$), injury type ($p = 0.76$) or injury mechanism ($p = 0.69$) or time since injury ($p = 0.12$). Compared with consented women, a larger proportion of refusals arrived via ambulance (29.8% vs. 42.9%, $p = 0.02$), as we had hypothesized. Ambulance arrival was associated with a 77% increased odds of refusal to participate in research in crude estimates (OR 1.77, 95% CI: 1.08, 2.91), compared to non-ambulance use. After adjusting for age, injury type, time since injury and injury mechanism, ambulance use was associated with over two times the odds of research refusal (adj. OR 2.12, 95% CI: 1.20, 3.73).

Though ambulance users met the parent study's inclusion/exclusion criteria, and were not any more severely injured than non-users, there is evidence to suggest that users may have *perceived* their injuries to be more urgent [13]; thus prompting the disinclination to volunteer for research. Subjects who refused cited a variety of reasons for not agreeing to participate, including perceived pain/fatigue. Future studies should investigate the role that ambulance transport plays in patients' perception of their injury severity, and compare that perception to objective assessments of injury severity. How patients' perceptions translate to "research volunteer decision making processes" should also be studied further. Studies should also consider whether ED mode of arrival affects women differently from men in the research decision.

A major limitation of our study is the team's inability to access potentially confounding variables such as education, race, insurance status and other measures of socioeconomic status (SES), which have been shown to affect ambulance use [14]. Future studies should evaluate if, when these covariates are adjusted for, ambulance transport still remains a significant predictor of research refusal.

As the ED increasingly becomes the focal point for addressing several public health challenges, the opioid epidemic notwithstanding, ED-based recruitment efforts should be tailored with the findings from this study in mind.

Table 1
Differences between study participants and refusals, and predictors of refusal to participate in research.

	Agreed to research (n = 299)	Refused research (n = 84)	Odds of refusing research (95% CI)	[a] Adjusted odds of refusing research (95% CI)
Age (p = 0.28)				
Mean (±SD)	28.7(±7.85)	27.7 ± (7.97)	0.98	0.98
Range: 18–45			(0.95, 1.01)	(0.95, 1.01)
Injury type (p = 0.76)				
Isolated concussion	123 (41.1%)	33 (39.3%)	0.93	1.02
Isolated extremity injured	176 (58.9%)	51 (60.7%)	(0.57, 1.52)	(0.60, 1.73)
			ref	ref
Time since injury (p = 0.12)				
≤24 h	221 (73.9%)	69 (82.1%)	1.62	1.40
>24 h	78 (26.1%)	15 (17.9%)	(0.88, 3.00)	(0.73, 2.70)
			ref	ref
Mode of arrival to ED [*](p = 0.02)				
Ambulance	89 (29.8%)	36 (42.9%)	1.77	2.12
Non-ambulance	210 (70.2%)	48 (57.1%)	(1.08, 2.91)	(1.20,3.73)
			ref	ref
Injury mechanism (p = 0.69)				
Assault	30 (10.0%)	8 (9.5%)	[**]ref	[**]ref
Fall	103 (34.5%)	34 (40.5%)	1.13	1.20
			(0.65, 1.96)	(0.69, 2.11)
Motor vehicle/motorcycle/struck	83 (27.8%)	17 (20.2%)	0.70	0.50
			(0.37, 1.34)	(0.24,1.02)
Non-fall sports injury	17 (5.7%)	5 (5.9%)	[**]ref	[**]ref
Other	66 (22.1%)	20 (23.8%)	[**]ref	[**]ref

[*] $p < 0.05$.
[**] Combined to create reference group, n = 146.
[a] All models adjusted for other predictors displayed in table.

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Improving handoff efficiency for admitted patients: A multidisciplinary, lean-based approach

Although Emergency Department (ED) crowding remains a national problem, efforts to improve ED process efficiency and optimize throughput can potentially increase functional ED capacity [1,2]. As a frequently occurring process with potential for significant waste and complexity, handoffs between the ED and inpatient teams represent an opportunity to apply systems improvement science and reduce delays [3,4]. In addition, the inpatient handoff process represents the final bottleneck in patient progression through many EDs and thus is a particularly important area of focus given the theory of constraints and potential effects on ED and hospital capacity utilization [5-7]. Systems engineering methodologies have demonstrated success in other areas of ED process flow [8-10]. Therefore, we hypothesized that a multidisciplinary, Lean-based effort involving different stakeholder groups could achieve improved handoff process efficiency and reduced turnaround times.

We performed a retrospective, before-and-after analysis at an urban, tertiary-care academic medical center with >112,000 annual visits. Patient ED flow follows a relatively standard course of diagnosis and disposition, with an inpatient admission rate of ~25% overall. All adults admitted to the medicine service between 8/1/16–8/1/2018 were included; the intervention occurred 7/10/17. The primary outcome was median overall turnaround time between "bed ready" and patient arrival on the inpatient unit. Secondary outcomes included median provider and nursing handoff times, and patient transport time. Data were collected from a computerized tracking system (EPIC, Verona, WI) and a run chart created to track progress (Tableau, Seattle, WA).

The intervention consisted of multiple, Lean-based process improvement and parallel processing optimizations developed by a multidepartmental team including leadership from Emergency Medicine, Medicine, Nursing, Admitting, and Patient Transport. Four workgroups focused on: (1) communicating expected discharges to Admitting earlier, (2) nursing handoff optimization, (3) provider handoff optimization, and (4) transport process optimization. Process optimization components included improved communication efficiency, utilizing planned discharge patient lead time to start the new patient handoff process, and performing provider handoff when the patient was assigned to a bed, even if the bed remained 'dirty' (not yet ready to accept the patient in transfer). Median turnaround times were compared using Mann-Whitney *U* Test for significance.

Post-intervention, improvement was noted in all metrics. Overall median time from "bed ready" to patient on-unit arrival decreased by 30 min (101 to 71 min, $p < 0.01$). Median provider handoff time decreased 33 min (52 to 18 min, $p < 0.01$). Nursing handoff and transport times decreased 9 min (35 to 26 min, $p < 0.01$) and 5 min (32 to 27 min, $p < 0.01$), respectively (Fig. 1). This represented a cumulative gain of ~10 ED bed hours daily.

In this pilot study, a multidisciplinary group utilizing Lean methodologies and parallel processing techniques successfully and sustainably decreased the overall median time from bed ready to patient arrival on an inpatient unit. Given the significant inpatient capacity constraints

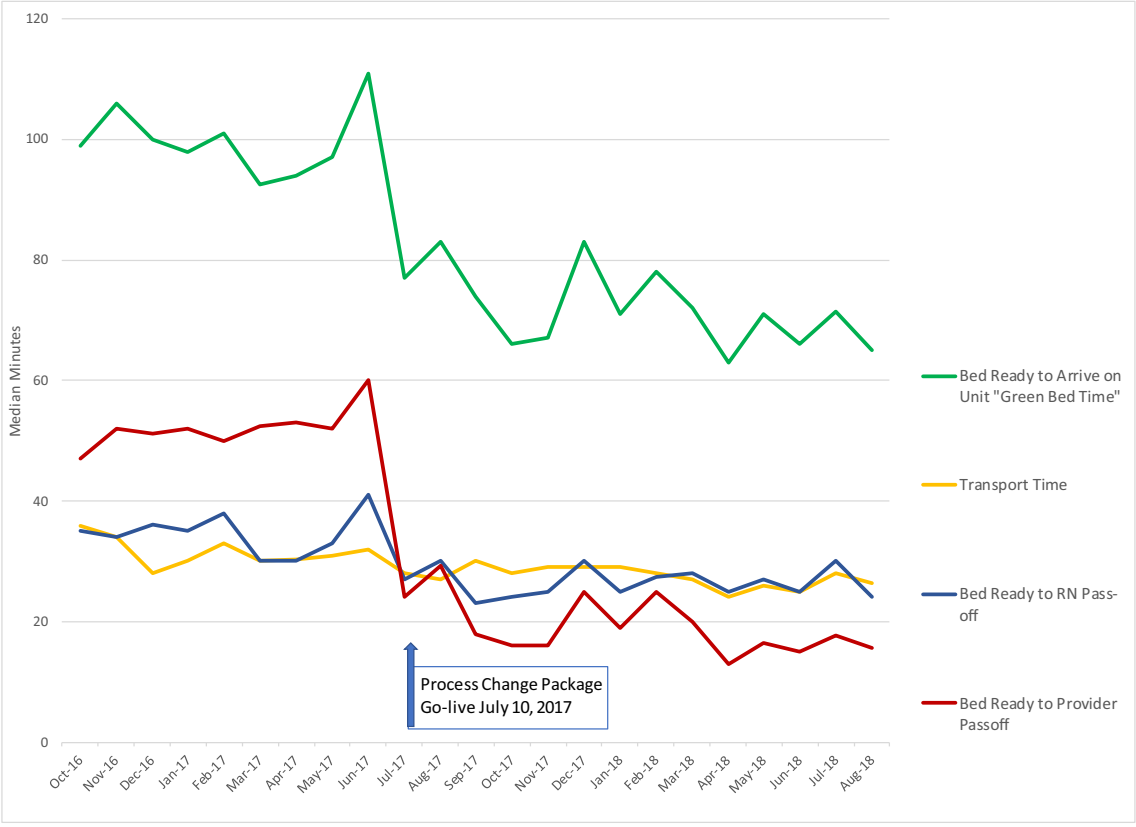

Fig. 1. Handoff process times.