


Integration of Geriatrician Consultation for Trauma Admissions May Benefit Patient Outcomes

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Abstract

Objective: Geriatric admissions to trauma centers have increased, and in 2013, our center integrated geriatrician consultation with the management of admitted patients. Our goal is to describe our experience with increasing geriatric fall volume to help inform organized geriatric trauma programs. **Method:** We retrospectively analyzed admitted trauma patients ≥ 65 years old, suffering falls from January 1, 2006, to December 31, 2017. We examined descriptive statistics and changes in outcomes after integration. **Results:** A total of 1,335 geriatric trauma patients were admitted, of which 1,054 (79%) had suffered falls. Falls increased disproportionately (+280%) compared with other mechanisms of injury (+97%). After 2013, patient discharge disposition to skilled nursing facility decreased significantly (−67%, $p < .001$), with a concomitant increase in safe discharges home with outpatient services. Regression analysis revealed association between integration of geriatrician consultation and outcomes. **Discussion:** Geriatrician consultation is associated with optimized discharge disposition of trauma patients. We recommend geriatrician consultation for all geriatric trauma activations.

Keywords

clinical geriatrics, falls, institutionalization, rehabilitation

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Background

Among the geriatric population in the United States, falls are the most common mechanism of injury (MOI) for unintentional nonfatal injury and are also a frequent cause of mortality (Kramarow, Chen, Hedegaard, & Warner, 2015). Annually, falls affect one third of adults above 65 years of age and half of adults above 80 years of age (Peel, 2011). Of these falls, one out of five leads to a severe bony fracture or brain injury (Peel, 2011).

Vision impairment, environmental risk factors, osteoporosis, medical comorbidities, physical debility, and polypharmacy contribute to an increased risk of geriatric falls (Ambrose, Paul, & Hausdorff, 2013; Grundstrom, Guse, & Layde, 2012; Tuunainen, Rasku, Jantti, & Pyykko, 2014). Furthermore, the risk of falling more than doubles after a geriatric patient has fallen once (Ambrose et al., 2013; Grundstrom et al., 2012; Tuunainen et al., 2014). An analysis by Goldberg, McCreedy, Gettel, and Merchant (2017) found that fewer than 10% of geriatric fall patients in the emergency department were evaluated by a geriatrician, physical therapist, or occupational therapist, and two

thirds of patients reported making no preventive changes after a fall.

Multiple recent studies have demonstrated a significant increase in geriatric fall-related injuries and mortality worldwide (Fairfax, Hsee, & Civil, 2015; Shankar, Liu, & Ganz, 2017; Wendelboe & Landen, 2011). In the United States, the direct medical costs of such injuries are US\$30 billion annually if nonfatal and US\$616 billion if fatal. These numbers are expected to increase as the population ages (Burns, Stevens, & Lee, 2016).

Trauma centers may make efforts to identify, classify, and manage this escalating frequency of geriatric injuries. The objective of this study was to describe

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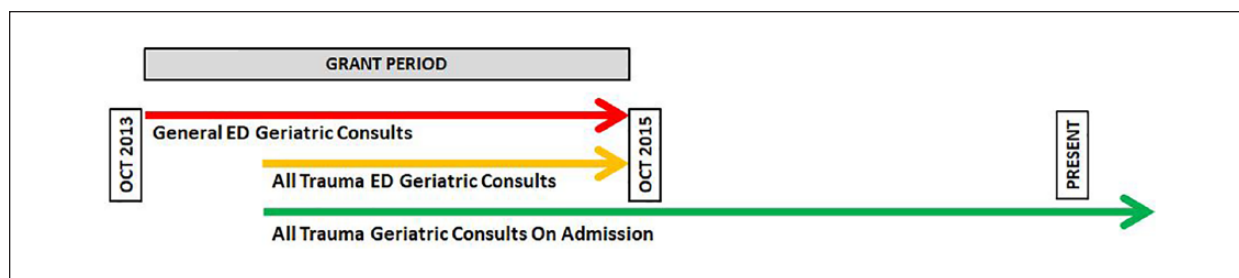


Figure 1. Schematic of integration of geriatrician consultation for trauma service patients.

Note. During the grant period, all ED geriatric patients had access to a daytime GNP stationed in the ED (red arrow). All geriatric trauma service patients began receiving daytime contact with the GNP (yellow arrow). Concurrently and through the present, all geriatric trauma service patients admitted to the hospital receive early consultation with a GNP or geriatric physician (green arrow). ED = emergency department; GNP = geriatric nurse practitioner.

associations of integration of geriatrician consultation with outcomes of geriatric patients suffering falls who were admitted to an urban trauma center. We hope to inform optimal practice patterns as they relate to integrated geriatric trauma programs.

Method

SBH Health System is a 350-bed American College of Surgeons–verified Level 2 trauma center in the southwest Bronx in New York City, treating a predominantly underserved urban population. In October 2013, under a grant by the Fan Fox and Leslie R. Samuels Foundation, SBH Health System stationed a geriatric nurse practitioner (GNP) in the emergency department during weekdays 8 a.m. to 5 p.m. This GNP was available for geriatrician consultation at the discretion of attending physicians.

Early during the grant period, the trauma surgery team established a standing plan for the GNP to consult every trauma patient ≥ 65 years old who presented as a trauma activation of any level. For geriatric trauma patients admitted during nights and weekends, geriatrician consultation was called immediately upon admission. The practice pattern change of early geriatrician consultation with consultation request placed at initial encounter with the trauma surgery team continued beyond the grant period. After the grant period ended, geriatrician consultations were serviced by in-house GNPs and attending geriatricians (Figure 1).

Content of geriatrician consultation was not regimented. However, geriatrician consultation care themes were noted during chart review, including management of polypharmacy, recommendations for appropriate physical and occupational therapy consultations, advance health care directives, and focus on discharge planning. These themes were also often documented in trauma surgery team progress notes more frequently as the integration of geriatrician consultation with trauma surgery team matured.

To assess potential benefits of the grant intervention and subsequent practice pattern change, we retrospectively abstracted all trauma patients ≥ 65 years old from our prospectively accrued trauma registry. Abstracted

data included demographics, MOI, medical comorbidities, Injury Severity Scores (ISSs), International Classification of Disease (ICD) Codes 9 and 10, procedures performed, length of stay (LOS), and discharge disposition (DD). Data were abstracted from January 1, 2006, to December 31, 2017.

We performed descriptive statistics using chi-square for nominal data and Student's *t* test or ANOVA for continuous data. We performed a multiple regression analysis to determine significance of geriatrician consultation with regard to patient outcomes. Analyses were performed with Excel ver. 14.0.7128.5000 (Microsoft Corporation 2010). By convention, we deemed value of $p < .05$ as significant.

Results

Over the study period, 1,335 geriatric patients were admitted to the SBH Health System trauma center, of which 1,054 (79%) had fall as their primary MOI. The total number of geriatric trauma admissions increased significantly as did the number of geriatric fall cases (both $p < .001$). Geriatric fall cases demonstrated a disproportionate increased trend compared with all geriatric trauma cases—a 97% increase in total geriatric trauma admissions occurred at the same time fall MOI increased 280% ($p = .14$). The fraction of geriatric fall cases to total geriatric trauma admissions has significantly increased from 65.8% in 2006 to 87.1% in 2017 ($p = .017$) (Figure 2).

The mean age of geriatric fall patients was 79 ± 1.14 years and did not significantly change over the study period ($p > .05$). Due to a change in data collection systems for our trauma registry, comorbidity data were only available for years 2012–2017 ($n = 755$), and ISS data were only available from years 2008–2017 ($n = 970$). The most common comorbidities in descending order were hypertension (71.6%), diabetes mellitus (32.4%), dementia (20.4%), history of myocardial infarction/cardiac surgery (18.6%), anticoagulant therapy (15.6%), current smoker (10.4%), and congestive heart failure (9.8%).

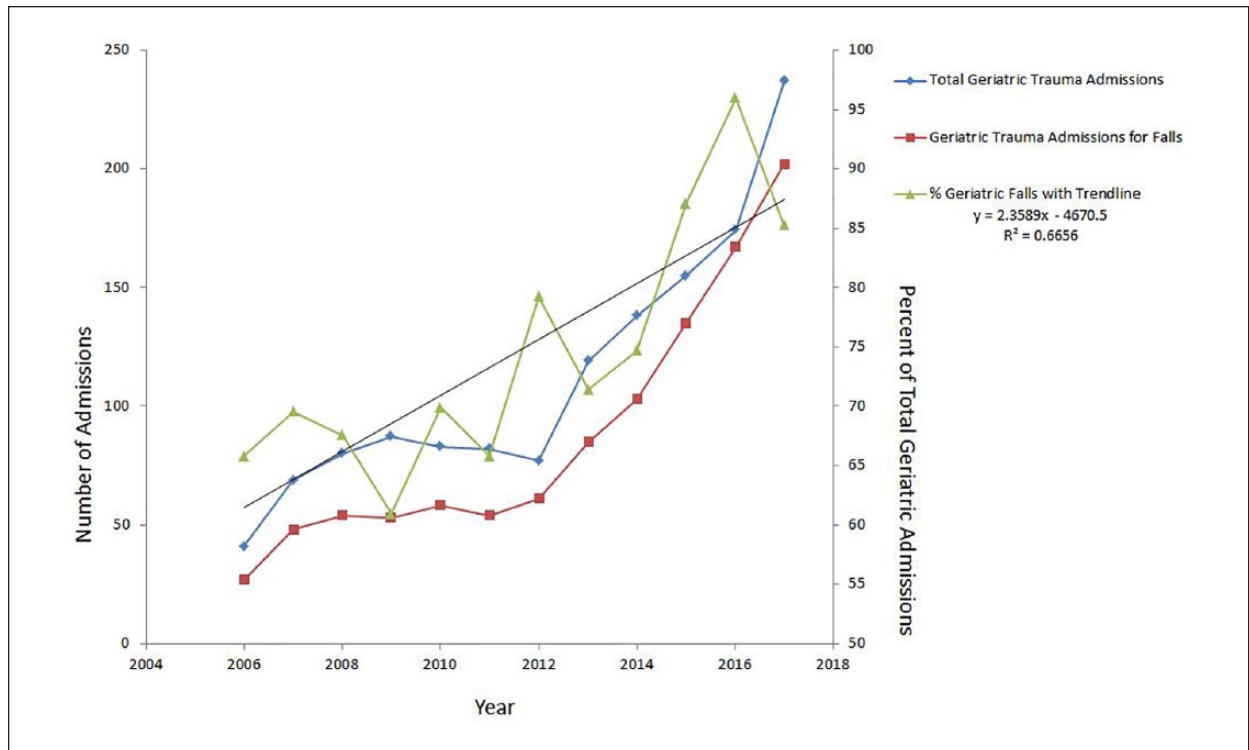


Figure 2. Statistically significant increases in total geriatric trauma admissions (diamonds, $p < .001$), trauma admissions for falls (squares, $p < .001$), and percentage of geriatric falls (triangles, $p = .017$).

Females accounted for 505 (48.8%) falls and increased proportionally to the increase in overall falls. Regarding injury patterns, we discovered interesting differences between sexes. Although the most common injury pattern for males in descending order was traumatic brain injury (TBI; 19.2%), other open head wounds (7.8%), femur fracture (7.8%), fracture of skull base (5.2%), and other closed-head injuries (4.1%), among women, the most common injury was femur fracture (19.5%) followed by TBI (12.3%) and vertebral and other fractures. Surprisingly, the majority of femur fractures in females were nonfemoral neck fractures (13.5%) rather than more commonly expected femoral neck fractures (6.0%).

After 2013, patient's DD to skilled nursing facilities (SNFs) decreased significantly (30.7% vs. 9.8%, $p < .001$) with a concomitant significant increase in safe discharges home (11.4% vs 24.2%, $p < .001$) (Figure 3). Multiple regression analysis revealed that geriatrician consultation, age, and ISS explain 7.7% of variation in DD with significant F statistics. Among these variables, coefficient of association was much higher for geriatrician consultation compared with age and ISS (-0.14 vs. 0.013 vs. 0.025 , respectively) (Table 1).

Mean LOS decreased by 40% over the study period. After 2013, mean LOS decreased with a nadir of 7 days in 2017 (9.12 ± 1.64 vs. 7.47 ± 0.78 , $p = .26$). The results of this study have informed the development of geriatric trauma guidelines, including geriatric TBI and femoral and hip fracture guidelines as well as a

pathway for osteoporosis workup of geriatric trauma service patients.

Discussion

Geriatric injuries are increasing in frequency in the United States and worldwide. Fairfax et al. showed an increase in Auckland's proportion of geriatric traumas from 15% to 20% between 2005 and 2012 (Fairfax et al., 2015). Liu, Obermeyer, Chang, and Shankar (2015) reported that the emergency department visit rate for geriatric fall-related injuries increased from 60.4 to 68.8 per 1,000 persons from 2003 to 2010, especially in 75- to 84-year-old and female subgroups.

Similarly, we found a disproportionate increase in geriatric fall MOI compared with all geriatric traumas which also increased. High pedestrian activity of the geriatric population in New York City in combination with an aging population may be a possible explanation for this differential increase. Further study of lifestyle and MOI as well as other epidemiological characteristics of this geriatric population would help clarify causes.

For overall body regions, men's injury rates exceeded those of females. This observation was not seen in other studies (Gioffre-Florio, Murabito, Visalli, Pergolizzi, & Fama, 2018; Stevens & Sogolow, 2005). Mangram et al. (2012), however, showed that males in a 60- to 69-year-old subgroup were significantly more injured by falls. We found that males were more

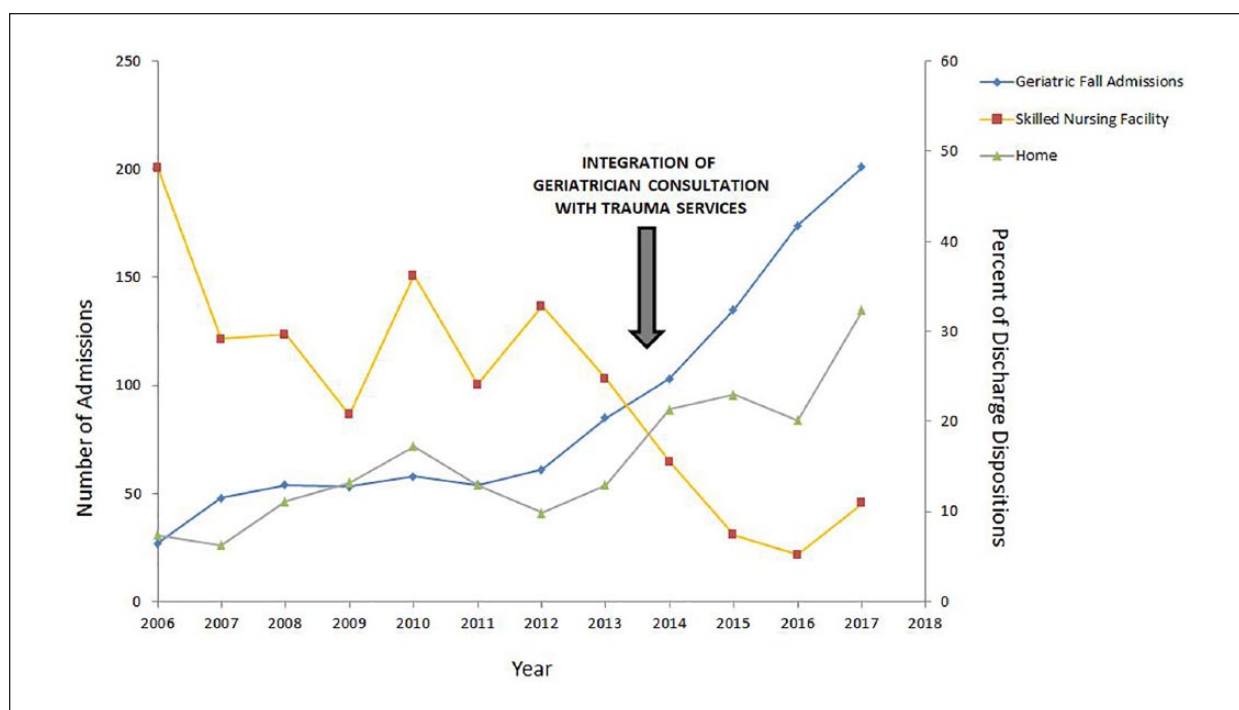


Figure 3. Total number of geriatric fall admissions (diamonds) and percentage of discharge dispositions from 2006 to 2017 for skilled nursing facility (squares) and home (triangles).

Note. Changes in discharge disposition after integration of geriatrician consultation in 2013 are statistically significant ($p < .001$).

Table 1. Multiple Regression Analysis Demonstrating Highest Association Coefficient of Geriatrician Consult and Discharge Disposition.

Regression statistics						
Multiple R				0.2778		
R ²				0.0772		
Adjusted R ²				0.0735		
Standard error				0.7508		
Observations				761.0000		
ANOVA						
	df	SS	MS	F	Significance F	
Regression	3.0000	35.6830	11.8943	21.0999	0.0000	
Residual	757.0000	426.7322	0.5637			
Total	760.0000	462.4152				
	Coefficients	Standard error	t statistics	p value	Lower 95%	Upper 95%
Intercept	0.5293	0.2511	2.1081	.0354	0.0364	1.0222
Geriatrician consult	-0.1403*	0.0606	-2.3158	.0208	-0.2592	-0.0214
Age	0.0133	0.0031	4.2614	.0000	0.0072	0.0195
ISS	0.0248	0.0042	5.9315	.0000	0.0166	0.0330

Note. ISS = Injury Severity Score, SS = sum of squares, MS = mean squares.

*Highest association coefficient of geriatrician consult and discharge disposition.

frequently affected by TBI, and this is consistent with other reports (Thomas, Stevens, Sarmiento, & Wald, 2008). In our study, females more commonly suffered femur fractures compared with males, and again this is consistent with other reports and has been attributed to decreased bone mass postmenopause (Stevens &

Sogolow, 2005). However, in contrast to previous studies, nonfemoral neck fractures were more frequent than femoral neck fractures in our population, and the cause of this discrepancy remains unclear.

LOS trended shorter over the study period, and patient's DD showed a significant shift from SNF to

discharge home after 2013. Few studies have described DD percentages specific to geriatric fall populations. In West Virginia, Whiteman, Davidov, Tadros, and D'Angelo (2012) reported 36.9% of geriatric fall patients went to SNFs and 37.3% returned home. Guse and Porinsky (2003) in Wisconsin reported 25% of geriatric fall patients returned home and 46% went to SNFs. An analysis by Owens, Russo, Spector, and Mutter (2006) reported 65.7% of patients were discharged to long-term care. In our current study, by the end of the study period, only 11% of fall injury patients were discharged to SNFs and 50% were discharged home. Multiple regression analysis determined statistical significance of geriatrician consultation, age, and ISS regarding modest amount of variance (7.7%) in DD. Geriatrician consultation had the highest coefficient (0.14); therefore, it had more profound association with DD compared with age (0.013) or ISS (0.025).

We theorize this shift in DD is predominantly related to the 2013 implementation of early geriatrician consultation for all injured patients above 65 years of age. After October 2013, all geriatric patients admitted to our trauma service received mandatory screening and/or treatment of memory loss, osteoporosis, medication management, incontinence, frailty and weakness, late-life depression, and fall and gait balance difficulties as a result of geriatrician consultation. These data from geriatrician consultation directly influenced care and discharge planning at both the physician and physical/occupational therapist levels. A primary goal of the geriatrics team was to encourage through education and annotation decreased DD to SNF and increased use of home services.

Prior studies utilizing geriatrician consultation for trauma activations found similar results. Carr et al. (2018) found that geriatric trauma activation shortened LOS and lowered mortality, especially in patients above 77 years of age. In addition, Mangram et al. (2012) developed a multidisciplinary geriatric trauma unit called the "G-60 unit" which significantly decreased mortality, complications, and LOS. Lenartowicz et al. (2012) and Sennour, Counsell, Jones, and Weiner (2009) reported shorter LOS and decreased discharge to long-term care facilities, utilizing similar early multidisciplinary geriatrician consultation services. Finally, a systematic review of randomized trials comparing geriatrician assessment with usual care for hospitalized patients concluded that comprehensive geriatrician assessment increased a patient's probability of being alive and in their own home up to 6 months after injury (Ellis, Whitehead, Robinson, O'Neill, & Langhorne, 2011). The core principle of these proactive multidisciplinary geriatrician consultation models is early involvement in prevention and management of geriatric syndromes, preservation of function, and discharge planning rather than reactive strategy seen in traditional care (Lenartowicz et al., 2012). In total, our data

support this core principle and illustrate how they apply to a trauma service in an underserved urban environment and the potential benefits of similar programs, including the development of trauma guidelines.

Limitations

Our study has several important limitations. First, because of its retrospective design, we are unable to demonstrate whether implementation caused the shift found after 2013. A prospective, randomized, blinded study would be necessary to establish a cause-effect relationship but is likely not feasible, and based on the current results, not providing geriatrician consultation may prove unethical. Our sample size is relatively small compared with similar studies, because all data came from only one metropolitan trauma center. Furthermore, in our multiple regression analysis, there may be other significant variables that we did not abstract that may be correlated with DD.

SBH Health System serves a predominately socio-economically underserved urban population, and our single-center data may not be representative of other geriatric populations in the United States. Multicenter assessment of a similar geriatrician consultation intervention would help generalize our results. In addition, some of our patients may have suffered recurrent falls during the study period that did not require emergency services or subsequent admission, and with two other trauma centers in close proximity to ours, some patients may have sought treatment elsewhere for recurrent falls. We are working to design ways to capture these data through use of an interhospital data collection system in the Bronx. Finally, the effect of preexisting comorbidities in the elderly on hospitalization course and DD remains unclarified given limitations in our registry data collection process.

Conclusion

In the southwest Bronx, geriatric falls are increasing disproportionately compared with otherwise increasing numbers of geriatric traumas. Geriatrician consultation early in the clinical course is associated with trends to lower LOS and significantly improved DD. We recommend early geriatrician consultation for all geriatric trauma admissions.

Access to Research Materials

Underlying research materials related to this manuscript may be accessed through the SBH Health System Institutional Review Board with appropriate permissions.

Ethics Statement

Institutional review board approval was obtained from the SBH Health System IRB (SBH IRB 2017.46).

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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