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# Hospital Costs and Reimbursement Model for a Geriatric Emergency Department

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## ABSTRACT

**Objectives:** The American College of Emergency Physicians' geriatric emergency department (GED) guidelines recommend additional staff and geriatric equipment, which may not be financially feasible for every ED. Data from an accredited Level 1 GED was used to report equipment costs and to develop a business model for financial sustainability of a GED.

**Methods:** Staff salaries including the cost of fringe benefits were obtained from a Midwestern hospital with an academic ED of 80,000 annual visits. Reimbursement assumptions included 100% Medicare/Medicaid insurance payor and 8-hour workdays with 4.5 weeks of leave annually. Equipment costs from hospital invoices were collated. Operational and patient safety metrics were compared before and after the GED.

**Results:** A geriatric nurse practitioner in the ED is financially self-sustaining at 7.1 consultations, a pharmacist is self-sustaining at 7.7 medication reconciliation consultations, and physical and occupational therapist evaluations are self-sustaining at 5.7 and 4.6 consults per workday, respectively. Total annual equipment costs for mobility aids, delirium aids, sensory aids, and personal care items for the GED was \$4,513. Comparing the 2 years before and after, in regard to operational metrics the proportions of patients with lengths of stay > 8 hours and patients placed in observation did not change. In regard to patient safety, the rate of falls decreased from 0.60/1,000 patient visits to 0.42/1,000 in the ED observation unit and 0.42/1,000 to 0.36/1,000 in the ED. ED recidivism at 7 and 30 days did not change. Estimated cost savings from the reduction in falls was \$80,328.

**Conclusion:** The additional equipment and personnel costs for comprehensive geriatric assessment in the ED are potentially financially justified by revenue generation and improvements in patient safety measures. A geriatric ED was associated with a decrease in patient falls in the ED but did not decrease admissions or ED recidivism.

In 2018, the American College of Emergency Physicians, with the support of the American Geriatrics Society, the Society for Academic Emergency Medicine, and the Mary and Gary West Health Foundation, initiated an accreditation process for geriatric emergency departments (GEDs). The accreditation process involves three tiers of quality improvement and assessment. The highest level of accreditation, gold or Level 1, requires EDs to provide 1) comprehensive geriatric assessment by a multidisciplinary team for high-risk older adults and 2) equipment to help with mobility, sensory, cognitive, and continence issues ([www.acep.org/geda](http://www.acep.org/geda)). The research behind comprehensive geriatric assessment in the ED is compelling.<sup>1-3</sup>

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However, this requires substantial costs to EDs in the forms of additional personnel and equipment. The initial pilot GED programs were funded by grants that resulted in the misconception that GEDs are only achievable with external funding. While large structural renovations (e.g., windows with natural lighting to reduce delirium) may be costly and infeasible due to differences in ED layout, the personnel and equipment required are theoretically obtainable in any ED.

Comprehensive geriatric assessment is a multidisciplinary evaluation by a case manager, geriatrics specialists, therapists, and pharmacists. Although case management services are not reimbursable, they are typically justified by the hospital cost savings from reduced ED revisits and prolonged hospitalizations. Comprehensive geriatric assessment in the ED may save money for health systems in a similar fashion; it reduces the ED admission rate for older adults by an absolute 4.7% to 16.5%.<sup>1,3</sup> This is important financially because older adults in the United States are more likely to have government health insurance which does not provide the profit margin for hospitals that private insurers allow.

Estimating the true savings from cost reductions is difficult. When evaluating the financial impact of a proposed program, cost savings are more difficult to estimate and justify than collected revenue for services. What is the anticipated revenue from multidisciplinary geriatric assessment in the ED? Is billed revenue sufficient to support the personnel required to provide this service? The first aim of this project was to model the revenue and productivity of a multidisciplinary geriatric assessment team consisting of a geriatric nurse practitioner (NP), pharmacist, physical therapist (PT), and occupational therapist (OT), with the intention of discovering the volume of reimbursable services that would result in self-sustainability of these positions (revenue neutrality).

The second aim was to report the start-up costs for the first year of a Level 1 GED and to investigate the impact on the department in terms of ED metrics and patient safety measures. Any quality improvement measure can have unintended consequences, including prolonging ED lengths of stay or ED revisits. Therefore, we chose to examine the GED in terms of how it financially affected the department from startup costs and how it operationally effects the department in terms of operational and safety metrics. Is the start-up cost justifiable? Determining how personnel and equipment costs could be financially justifiable and

sustainable is critical to GEDs becoming the standard of care. For a Level 1 GED, necessary equipment includes mobility, sensory, cognitive, and continence aids, which are used to assist patients with safe mobility and to manage and prevent delirium. These are not billable to patients and so the ED must cover the costs.

One potential cost savings to a hospital or ED is fall prevention. Inpatient falls are important financially to hospitals as the cost of an inpatient fall includes 6.3 additional hospital days and \$6,694 in nonreimbursable care costs.<sup>4</sup> A National Health Audit in the United Kingdom found that not having the appropriate mobility aid in reach of the patient was a factor in 32% of inpatient falls, suggesting that sufficient mobility aids might decrease falls.<sup>5,6</sup> GED equipment could be justifiable financially if it reduces uncompensated hospital costs from falls. We set out to discover if this was possible using data from one Level 1 GED program.

## METHODS

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This study was deemed exempt by the institutional review board as data was either publicly available or already obtained for routine quality improvement purposes. This is a combination modeling/single analytic study design with a quasi-experimental pre/post analysis of the effects of the program on operational and safety metrics.

### Setting

A Midwest academic medical center with an annual volume of more than 80,000 ED visits, 21% by adults aged  $\geq 65$  years. The ED received Level 1 GED accreditation in August 2018 for a geriatric-focused ED observation unit (EDOU), with multidisciplinary assessments performed in the EDOU.<sup>7</sup> The EDOU is a 20-bed unit confluent with the ED, and ED patients are cared for in that space as well if beds are not filled by observation patients. This is a model of GED care where all the ED staff receive geriatric education and there is geriatric equipment available for the entire ED. The equipment is stored in equipment stations throughout the ED. If multidisciplinary geriatric consultations are required, the patient is seen during the ED visit or placed in observation status to allow for the added time for consultation and care coordination. This model reduces the need for additional overnight staff for multidisciplinary geriatric assessment and does not require dedicated area or GED unit in the ED.

The inpatient geriatric consult team consists of a board-certified geriatrician, NP, fellows, and other

learners and is available Monday through Friday during business hours. The PT team is available 7 days a week from 7 AM to 8 PM on weekdays and until 3 PM on weekends. OTs are available weekdays during business hours. ED pharmacists are available 18 hours a day. The physician can order these consultations for any older adult ED patient regardless of chief complaint or disposition. If the patient requires full admission, the consultation orders are still placed from the ED to expedite care.

### Personnel

The salary range for each position for FY2019 was obtained from the human resources department. A 30% fringe rate was applied to obtain annual personnel cost. Full-time work included 4.5 weeks of vacation per year and assumed 5-day work weeks. Consultations per workday were calculated for one provider or FTE (full-time equivalent) and do not include covering the service during vacation time. Revenue for geriatric consultations by the physician team were obtained from the hospital's billing department. Revenue from only the Medicare patient encounters in the ED was averaged and then decreased by 15% to simulate NP only reimbursement rates. Therapist reimbursements were modeled using the Centers for Medicare & Medicaid Services rates for moderate complexity evaluations, CPT codes 97162 and 97166. Pharmacist consultation rates were estimated using the medication therapy management services code 99605 for ambulatory settings, assuming in-depth medication counseling session for four or more medications.

Additionally, the number of formal consultation orders for these teams for FY2018–2019 were obtained. These totals were divided by 24 months to get the monthly average volume. Average daily volume was calculated by dividing the total by the number of annual workdays (237.5) for one provider. Of note, the PT and OT teams have several providers that flex between inpatient consults and the ED to cover the ED consult volume.

### Equipment

Invoiced orders for the GED were reviewed for the equipment ordered for the GED program. Items that were previously stocked in the ED and not ordered as part of adherence to the geriatric guidelines were not included in the startup costs of the GED. This includes IV sleeves, soft-touch call buttons, condom catheters, and gait belts. Equipment ordered for GED

was divided into mobility, continence and personal care, cognition, and sensory devices. The number of patients requiring mobility devices was estimated from the ED triage fall risk assessment. Patients who responded affirmatively to "Do you use a walker or a cane?" were counted as requiring mobility equipment while in the ED. There were three walkers for use prior to the full deployment of geriatric equipment in FY2018. Equipment was placed in two stations on opposite ends of the ED and was available to all ED patients regardless of age. Single-use equipment was checked for restocking needs weekly.

### Operational Metrics and Patient Safety

The total number of older adult ED encounters, proportions admitted, placed in observation, and those with a >8-hour length of stay in the ED were obtained from the annual hospital reports for FY2016–2019. An 8-hour length of stay is a dichotomous variable used in our quality reporting, which measures the time of placement in a bed to be seen by the ED medical team to leaving the ED. For patient safety measures, the total number and rate of falls per thousand patient encounters in the ED and the ED observation unit for all ED patients were obtained from the hospital's safety and quality center. ED return visits at 7 and 30 days were obtained from the annual hospital reports. The data was grouped into the 2 years before (FY2016–2017) and the 2 years after the expansion of mobility equipment and GED accreditation (FY2018–2019). Student's t-test was used for comparison of the continuous variables.

Fall rates with 95% confidence intervals (CIs) were calculated. To estimate the cost of falls, the change in the absolute number of falls during the time frames was multiplied by the estimated nonreimbursable care costs of an inpatient fall, \$6,694.<sup>4</sup>

## RESULTS

### Personnel

The number of consultations per work day to justify a revenue neutral position were 7.1 for geriatric NP, 5.7 for PT, 4.6 for OT, and 7.7 for a pharmacist (Table 1). Consult volumes would have to increase to support a geriatric NP or a full-time pharmacy position. Only 61% of PT consults and 40% of OT consults were independently billed, which results in 7.3 PT and 4.1 OT consults per day on average billed (see Discussion for more on billing practices for PT

**Table 1**  
Average Staff Salaries and Workload Required to Maintain a Budget Neutral Staff Position

Position	Annual Salary plus 30% Fringe, Median [Range]	Revenue per assessment	Consultations per Day for Salary Neutrality, Median [Range]	Actual ED Consultations FY2018–2019	Proportion of Consultations Billed FY2018–2019
Geriatric NP	\$150,000 [\$118,040–\$182,962]	\$88.92	7.1 [5.6–8.7]	0.8 per day 17 per month	100%
PT	\$101,319 [\$88,400–\$132,600]	\$81.08	5.7 [4.6–6.9]	11.9 per day 235 per month	61%
OT	\$91,450 [\$76,570–\$95,712]	\$87.26	4.6 [3.7–5.5]	10.2 per day 202 per month	40%
Pharmacist	\$161,772 [\$126,880–\$196,664]	\$101	7.7 [6.0–9.3]	0.4 per day 8 per month	0%

For geriatric NP, PT, and OT revenue per consultation is based on CMS rates for 2019 for a moderate complexity encounter. Pharmacist revenue is based on medication therapy management high-complexity encounter. Annual workdays was estimated at 237.5 accounting for 5 day work week and 4.5 weeks of vacation. Actual consult volume is derived from the number of formal consult orders placed. Pharmacy consults are most often informal and not currently being billed, so these data do not reflect the actual number of patients assisted by the ED pharmacy team through this program. The proportion of consultations billed is the number of encounters billed divided by the total number of consults placed. Consultations for therapy are not independently billable if the ED patient is admitted to the hospital:

$$\text{Consultations per day} = \frac{1.3 \times \text{Salary per year}}{\text{Revenue per Consultation}} \div \frac{1}{237.5 \text{ workdays per year}}$$

NP = nurse practitioner; OT = occupational therapist; PT = physical therapist.

and OT). This would support a full-time PT and almost a full-time OT each in the ED.

### Mobility Equipment Estimations

In an ED of 80,000 patient visits, 18.2% endorsed needing a walker or cane to ambulate or ~40 patients per day. Average ED length of stay for adults  $\geq 65$  years old in FY2018 was 8.2 hours. During any given hour an average of 13 to 14 patients will need a mobility aid (40 patients  $\times$  8 hours per patient/24 hours per day). An assortment of rollators (wheeled walkers), quad point canes, and two-button walkers in regular and bariatric sizes were obtained. Total cost for the 15 items of mobility equipment was

\$1,161 (Table 2). The items were stored on wall-mounted shelving to improve access and reduce the storage footprint (Figure 1).

### Other GED Equipment

Costs for personal care, cognition, and sensory aid devices were \$3,352 for 1 year (Table 2). The reading glasses, hearing aids, and agitation equipment were all single-patient use, while the bedside commodes are cleanable and reusable.

### ED Metrics and Patient Safety

Total ED encounters increased annually, from 78,330 in FY2016 to 82,385 in FY2019. Therefore,

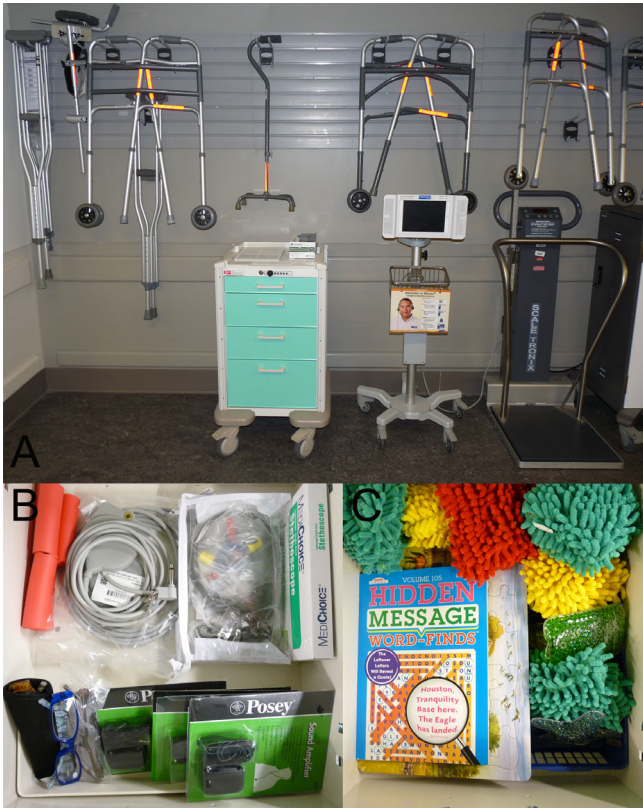
**Table 2**  
Geriatric Equipment Prices and Estimates of Use Rates for an 80,000 Annual Visit ED (2018 Dollars)

Classification	Equipment	Cost per item	Items per year	
Mobility	Lightweight aluminum rollator*	\$145	2	\$1,161
	Bariatric Rollator with pouch*	\$299	1	
	Two button walker*	\$52	10	
	Quad cane, wide-based*	\$26	2	
Continence and personal care	Deluxe steel drop arm bedside commode*	\$143	5	\$874
	Deluxe bariatric drop arm commode*	\$159	1	
Cognition	Activity apron†	\$40	10	\$658
	Fidget toys and puzzles for cognitive play	\$0.50 to 8.00	24 puzzle books, 48 squeeze balls, 8 jigsaw puzzles	
Sensory	Reading glasses	\$3	156	\$1,820
	Sound amplifier†	\$13	104	
Total equipment costs:				\$4,513

This is equipment for patient use in the ED. Durable medical equipment needs of patients at discharge were provided via a home health equipment company and not included in the ED equipment costs.

\*Performance Health, Warrenton, IL.

†Posey Company, Arcadia, CA.



**Figure 1.** Space for new equipment storage can be an concern when obtaining large or bulky equipment for an ED. Items for (A) cognition and (B) sensory impairment are kept in carts, while (C) a horizontal wall storage solution provides easy accessibility to items while minimizing the footprint of storage space required.

proportions were used for comparison. Comparing the 2 years before and after GED accreditation, proportion of older adults place in observation did not change (10.9% vs. 10.4%,  $p = 0.22$ ). The admission rate increased from 63.6% to 66.6% ( $p < 0.01$ ), which mirrors the increase in admission rate seen in younger adults over the same time period (21.4% vs 26.1%,  $p < 0.01$ ). The proportion of older adults with lengths of stay  $> 8$  hours remained unchanged (38.0% vs 39.0%,  $p = 0.43$ ) despite the increased patient volumes.

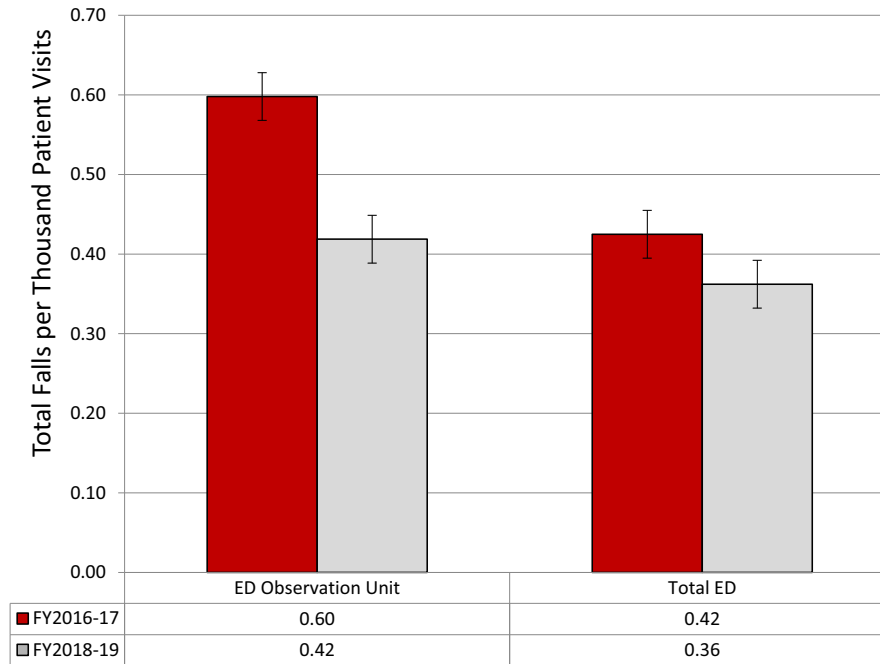
In regard to patient safety metrics, ED recidivism trended downward but did not significantly change at 7 days (5.4% vs 5.0%,  $p = 0.064$ ) and 30 days (17.9% vs 17.3%,  $p = 0.061$ ). The rate of falls decreased from 0.60/1,000 patient visits (95% CI = 0.597 to 0.603) to 0.42/1,000 (95% CI = 0.416 to 0.423) in the ED observation unit. For patients in the rest of the ED, the fall rate decreased from 0.42/1,000 (95% CI = 0.418 to 0.421) to 0.36/1,000 (95% CI = 0.359 to 0.361; Figure 2). Despite higher patient volumes, there was an absolute difference of 12 fewer falls in FY2018–2019.

Estimated cost savings from the reduction in falls was \$80,328 (12 falls  $\times$  \$6,694 per fall).<sup>4</sup>

## DISCUSSION

The goal of this project was to quantify real-world costs of a Level 1 GED to the hospital or department that is funding the GED, and to model possible revenue and cost savings to the health system. The data suggest that a Level 1 GED can be justified financially through personnel reimbursement for multidisciplinary geriatric assessment and savings from improved patient safety. Additional start-up costs to consider are the initial accreditation cost (\$10,000 fee) and education and hiring costs. For our model, staff education was covered through normal physician and nurse education time, other than a \$250 training fee for our nurse champion. Staff education can be estimated in several ways. One could consider the costs of registration for geriatric education courses (such as geriatric emergency nurse education course through the Emergency Nurses Association [<https://www.ena.org/education#online>] or Nurses Improving Care for Healthsystem Elders [<https://nicheprogram.org/>]) multiplied by the number of nurses doing the training. If an internal training program is developed, the cost could be measured by the calculation of number of nurses  $\times$  the hours of training needed  $\times$  cost per hour of nurse time. Our institution had one nurse educator take the GENE training (\$250) and then develop a 2-hour course specific to our GED for all ED nurses. This internal training was made part of annual nurse onboarding and training requirements, and so training costs were covered under the normally budgeted training costs for the department. Similarly estimates of physician continuing medical education time and costs can be made. In our academic program, 3 to 5 dedicated hours of geriatric training annually were added into the residency programming schedule, which was developed internally and covers topics such as trauma, polypharmacy, transitions of care, wound care, capacity, and end-of-life decision making.

Because the program used existing training mechanisms, existing inpatient hospital staff, and existing space, the initial “out-of-pocket” costs of the program were the application fee, GENE training, and equipment. This totals to \$14,763. Potential hidden costs exist. If more patients are kept in ED observation status, those ED beds are not being used for new patients. We did not find higher proportions of observation patients,



**Figure 2.** Fall rates per a thousand patient visits declined in the ED and ED observation unit with added equipment for safe mobility. Data are for the 2 years before and 2 years after introduction of equipment, *error bars* show 95% CIs of  $\pm 0.03$ .

but due to the increase in total patient volumes there were higher absolute numbers of observation patients. Similarly, if length of stay is increased then patient flow decreases and departmental revenue decreases. We did not see an association with longer lengths of stay. We did see an increase in admissions (63.6% to 66.6%). However, admission rate for younger patients increased a similar amount during the same time frame (21.4% to 26.1%) so this association is likely due to external factors other than the GED initiative. During this same time frame, an oncology ED was also developed that increased our annual volumes of patients with active malignancy. This contributed to the increase in hospital admissions.

In regard to sustainability of the program, our model predicts that dedicated positions for a geriatric NP, PT, OT, and pharmacist are all potentially revenue neutral. We have sufficient volume for full-time PT and OT positions. We likely have sufficient patient volume for a geriatric NP, but currently are consulting the geriatrics team rarely. We are currently investigating screening systems to better identify which patients are most likely to benefit from geriatric consults and anticipate seeing the number of consultations increase. For our institution, a geriatric consultation rate of 7.1 per day is comparable to what is expected for our inpatient consult services (six per day). Revenue could be increased if the provider sees more complex patients (higher billing code) or the payer mix is not assumed to be 100%

Medicare. One additional advantage of a dedicated geriatric staff member embedded in the ED is a likely increase in the number of patients with geriatric needs identified, improving access to this program. This program provides consultation during day hours only. In the geriatric-focused observation unit model, patients who arrive after geriatric consult hours can be kept in observation to be seen the following day and have access to these services. In other models of care, additional night staffing would be required.<sup>7</sup> Expanding staffing coverage to weekends and evenings could change revenue calculations, as a pay differential may be required for additional coverage.

When considering possible revenue and consults per day, it is important to note that not all older patients require evaluation by the entire multidisciplinary team. Revenue is dependent on *appropriate* consultation and the idiosyncrasies of billing for these different consultations are complex. Currently full medication management by a pharmacist has the highest reimbursement rate of all these consultations but this reimbursement is only applicable to patients with chronic illnesses such as congestive heart failure and only billable if a patient is discharged from the ED. Medication review in the ED does add value to the inpatient team, so the value of the review is not lost with admission but the independent billing is no longer possible. In our ED, most pharmacy consults are done informally and so this billing is not being captured. Similarly, evaluations by PT and OT are only

separately billable if the patient is discharged from the ED. This is shown in our data, as only 61% of PT and 40% of OT encounters were billed (Table 1). However, there is still value gained to the hospital by initiating therapy in the ED for admitted patients. Early physical therapy involvement decreases hospital length of stay by 2.3 days, another source of hospital cost savings.<sup>8</sup> A final consideration about revenue is that payment structures that are capitated such as accountable care organizations may have different revenue models. This is data from one Midwestern hospital and is presented as an example of how these calculations can be done for other health systems interested in designing a GED.

Similarly to personnel costs, equipment costs at other institutions may vary. The equipment cost for this large academic ED of >80,000 annual visits was < \$5,000, but this study did not determine if items were under- or overutilized. The investment appears to be positive, as the fall rate decreased, but this report only shows a contemporaneous correlation with a decrease in falls and causation cannot be assumed. We found a reduction in falls from 0.42 to 0.36 falls per 1,000 patient visits, which is still within the range of 0.29 to 0.63 falls per 1,000 patient visits reported in other adult EDs.<sup>9,10</sup> Therefore, this could be normal variation. An association is suggested by other data linking improved mobility with delirium prevention which also decreases falls.<sup>11</sup> The cost savings estimate from fall prevention is also based on inpatient fall data which may overestimate the hospital costs of an ED fall. Assuming that the cost of a fall in the ED is only 1/10th of the inpatient fall costs results in a relative savings of \$8,033; the initial equipment costs for this program were low enough that this is still a cost savings to the hospital.

In addition to multidisciplinary consult revenue and hospital savings from improved care, another possible source of financial sustainability for a GED is through reducing insurance reimbursement withholds. We did not significantly reduce admissions or ED recidivism. Other GED studies have found these outcomes, which has the potential to reduce insurance withholds for prolonged hospital stays and repeat hospitalizations.<sup>1,3</sup> The patient-centered goals of GEDs align well with Medicare Access and CHIP Reauthorization Act (MACRA) reforms. The merit-based incentive payments system (MIPS) and advanced alternative payment models (APMSs) also focus on avoiding readmissions and decreasing hospital length of stay.

These presumed financial benefits must be countered with the possible impact of a GED on ED

length of stay. Our program does not seem to increase the percent of older adults with prolonged ED stays (stays greater than 8 hours). One program targeting fall risk evaluations for older adults in the ED did not find an increased length of stay, but other GED models have.<sup>1,12</sup> It is likely that the effect of GED programs on operational metrics is dependent on a multitude of factors inherent to each individual ED.

## LIMITATIONS

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Data generalizability is limited by using institution-specific revenue data and salaries. Accreditation costs for the GED and training programs can change and are available at [www.acep.org/geda](http://www.acep.org/geda). Equipment carts were restocked weekly; this may underestimate the true need for single-use items such as hearing amplifiers if a provider were to need one and the cart was understocked. Finally, the impact of this program on operational metrics and patient safety is only an association, and the program cannot be considered to be fully causative of any trends discovered.

## CONCLUSION

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Emergency department metrics and patient data can be used to estimate initial equipment and staffing needs to provide geriatric ED guideline-appropriate care. While the data provided are only estimates from a single Midwest hospital site, this analysis could be repeated for any ED to determine the start up costs and financial impact of a geriatric ED.

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