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## Geriatric Emergency Department Innovations: Transitional Care Nurses and Hospital Use

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## Geriatric Emergency Department Innovations: Transitional Care Nurses and Hospital Use

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### Abstract

**Background / Objective:** Improving care transitions for older emergency department (ED) patients may result in more effective and efficient health care utilization. To examine the impact of an ED-based transitional care nurse (TCN) on hospital utilization.

**Design:** Prospective observational cohort.

**Setting:** 3 United States (NY, IL, NJ) EDs from 1/1/13 – 6/30/15

**Participants:** 57,287 unique ED patients age 65+.

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Author Contributions:

Ula Hwang, George Loo, Jeremy Sze, and Carmen Vargas-Torres had access to the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Ula Hwang, George Loo, Melissa Garrido, Jeremy Sze, Carmen Vargas-Torres are responsible for the data analysis. All remaining authors participated in the study concept and design, interpretation of data, and preparation of manuscript.

**Intervention:** The intervention was first TCN contact for a unique patient. Control patients were never seen by a TCN during the study period.

**Measurements:** We examined sociodemographic and clinical characteristics associated with both TCN use and outcomes. The primary outcome was inpatient admission during the index ED visit (admission on Day 0). Secondary outcomes included cumulative 30-day admission (any admission on Days 0–30), and 72 hour ED revisits.

**Results:** 5,930 (10%) patients were seen by a TCN and 42% were admitted. After accounting for observed selection bias using entropy balance, results showed that compared to patients discharged without a 72-hour ED revisit, TCN was associated with reduced risk of admission (site 1: -9.9% risk of inpatient admission (95% CI = -12.3%, -7.5%), site 2: -16.5% (-18.7%, -14.2%), site 3: -4.7% (-7.5%, -2.0%)). TCN patients had increased risk of 72-hour ED revisits for two sites (site 1: 1.5% (0.7%, 2.3%), site 2: 1.4% (0.7%, 2.1%)). Risk of any admission within 30 days of the index ED visit remained reduced for sites 1 and 2 (site 1: -7.8% (-10.3%, -5.3%), site 2: -13.8% (-16.1%, -11.6%)).

**Conclusion:** Targeted evaluation by geriatric ED transitions of care staff may be an effective delivery innovation to reduce risk of inpatient admission.

### Keywords

emergency department; transitions of care; admission

## INTRODUCTION

### Background:

The U.S. healthcare system is simultaneously challenged by rising inpatient costs, and inefficient and inequitable care with variable application of evidence-based practices. One of the most vulnerable populations, geriatric patients, may be significantly affected by these pressures at times of acute illness or injury.<sup>1</sup> An emergency department (ED) visit is often described as a sentinel event signifying a breakdown in care coordination for older adults.<sup>2, 3</sup> With the ED at the crossroads of multiple healthcare settings, it has been described as “a portal of entry to inpatient care.”<sup>4–7</sup> Unfortunately, both hospitalization and being discharged from the ED carry significant risks for older patients that include iatrogenic complications, functional and cognitive decline, and loss of independence.<sup>8–14</sup> This highlights the importance of greater care to support transitions from the ED.

To address these challenges, programs like Geriatric Emergency Department Innovations in Care through Workforce, Informatics, and Structural Enhancements (GEDI WISE) have developed. GEDI WISE was a Center for Medicare & Medicaid Innovation (CMMI) Health Care Innovation Award program (1C1CMS331055–01).<sup>15</sup> It is a model of geriatric emergency care in 3 large, urban hospitals [ Mount Sinai Medical Center (MSMC) in New York, NY, St. Joseph’s Regional Medical Center (SJRMC) in Paterson, NJ, and Northwestern Memorial Hospital (NMH) in Chicago, IL] that operationalizes the structural and process interventions of the Geriatric ED guidelines endorsed by national geriatric and emergency medicine organizations.<sup>16</sup> GEDI WISE targets older ED patients using geriatric

clinical protocols, informatics for patient monitoring and clinical decision-making, and structural enhancements to meet the triple aim of improved geriatric emergency care, improved geriatric patient health, and reduced health care costs. GEDI WISE includes an ED-based transitional care nurse (TCN) program to identify patients with geriatric specific health-related needs and coordinate their ED to home transition with the goal of avoiding inpatient admissions.

**Objective:**

The objective of this study was to evaluate the effect of TCN exposure during an ED visit on risk of inpatient admission, subsequent admission, and ED revisits. We hypothesized patients seen by a TCN would have reduced risk of admission, subsequent admission, but may have increased ED revisits.

**METHODS****Study Design, Setting and Participants**

This was a prospective observational cohort study of unique patients, 65 years and older with an ED visit at a GEDI WISE hospital during the program implementation period (January 1, 2013 to July 30, 2015 for MSMC and SJRMC; April 1, 2013 to July 30, 2015 for NMH).(See Table 1.).

To evaluate the impact of the TCN intervention, patients exposed to the TCN at least once during the study period were included in the intervention group. Patients with no TCN contact during the study period were in the control group. All comparisons were performed with the unit of analysis restricted to the first TCN contact for the treated group and the first ED visit for the control group (henceforth defined as the *index visit*) during the study period. Analyses were stratified by site using standardized data for all 3 sites.

**Intervention:**

The GEDI WISE TCN intervention consisted of emergency nurses trained to facilitate care transitions of older adults in the ED to the community with the goal of avoiding inpatient admission, when possible. This included evaluation of functional and cognitive impairment, physical frailty, and medical complexities common in older patients that often limit their ability to navigate the outpatient healthcare system. Sites customized the TCN intervention to address patient needs and site-specific resources available, reflecting best practices for implementation projects. The TCN model at NMH and MSMC have both been previously described.<sup>17, 18</sup>

At all sites, the TCN position was staffed by a nurse or nurse practitioner. Patients targeted by the TCN were assessed for cognitive function (Short Portable Mental Status Questionnaire,<sup>19</sup> or Mini-Cog<sup>20</sup>), delirium (Confusion Assessment Method,<sup>21</sup> Richmond Agitation Sedation Scale,<sup>22</sup> or CAM-ICU<sup>23</sup>), functional status (Katz Activities of Daily Living),<sup>24</sup> falls risk (Timed Up and Go test),<sup>25</sup> care transitions (Care Transitions Measure-3),<sup>26</sup> and caregiver strain (Modified Caregiver Strain Index). Choice of GEDI WISE

assessments were based on pre-existing hospital programs already implemented or staff choice.

The TCN initiated interdisciplinary ED geriatric care utilizing resources available to the ED based on physical, functional, cognitive, or other needs identified during the GEDI WISE assessment. Thus, the assessments and transitional care needs of the patient determined the extent of ED resources delivered to patients - some required little support, others required extensive transitional resources. All TCN interactions were recorded in the medical record or in logs kept by staff and imported to a secure database from the institutions' data warehouses.

The TCN intervention had limited staffing and thus targeted patients based on criteria or availability. At MSMC, patients with Identification of Senior At Risk score (ISAR)<sup>27</sup> scores 4, Emergency Severity Index (ESI)<sup>28</sup> 3, hospital discharge 30 days prior to the index ED visit, or request by ED clinicians were eligible to be seen by the TCN who was available 7 days a week, 11a-8p. At NMH, patients with ISAR score of 3, or request of the ED clinicians during weekdays from 9a-8p were seen by the TCN. At SJRMC, all patients 65+ years in age placed in their Geriatric ED zone were evaluated weekdays, 9a-5p. For all sites, patients were evaluated by the TCN only when available. Thus, many did not receive the intervention for reasons unrelated to patient risk factors but were similar to those who did receive the intervention. We sought to identify these control patients eligible for the TCN intervention, similarly sick, with similar likelihood of discharge, but not see by the TCN.

Intervention patients were defined as having ANYTCN contact, *regardless* of duration or extent of geriatric care provided. TCN contact was identified by: medical record reports, consult requests, if the patient visit was in the TCN logs, or if a TCN geriatric assessment was documented.

#### **Data:**

Data were collected from electronic health record reports and institution data warehouses. Through a data use agreement, NMH and SJRMC transmitted files securely to MSMC to create a standardized 3-site database. There were 58,310 unique patient ED visits during the study period.. Since patients with high acuity were not targeted by the TCN, our analysis focused on 57,287 patients with an ESI score >1.

#### **Utilization Outcomes:**

The primary outcome was inpatient admission on the index ED visit (admission on Day 0). Observation admissions were excluded since this was not available at all sites. Secondary outcomes for patients discharged during the index ED visit included any subsequent 72 hour ED revisit and any inpatient admission within 30 days of the index ED visit.

#### **Analysis:**

Analyses were conducted by site; data were not pooled because hospitals varied in clinical implementation, TCN workflow, as well as duration of Geriatric ED (GED) programs (e.g., SJRMC had a GED program since 2009, while NMH began in 2013).

Patients receiving and not receiving TCN contact may have differed in systematic ways that could bias our intervention effect estimates if not accounted for in analyses. To account for selection bias and ensure patients in our intervention and control groups were as similar as possible, we used entropy balancing<sup>29–31</sup> to obtain a weighted comparison group with similar covariate means and distributions as the TCN (intervention) group for each site. We estimated multivariable regression models on the weighted datasets.

**Entropy balancing**—In entropy balancing, treated individuals (TCN intervention) are assigned a weight of one. Comparison (control) individuals are assigned weights so that in the aggregate, the means of dichotomous variables and the mean and variance of continuous variables are equal across the treated and comparison individuals. Weights for comparison individuals are then normalized so that their sum equals the number of treated individuals. Entropy balancing is akin to survey weighting, in which weights are assigned to respondents so that their characteristics are representative of the population from which they were derived.<sup>29</sup> Entropy balancing allowed us to create a comparison control group similar to the TCN group, except for receipt of the TCN intervention.<sup>31, 32</sup>

Our treatment and comparison groups were balanced on the following (measured during the index ED visit): risk of adverse outcome [Emergency Severity Index = 2 (more urgent), 3, 4–5 (less urgent);<sup>28</sup> ISAR = 0–1 vs. ISAR = 2<sup>27</sup>], likelihood of not encountering TCN interventions [index ED visit occurred during evening hours (9p–9a) or the weekend (yes/no); if the patient was placed in a geriatric ED structural environment (yes/no)], overall clinical status [discharge from hospital in previous 30 days; Charlson comorbidity scores (0, 1, 2, 3, 4);<sup>33</sup> the 6 most common chief complaints at all sites for older patients (pain, falls, difficulty breathing, weakness, altered mental status, or psychiatric)], and sociodemographic characteristics [age; sex]. Balance in covariates across treatment groups was assessed by standardized differences, with differences of less than 10% considered ideal.

**Regression models**—Adjusted regression models on weighted samples allowed us to account for potential covariate imbalance that could remain after entropy balancing, allowing a doubly robust estimation.<sup>36, 37</sup> Models included all covariates used to create entropy balance weights.<sup>34, 35</sup> Within each site, we estimated a multinomial logistic regression model to examine the relationship between TCN intervention and 3 potential outcomes: discharge with no ED revisit within 72 hours (the ideal outcome and reference category), discharge with an ED revisit within 72 hours, and hospital admission. Results are presented as average incremental marginal effects (AME) by percentage (i.e., mean change in likelihood of hospital admission when a patient is moved from the control group to the TCN group, holding all other covariates at their weighted values). Logistic regression was used to examine the relationship between TCN intervention and hospital admission within 30 days. Sensitivity analyses were completed restricting our sample to ED patients during the day hours and weekdays. (Results available in Supplemental Materials, Supplementary Table S1)

All analyses were conducted with Stata 14.2 (Stata Corp; College Station, TX). This evaluation was approved by institutional review boards at all 3 sites.

## RESULTS

During the study period, 57,287 unique patients, 65 years in age with an ESI >1 made 120,221 ED visits at the 3 participating hospitals. Ten percent were exposed to a TCN (10% (2,137 of 21,293 visits) at MSMC; 12% (2,406 of 20,040 visits) at NMH; 9% (1,387 of 15,654 visits) at SJRMC). During the study period, average rates of Day 0 inpatient admission by patients ESI>1 and 65 years and older was 42% (46% for MSMC, 35% for NMH, and 44% for SJRMC).

With entropy balancing, we created weighted comparison groups for each site that were similar to the TCN group, except for receipt of the TCN intervention (Table 2.). After balancing, standardized differences in risk for adverse outcomes, clinical characteristics, and sociodemographics approached 0 (Figure 1.).

In bivariate analyses of balanced samples, patients receiving TCN care on their first index ED visit had significantly lower Day 0 inpatient admission rates than control patients at all 3 hospitals (MSMC: 36% TCN vs. 46% control,  $p<0.0001$ ; NMH: 36% vs. 53%,  $p<0.0001$ ; SJRMC: 46% vs. 51%,  $p=0.01$ ). For TCN patients discharged from the ED during the index visit compared to control patients, there was an increased rate of 72 hour ED revisit at MSMC (3% TCN vs. 2% control,  $p=0.03$ ) but not for SJRMC (3% vs. 2%,  $p=0.77$ ) nor NMH (3% vs. 1%,  $p=0.06$ ). Lower rates of any inpatient admission from Days 0–30 for TCN patients were sustained at both MSMC (43% TCN vs. 51%,  $p<0.0001$ ) and NMH (42% TCN vs. 56%,  $p<0.0001$ ) but not at SJRMC (52% vs. 53%,  $p=0.43$ ).

In multivariable logistic regression models, many of these findings persisted. From the multinomial model, TCN patients from all sites were less likely to require a Day 0 inpatient admission relative to patients discharged with no 72 hour ED revisits (MSMC average marginal effect (AME)  $-9.9\%$  (95% CI  $-12.3, -7.5$ ); NMH AME  $-16.5\%$  ( $-18.7, -4.2$ ); SJRMC AME  $-4.7\%$  ( $-7.5, -2.0$ )). For patients at MSMC and NMH, there was an increased risk of 72 hour ED revisit for TCN patients relative to patients who were discharged with no revisits (MSMC AME  $1.5\%$  (0.7, 2.3); NMH AME  $1.4\%$  (0.7, 2.1)), but not for SJRMC. From the logistic regression, patients at MSMC and NMH, were less likely to have any inpatient admission the subsequent 30 days (MSMC AME  $-7.8\%$  ( $-10.3, -5.3$ ); NMH AME  $-13.8\%$  ( $-16.1, -11.6$ )). (Table 3).

## DISCUSSION

At a time of increasing pressure to deliver efficient healthcare to an aging population that often requires greater services, opportunities to improve quality and reduce utilization are needed. With over a third of U.S. outpatient care delivered in the acute care setting,<sup>36</sup> the ED is a significant medical decision maker, conduit for inpatient admissions, and setting from which not only safety net care is delivered, but where care transition programs can be integrated.<sup>37</sup>

In this study, patients exposed to a transitional care nurse had a significantly reduced risk of inpatient admission during the index ED visit at all 3 hospitals and for 2 of the 3 hospitals, this risk persisted over the subsequent 30 days. We anticipated that an initiative designed to



decrease inpatient admissions might result in greater ED utilization if the discharge was unsuccessful. This occurred at 2 of the hospitals, however the likelihood of admission from Day 0–30 remained lower for the TCN group. At a time when the national average for ED admissions with older adults is 1 in 3,<sup>38</sup> ED-based programs able to reduce this risk is significant - especially at these hospitals with higher than national average rates of admission for older patients (35–46%). At the GEDI WISE hospitals, the TCN saw ~10% of the ED patients and was able to reduce the risk of admission for these patients by 5–17% when compared to control patients.

The ED-based TCN intervention is unique in its focus on averting inpatient admissions for older adults *while* in the ED. Hospital and community-based care coordination programs aimed at improving outcomes and reducing unnecessary healthcare use for older adults have proliferated over the last 2 decades. Evidence of impact by these programs on admissions is mixed,<sup>39, 40</sup> and none of these programs have been ED-based with a strategy to avoid hospitalization *during* the ED visit. Other ED-based programs have focused on coordination of care and transitions at the end of an ED visit or post-ED discharge of patients expected to be or already discharged from the ED - when there is limited or no time to avoid hospitalization from the ED for those already admitted.<sup>41</sup> Fortunately, some programs have demonstrated early evidence of success with comprehensive geriatrics assessments and/or interdisciplinary teams that have kept discharged patients from future admissions and ED visits.<sup>42–44</sup> These studies, however, were limited in terms of single-site evaluation and methodology or were not systematically evaluated for impact.<sup>40, 41</sup> None of these programs attempted to avert and analyze inpatient admissions for older adults presenting to the ED.

To our knowledge, this is the first study to show a significant decrease in hospitalization risk through an ED-based geriatric assessment and care transitions program.<sup>45</sup> Many patients seen in the ED setting appropriately require inpatient admission, and older adults have higher rates of admission than the general population.<sup>46</sup> Retrospective review of existing hospitalization data, however, indicates many of these are potentially avoidable.<sup>47</sup> Hospitalization for older adults carries significant risks of iatrogenic complications including potentially inappropriate medication prescribing.<sup>8</sup> Both during and after a hospitalization, many older patients experience functional decline and deconditioning, worsened quality of life, cognitive decline, and loss of independence.<sup>9–13</sup> Over 30% of older patients develop hospitalization-associated disability. After an acute admission, many patients do not return to their previous functional state and often acquire additional geriatric syndromes.<sup>13</sup> Although potentially preventable admissions have decreased over the past decade, the basis for this decrease remains uncertain and the challenge remains in providing assessments and programs to support the safe discharge of older adults from the ED. The ED may play a significant role in changing the trajectory of an older patient's risk to the adverse effects and sequelae of hospitalization.

This study has several limitations. Although entropy balancing was used to account for observed selection bias, there may still be unobserved confounders associated with TCN use and utilization outcomes. Outcomes for patients that may have gone to other hospitals could not be evaluated. Exposure to the intervention was defined as patients who had any contact from the TCN. The degree in which the TCN provided and facilitated care transitions for the

individual patient were not measured. The implementation and operationalization of the TCN intervention, which patients they saw, and what resources were available to older patients varied across the 3 sites. These differences, along with duration of geriatric emergency care programs at each site may account for the variation seen on outcomes. The reduction in hospital admission at SJRMC was only modest when compared to the other 2 hospitals. This impact attenuated and became insignificant over the subsequent 30 days. SJRMC, however, had a Geriatric ED program for several years prior to the implementation of the GEDI WISE programs. The baseline opportunity for improvement may have already changed with earlier programs and may have been susceptible to contamination bias. Analyses also could not account for other programs and policies at the hospitals that may have influenced the outcomes presented (e.g., other departmental transition programs, policies targeting inpatient admissions). It is for these reasons analyses were stratified by site and not pooled. However, even with the known variability in intervention implementation not only by site and within site, we observed a consistent and significantly reduced risk of admission for patients seen by a TCN, strengthening our results that may be conservative. Our approach of evaluating only the first TCN contact, regardless of intensity, likely provides conservative estimates of the intervention's potential impact on outcomes evaluated here. Further research is needed to observe and evaluate how TCN care is provided, what elements of the care transitions processes and care coordination were delivered, and amount of time spent on each patient and link which of these are associated with better patient outcomes. These findings should be replicated with a randomized control trial in the ED setting to demonstrate causal effect.

In summary, programs focused on improving care transitions for older patients seen in the ED may be an effective model to reduce risk of inpatient admission during an ED visit (and the following 30 days), though may lead to an increase in ED revisit rates. Targeted evaluation by clinically trained nursing staff focused on improving the ED transitions of care may be an effective delivery innovation to reduce likelihood of hospital admission, reduce subsequent complications, loss of function and independence associated with hospitalizations, and potentially reduce costly inpatient care.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication were supported by West Health Institute.

## Appendix

### Conflict of Interest Checklist:

Elements of Financial/Personal Conflicts	*UH		SMD		MSR		MMG	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X	X			
					ACEP BOARD OF DIRECTORS MEMBER			

Elements of Financial/Personal Conflicts	*UH		SMD		MSR		MMG	
	Yes	No	Yes	No	Yes	No	Yes	No
Patents		X		X		X		X
Personal Relationship		X		X		X		X
Elements of Financial/Personal Conflicts	GL		JS		SG		DMC	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X	X	
							SAEM BOARD OF DIRECTORS, PRESIDENT	
Patents		X		X		X		X
Personal Relationship		X		X		X		X
Elements of Financial/Personal Conflicts	RK		CZ		CVT		CRG	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X

Elements of Financial/Personal Conflicts	*UH		SMD		MSR		MMG	
	Yes	No	Yes	No	Yes	No	Yes	No
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X
Elements of Financial/Personal Conflicts	LDR		Author 2		Author 3		Etc.	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X						
Grants/Funds		X						
Honoraria		X						
Speaker Forum		X						
Consultant		X						
Stocks		X						
Royalties		X						
Expert Testimony		X						
Board Member		X						
Patents		X						
Personal Relationship		X						

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**Impact Statement:**

We certify that this work is novel of recent clinical research and demonstrates that ED-based transitional care clinicians may impact and reduce risk of hospital admission for older adults seen in the emergency care setting.

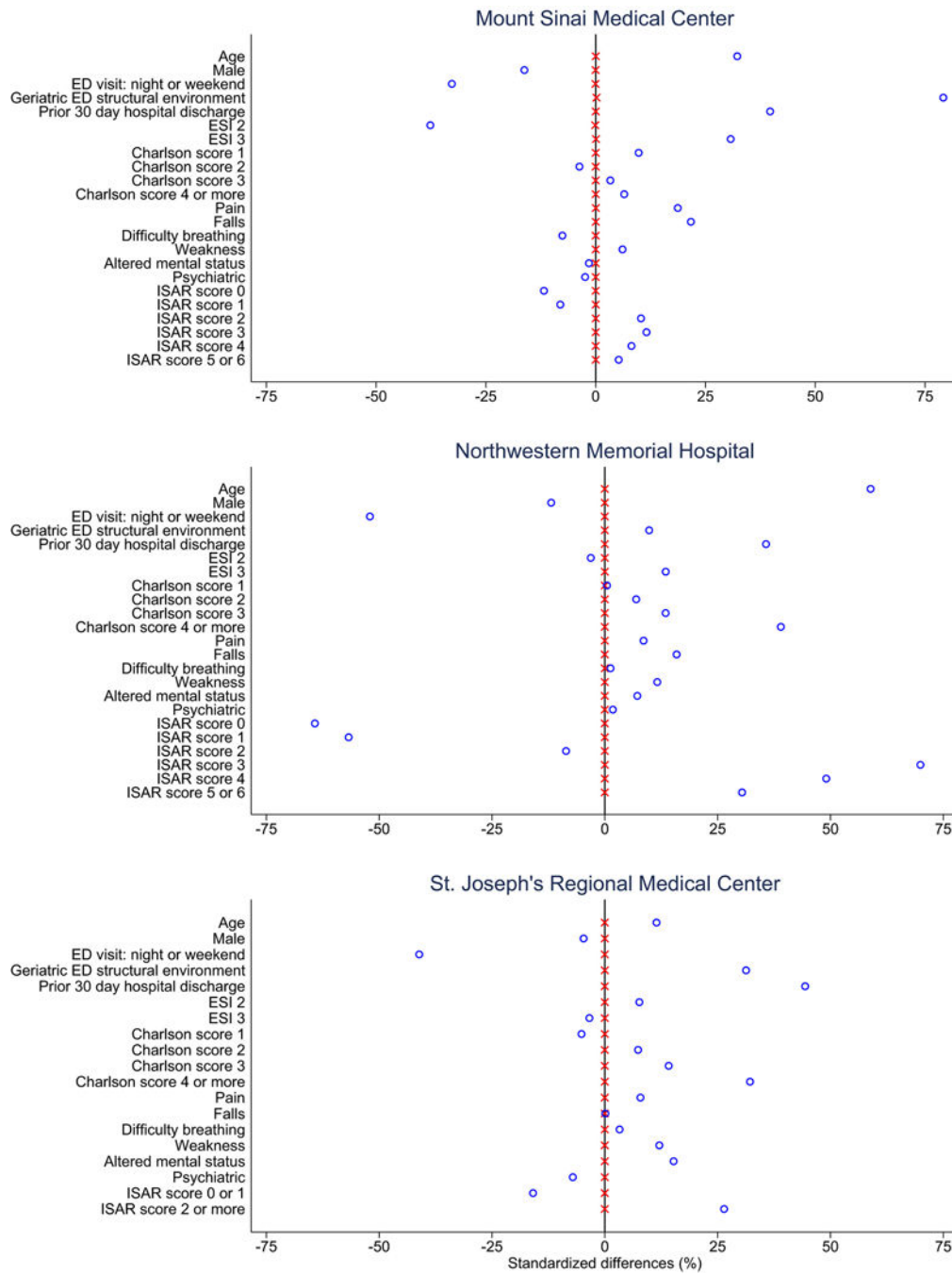
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**Figure 1.** Entropy balancing resulted in improved covariate balance (smaller absolute value of standardized difference) across treatment and comparison groups for each site

**Table 1.**

## GEDI WISE Site Characteristics (2013–2015)

Hospital	Mount Sinai Medical Center (MSMC)	Northwestern Memorial Hospital (NMH)	St. Joseph's Regional Medical Center (SJRMCC)
Annual ED visits all ages	109,258	86,998	157,413
Annual ED visits by ages 65+	18,574 (17%)	16,530 (19%)	16,218 (10%)
Location	New York, NY	Chicago, IL	Paterson, NJ
Total # hospital beds	1,127	881	651
Total # ED beds	48	64	88
Geriatric ED structural beds	10	28	24
Race/ethnicity (%)	White 36 Black 40 Hispanic 24 Other <1	White 63 Black 35 Hispanic 7 Other 2	White 14 Black 26 Hispanic 47 Other 10
ESI (most acute) Level 1 (%)	<1	1	1
2 (%)	16	37	18
3 (%)	46	40	54
4 (%)	29	20	23
(least acute) 5 (%)	8	2	2
# Transitional Care Nurses	2	4	2
# ED Physicians and mid-level practitioners (PA = Physician Assistant NP = Nurse Practitioner)	Attending MDs: 39 EM Residents: 60 PAs: 6	Attending MDs: 33 EM Residents: 48 PAs: 1; NPs: 2	Attending MDs: 55 EM Residents: 24 PAs: 1; NPs: 7
# ED Nurses	92	120	119
# ED Social Work	4	0.5	1
# ED pharmacists	5	1	1
Electronic medical record	EPIC	Cerner	MedHost

**Table 2.**

Comparison of Weighted Controls and TCN Intervention By Site (Unique First Time ED visits)

Variables	Mount Sinai Medical Center (MSMC)			Northwestern Memorial Hospital (NMH)			St. Josephs Regional Medical Center (SJRCM)		
	Weighted Control	Weighted TCN Intervention	Standardized Differences	Weighted Control	Weighted TCN Intervention	Standardized Differences	Weighted Control	Weighted TCN Intervention	Standardized Differences
	N= 2,137	N=2,137		N= 2,406	N=2,406		N= 1,387	N=1,387	
Age, mean years (sd)	78.9 (8.9)	78.9 (8.6)	0.0	79.0 (9.0)	79.0 (8.4)	0.0	76.4 (8.4)	76.35 (8.5)	0.0
Male (%)	748.2 (35.0)	748.0 (35.0)	0.0	898.0 (37.3)	898.0 (37.3)	0.0	552.0 (39.8)	552.0 (39.8)	0.0
ED visit night or weekend presentation (%)	513.5 (24.0)	513.0 (24.0)	0.1	464.0 (19.3)	464.0 (19.3)	0.0	352.0 (25.4)	352.0 (25.4)	0.0
ESI 2 (%)	398.8 (18.7)	398.0 (18.6)	0.1	1,203.0 (50.0)	1,203.0 (50.0)	0.0	1,054.0 (76.0)	1,054.0 (76.0)	0.0
ESI 3 (%)	1,535.34 (71.9)	1,536.0 (71.9)	0.1	983.0 (40.9)	983.0 (40.9)	0.0	245.0 (17.7)	245.0 (17.7)	0.0
ED visit occurring in a geriatric ED structural environment (%)	1,527.4 (71.5)	1,529.0 (71.6)	0.2	995.0 (41.4)	995.0 (41.4)	0.0	1,015.0 (73.2)	1,015.0 (73.2)	0.0
Prior 30 day hospital discharge (%)	187.9 (8.8)	188.0 (8.8)	0.0	318.0 (13.2)	318.0 (13.2)	0.0	183.0 (13.2)	183.0 (13.2)	0.0
ISAR 0–1 (%)	768.0 (35.9)	768.0 (35.9)	0.1	448.0 (18.6)	448.0 (18.6)	0.0	129.0 (9.3)	129.0 (9.3)	0.0
ISAR 2 or MORE (%)	1,369.0 (64.1)	1,369.0 (64.1)	0.0	1,958.0 (81.4)	1,958.0 (81.4)	0.0	423.0 (30.5)	423.0 (30.5)	0.0
Charlson 1 (%)	528.0 (24.7)	528.0 (24.7)	0.0	424.0 (17.6)	424.0 (17.6)	0.0	376.0 (27.1)	376.0 (27.1)	0.0
Charlson 2 (%)	316.0 (14.8)	316.0 (14.8)	0.0	296.0 (12.3)	296.0 (12.3)	0.0	259.0 (18.7)	259.0 (18.7)	0.0
Charlson 3 (%)	254.0 (11.9)	254.0 (11.9)	0.0	240.0 (10.0)	240.0 (10.0)	0.0	166.0 (12.0)	166.0 (12.0)	0.0
Charlson 4 or more (%)	512.0 (24.0)	512.0 (24.0)	0.0	627.0 (26.1)	627.0 (26.1)	0.0	222.0 (16.0)	222.0 (16.0)	0.0
Chief Complaint: Pain (%)	360.8 (16.9)	361.0 (16.9)	0.0	353.0 (14.7)	353.0 (14.7)	0.0	200.0 (14.4)	200.0 (14.4)	0.0
Chief Complaint: Falls (%)	258.9 (12.1)	259.0 (12.1)	0.0	298.0 (12.4)	298.0 (12.4)	0.0	129.0 (9.3)	129.0 (9.3)	0.0
Chief Complaint: Difficulty Breathing (%)	129.1 (6.0)	129.0 (6.0)	-0.0	136.0 (5.7)	136.0 (5.7)	0.0	109.0 (7.9)	109.0 (7.9)	0.0

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Variables	Mount Sinai Medical Center (MSMC)			Northwestern Memorial Hospital (NMH)			St. Josephs Regional Medical Center (SJRMC)		
	Weighted Control	Weighted TCN Intervention	Standardized Differences	Weighted Control	Weighted TCN Intervention	Standardized Differences	Weighted Control	Weighted TCN Intervention	Standardized Differences
Chief Complaint: Weak (%)	128.0 (6.0)	128.0 (6.0)	0.0	114.0 (4.7)	114.0 (4.7)	0.0	97.0 (7.0)	97.0 (7.0)	0.0
Chief Complaint: Altered Mental Status (%)	58.0 (2.7)	58.0 (2.7)	0.0	70.0 (2.9)	70.0 (2.9)	0.0	74.0 (5.3)	74.0 (5.3)	0.0
Chief Complaint: Psychiatric (%)	43.0 (2.0)	43.0 (2.0)	0.0	63.0 (2.6)	63.0 (2.6)	0.0	51.0 (3.7)	51.0 (3.7)	0.0

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**Table 3:**

Percentage change in Day 0 inpatient admissions; discharges with subsequent 72 hour ED visits from multinomial logistic model; and any admission in the 30D following ED discharge associated with TCN intervention from logistic model.

Outcome (%)	MSMC		NMH		SJRMC	
	Impact of TCN vs. Control	95% CI	Impact of TCN vs. Control	95% CI	Impact of TCN vs. Control	95% CI
*Discharged With No Repeat 72 Hour ED Visit	Ref		Ref		Ref	
*Inpatient Admission (Day 0)	-9.90	-12.31, -7.47	-16.46	-18.68, -14.24	-4.72	-7.47, -1.98
*Discharged With Subsequent 72 Hour ED Visit	1.49	0.65, 2.33	1.38	0.65, 2.12	0.37	-0.53, 1.28
**Any Inpatient Admission (Day 0 – 30)	-7.79	-10.33, -5.25	-13.82	-16.07, -11.58	-1.38	-4.04, 1.27

Results obtained from

\* multinomial logistic regression models or

\*\* logistic regression models, which were adjusted for age, male, index ED visit during evening hours (9p-9a) or on weekend day, Emergency Severity Index (2, 3), use of a geriatric ED structural environment during the index ED visit, discharge from a hospital admission in the prior 30 days, Charlson comorbidity scores, Chief complaints related to pain, falls, difficulty breathing, weakness, altered mental status and psychiatric, Identification of Seniors Risk Score.