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EMS utilization predictors in a Mobile Integrated Health (MIH) program: A retrospective analysis

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Abstract

Background. The provision of unnecessary Emergency Medical Services (EMS) care remains a challenge throughout the US and contributes to ER overcrowding, delayed services and lower quality of care. New EMS models of care have shown promise in improving access to health services for patients who do not need urgent care. The goals of this study were 1) to identify factors associated with EMS utilization (911) and 2) their effects on total EMS calls and transports in an MIH program.

Methods. The study sample included 110 MIH patients referred to the program or considered high-users of EMS services between November 2016-September 2018. The study employed descriptive statistics and Poisson regression to estimate the effects of covariates on total EMS calls and transports.

Results. The typical enrollee is a 60-year old single African-American male living with two other individuals. He has a PCP, takes 12 medications and is compliant with his treatment. The likelihood of calling and/or being transported by EMS was higher for males, patients at high risk for falls, patients with asthma/COPD, psychiatric or behavioral illnesses, and longer travel times to a PCP. Each prescribed medication increased the risk for EMS calls or transports by 4%.

Conclusions. This study shows that age, marital status, high fall risk scores, the number of medications, psychiatric/behavioral illness, asthma/COPD, CHF, CVA/stroke and medication compliance may be good predictors of EMS use in an MIH setting. MIH programs can help control utilization of EMS care and reduce both EMS calls and transports.

Background

For more than twenty years, the demand for Emergency Medical Services (EMS) and Emergency Department (ED) care services in the US has risen consistently, contributing to increasing healthcare costs and impacting quality of care. [1] Some consider a proportion of these services medically unnecessary because they involve low-acuity conditions that are more appropriately handled in settings other than an emergency room. [2] Accurate judgements on medical necessity are complex and require detailed clinical assessments, laboratory tests and medical interventions that challenge even the most seasoned clinicians. [3] Nevertheless, some patients with varying degrees of acuity who seek emergency care can be safely treated by EMS clinicians and/or transported to other non-ED facilities where they can receive definitive care. Medically unnecessary emergency care represents anywhere from 13–32% of all EMS calls and cost EMS services an average of $448.50 USD per transport. [4,5, 6,7] For a jurisdiction responding to 10,000 calls per year, this translates into 1300-3,200 transports costing anywhere between $583,050 and $1,435,200 USD per year.

Unnecessary EMS care also contributes to overcrowded emergency departments, delays in EMS services and potential reductions in quality of care. [4, 8, 9, 10] Since reimbursement for services occurs only when EMS transports patients to an ED, there is a strong financial incentive to provide services even when they are unnecessary. [11] Furthermore, the current ambulance fee schedule reimburses ambulance suppliers on a Fee-For-Service (FFS) basis, which promotes volume over efficiency. [12] The Centers for Medicare and Medicaid Innovation (CMMI) is implementing a pilot program to explore alternative destinations that can potentially save CMS between $200 and $500 million dollars per year. [13]

New EMS models of care, finance and delivery have emerged in an effort to control unnecessary EMS care and improve patient outcomes. Some of these models have shown promise in reducing the number of low acuity EMS services and improving access for patients who do not need an ED. Three innovative delivery models include Community Paramedicine (CP), Mobile Integrated Healthcare (MIH) and Alternative Destination (AD) programs. CP programs involve expanded roles for clinicians, MIH programs involve the use of technology (e.g. telemedicine) and AD programs focus on transporting non-urgent patients to destinations that can appropriately offer definitive treatment to patients (e.g. urgent care centers) other than the ED. All these programs follow patient-centered care approaches, similar to the development of Advanced Primary Care (APC) models.

MIH programs have shown improvements in health-related quality of life as well as reductions in ER transports, and ER and hospital admission and readmission rates.[13, 14] Maryland has six (6) active MIH pilot programs throughout the state. One such program is in Prince George's County, located in the state of Maryland and bordering with Washington, D.C. Prince George's (PG) County is the second most populous county in Maryland at 905,161 residents (2017 estimate). The top ten leading causes of death in the county include heart disease, cancer, stroke, injuries, diabetes, septicemia, nephritis and pneumonia. Most of these conditions are chronic

and require highly specialized and coordinated care. Although the population has access to five major hospitals, the availability of Primary Care Practitioners (PCP) is less than ideal with one PCP per 1,131 residents.[15] Moreover, a large percentage of the population resides in Health Professional Shortage Areas (HPSAs) for primary care, dental and mental health services. [16] This lack of access to care leads many residents to rely on the 911 emergency services system to get the care they need.

To understand EMS service utilization trends, PG analyzed 911 call data from July 2015 through June 2016. They identified 1,390 patients who requested EMS services 5 or more times and 213 patients who requested EMS services 10 or more times, also known as “super users”. High users called EMS more than 8,500 times and requested over 16,400-unit responses in a single year. In 2016, PG created the MIH pilot program staffed with a paramedic-only team at the beginning, and added nurse practitioners, community nurses and social workers in 2017 and 2018, through a collaborative effort between the Prince George’s Fire and EMS Department, and the County Health Department. The pilot program paired patients, either identified as high-users of referred to the program, with MIH team members, who then met with patients to perform a home safety assessment, a fall risk assessment, a nutrition evaluation, a medication review, physical and mental health assessment, and also linked patients with appropriate community-based services (intervention). The pilot program captured several data points and used key performance measures to assess the program’s overall impact. By September 2018, the program had served 137 patients throughout the county.

To be eligible for the program, patients had to have called EMS five or more times in a 6-month interval or been referred to the program by other health professional(s) or EMS provider(s). Once enrolled, patients received the intervention, including goal setting, from the first home visit to eventual program separation or discharge. During program enrollment, patients were required to remain in close contact with the MIH team (engagement), who assisted patients with coordination of healthcare, reconnecting them with their PCP or connecting them to a new one. MIH clinicians also facilitated transportation to health appointments and bridged health literacy gaps. During program enrollment, the MIH team also assisted with medication therapy management through a physician or pharmacist, coordinated referrals to specialists (including behavioral health) and addressed social determinants of health. After 4 months of enrollment, all patients underwent a quality assurance review before discharge. Separation occurred because of patients’ failure to engage, patient dropout, or death. Patients were encouraged to maintain their relationship with the MIH clinicians after discharge and could re-enroll in the program. They also received follow-up from the MIH team at regular intervals after discharge.

Our research goals were to identify (i) the factors associated with EMS utilization and (ii) their effects on total EMS calls and transports.

Methods

Data and Sample

Between November 2016 and September 2018, 137 patients participated in PG’s MIH pilot program. The data collected by the MIH team included EMS (911) calls, transports and dispatches, socio-demographics (e.g. age, race/ethnicity, sex), insurance/access (e.g. private, Medicare, Medicaid), assessments and medications (e.g. fall risk scores, number of medications), as well as data on clinical/chronic illness (e.g. diabetes, hypertension, chronic heart failure).

Twenty-seven patients were excluded from the original dataset because key variables of interest had missing data, including base calls and transports, sociodemographic variables and chronic health conditions. The final sample, therefore, consist of 110 patients of whom 45 requested emergency medical services five or more times before being recruited into the program, and were considered high frequency (HF) users, and 65 patients, who requested emergency medical services less than five times before being recruited into the pilot program, and were considered low frequency (LF) users. Combined, these patients accounted for 3081 calls and 2024 transports.

Statistical Analysis

The analysis was conducted in two parts. The first part includes a descriptive analysis of our study sample. Because of our interest in the differences between high- and low-frequency EMS users, the analysis presents proportions for all measures for all participants and by utilization frequency (i.e. high frequency, low frequency).

The second part includes a regression analysis, in which the outcome variables are the (i) number of 911 calls and (ii) the number of 911 transports, and the covariates include socio-demographic, insurance/access, assessments & medications and clinical/chronic illness data. Seventy-three observations had complete data and were therefore included in the regression model. Because the outcome measures represent counts of events, we utilize a Poisson regression model and report incidence rate ratios (IRRs) for each of our covariates. Because of the variability of exposures in EMS calls and transports among patients, we used census population estimates as an offset variable. We also conducted collinearity test, as well as sensitivity analyses discussed in the results section. All analyses were conducted using Stata 15 statistical package and used a 99% significance level. This study was submitted and considered exempt from IRB review by the University of Maryland Institutional Review Board (HP-00086030).

Results

Descriptive Analysis

Tables 1 and 1a include descriptive statistics. The analytical file included data on 110 patients. The typical enrollee is a 60-year old single African-American male living with two other individuals. He has a PCP and takes him 23 minutes to get to his/her office, and has Medicare coverage but is not dually eligible. He takes 12 medications for at least one chronic condition and is compliant with his treatment.

Eighty-four (76%) patients were 49 years or older and 81 (74%) were African-American, with an almost even split between men and women. Sixty-nine were single (68%), 25 (25%) were married and 104 (95%) were introduced to MIH via phone call. Sixty-five (74%) had low fall risk scores with an average score of 2.5. One-hundred (91%) were sometimes or always compliant with their medication regimens and took an average of 12 medications, with 77 (76%) of them taking 10 or more medications. The majority (102, 93%) have a PCP and all 110 patients have insurance, with Medicare, Medicaid and private insurance covering 61 (56%), 35 (32%) and 14 (13%) patients, respectively. Patients took an average of 23 minutes to get to their PCP, with 101 (82%) taking anywhere from 10 to 39 minutes. Seventy-five (68%) patients had hypertension followed by 46 (42%) with diabetes, 40 (36%) with psychiatric/behavioral disorders, 37 (34%) with asthma/COPD, 29 (26%) with hypercholesterolemia, 26 (24%) with Chronic Heart Failure (CHF) and 25 (23%) have had a stroke/CVA.

[Tables 1 and 1a here]

From the 110 patients in the full sample, 45 (41%) were classified as High-Frequency (HF) users, with the other 65 (69%) classified as Low-Frequency (LF) users of EMS services (Tables 1 and 2). The HF group was relatively younger, 58 years on average, and had a larger proportion of women (26, 58%). They also had slightly higher fall risk scores (2.8) and were less compliant with medications. In terms of access to care, the rates for PCP were higher on the HF group, where 42 (93%) had a PCP compared with 60 (92%) on the LF group. Dual eligibility was higher on the HF group with 10 (22%) patients, compared with the LF group where only eight (12%) patients. The HF group had lower rates of private insurance and a slightly larger share of Medicaid beneficiaries. Travel times to PCPs were similar between groups. Asthma/COPD and hypercholesterolemia were slightly more prevalent in the HF group, although they had higher rates of CHF and psychiatric/behavioral illness. Hypertension and diabetes were not as prevalent in the HF group as with the LF group.

Since a large number of MIH patients (65) were not HF users of EMS services, non-parametric statistics were run to determine if there were any associations between covariates in the HF and LF groups that could influence 911 calls and transports counts. Based on a 95% significance level, the study found no statistically significant associations between sociodemographic, assessment & medications, insurance/access to care or clinical/chronic illness covariates and eligibility, with only moderate, not statistically significant associations between persons living in residence, compliance with medications, dual eligibility, CHF and psychiatric/behavioral illnesses. Given these results, it was appropriate to use the full sample to test for predictors of EMS calls and transports. Prior to running the regression, collinearity tests revealed no significant correlations between covariates.

Regression model

Table 2 and 2a include the regression results for EMS calls and transports. For EMS calls, patients ages 65 and older were less likely to call EMS compared to their younger counterparts. Patients ages 64 to 78 were 49% (p-.005) less likely to call EMS, whereas those 79 years and older were 92% (p=.000) less likely to call EMS, compared to the youngest group. Patients who were either married or

divorced were 65% (p=.000) and 51% (p=.001) less likely to call EMS, respectively, compared to single patients. In contrast, widowed patients were more than 4 times more likely to call EMS (p=.003). Men were two (2) times (p=.000) more likely to call EMS compared to women. In terms of race, Blacks had 89% (p=.000) higher chance to call EMS and Hispanics showed a 7-fold increase (p=.000) in their chance of calling EMS, when compared to White patients. Patients with a high fall risk score were 2.7 times (p=.000) more likely to call EMS compared to patients with low scores. Patients living with three to six additional people in the same residence had more than twice the chance of calling EMS compared to patients living with one person.

Patients with asthma/COPD were 2.7 (p=.000) times more likely to call EMS, and those with hypertension, CVA/Stroke, and psychiatric or behavioral conditions had between 48% and 58% chance of calling EMS compared with patients without these illnesses. Patients with high cholesterol were 33% less likely to call EMS and those with diabetes were 10% more likely to call EMS compared with patients without these illnesses, but the results were not statistically significant. Compliance with medications showed an increased risk for calling EMS, but the results were not statistically significant. For each medication patients took, the changes of calling EMS increased by 4% (p=.000). Patients covered through Medicaid were 71% (p=.000) less likely to call EMS compared with patients with private insurance coverage, whereas patients eligible for dual coverage were 49% (p=.000) less likely to call EMS. Travel times to PCP offices showed large and statistically significant results. Patients travel times greater than 30 minutes were between 10 and 17 times (p=.000) more likely to call 911 compared with patients travelling less than 10 minutes to their PCP office.

[Tables 2 and 2a here]

Patients 49-64 and 65-78 years were 46% (p=.02) and 48% (p=.04) less likely to be transported compared to those ages 19-33, whereas patients 79 and older were 91% (p=.000) less likely to be transported compared to the youngest group. Marital status had a similar effect as 911 calls. Married patients were 72% (p=.000) less likely to require transport compared to single patients. Divorced patients also showed a protective effect, with 56% (p=.003) less chance for transport. In contrast, widowed patients were 10 times (p=.000) more likely to require transport compared with single patients.

Males were 2.4 times (p=.000) more likely to be transported compared to women. Blacks and Hispanics were 1.9 (p=.002) and 3.6 (p=.000) times more likely to require transport, respectively, compared with Whites. Living with three to six people in the same residence increased the chances of transport anywhere between 1.6 and 4.9 times, compared with living with one person only.

Chronic illnesses differed somehow between transports and calls. Patients with diabetes, psychiatric or behavioral illnesses, CVA/Stroke, high cholesterol and asthma/COPD were more likely to require transport compared with patients without any of these conditions. Asthma/COPD, psychiatric/behavioral conditions and diabetes had the largest effect, with 4.3 (p=.000), 1.8 (p=.000) and 1.9 (p=.000) higher chances of transport, respectively, compared with patients without these conditions. Patients who were sometimes compliant with their medications were 50% (p=.008) more likely to require transport compared with patients who were never compliant. The effect on the number of medications was similar as with 911 calls, with a 4% (p=.000) chance of transport for each medication. Patients with Medicare coverage were 2.1 times (p=.002) more likely to require transport compared with those with private insurance. Travel times for 911 transports were significant and showed increased likelihood of transport by up to 15 times (p=.000) when travel exceeded 40 minutes or longer, compared to travel times shorter than 10 minutes.

Sensitivity analysis

After dropping non-significant variables from the model, the likelihood of EMS calls remained for patients who were married and widowed, with a high fall risk score, patients who referred CVA, psychiatric or behavioral illness, CHF and asthma/COPD, the number of prescription medications, and travel times. For EMS transports, the effects remained for married or widowed male patients, those with asthma/COPD, CHF, psychiatric/behavioral illnesses, the number of prescription medications and travel times.

911 call and transport data

As shown in Table 3 and figure 1, both calls and transports experienced sharp reductions 30 days after the first patient visit by the MIH team, 75% and 79%, respectively. At the 4th month mark, calls and transports remained 11% and 16% below baseline although both increased compared to the 30-day mark. By the 6th month mark, both call and transports increased by 24% and 18%, respectively, compared with the baseline.

[Table 3]

Discussion

Some of the predictors for EMS use in general may apply differently to populations targeted by MIH programs, including age. Older patients had a much lower chance of being transported compared to younger ones, although they may still seek EMS care more frequently.[17] Marital status is a well-known predictor of health, where unmarried individuals report poorer health and higher risks for morbidity and mortality compared to married ones, and our data is consistent with the literature. Interestingly, widowed patients showed a high likelihood for both 911 calls and transports, even after model adjustments.

Patients with high fall risk scores were more likely to call EMS and need emergency transport as a result, so this may be a reliable predictor for both outcomes of interest. It is unclear why the number of people living with the patient has a positive effect on EMS calls and transports, although the results were not very consistent. One explanation may be that when people live and know the patient well, they may be better at recognizing the need to both call EMS and to encourage patients to go to a hospital.

Chronic illnesses, particularly diabetes, psychiatric or behavioral illnesses, CHF and asthma/COPD, were consistent predictors of both EMS calls and transports. Another consistent predictor was the number of medications patients took, increasing by approximately 4% for each medication patients take. Considering that, on average, patients take 12 medications, the risk for EMS calls and transports would be 48%. Compliance with medications showed a statistically significant likelihood for EMS transports but was not significant for EMS calls, although it also showed positive effects. This may be because patients who are managing their conditions more closely and pay close attention to their medication regimens, may be more acutely aware when their condition deteriorates and when they truly need to get care.

Patients covered through Medicaid had a lower likelihood for EMS calls (71%) and those with Medicare had a high likelihood for transports (2.1 times) across the models compared with private insurance. The latter results are consistent with Emergency Department (ED) use by insurance type, where Medicare represents 87% of all ED visits for patients 65 and older and shares 16% among those ages 45 through 64. [18]

When EMS receives a call, the information comes almost exclusively from the people at the scene (e.g. patients), who provide dispatchers with information they use to make a determination on whether or not to send an ambulance. This information may not be as accurate or relevant as the information obtained by EMS clinicians at the scene, where a series of more objective assessments (e.g. vital signs, medications, fall risk scores) help construct a decision for transport. This dynamic may be a reason why the transport results remained more stable and consistent compared with the calls results.

The program achieved reductions of both EMS calls and transports during the intervention period, but disappeared soon thereafter. These short-lived effects may be due [in part] to the complexity of the patients' conditions, the need for multi-disciplinary teams, the end of the MIH intervention at the 4th month mark, and to the many socio-economic forces that shape health services and behaviors. For example, the majority of patients mention they have a PCP and health coverage. This is just one dimension of access to care; having a PCP does not necessarily translate into seeing him/her more often or as needed, or getting the right care. Likewise, being covered by an insurance plan does not directly translate into receiving all the care you need at the time you need it, and usually comes with some degree of cost-sharing. Gaps and limits in coverage, copays and out-of-pocket expenses occur at every level of coverage, and are mostly patient-borne costs. This affects poorest groups the most (e.g. Medicaid recipients), and compounds other barriers to accessing health services irrespective of need, with negative health impacts. Most patients in our sample have access to a PCP and have public insurance coverage. However, we do not have information about the quality of the patient-provider relationship, the frequency of visits or the degree of care coordination between their PCP and other specialists needed to help patients manage their conditions.

Limitations

One limitation of our study is the small sample size, given there were more than 1300 patients considered to be high-users but only 137 (10%) agreed to participate. Another limitation is selection bias, since patients who were either high-users or referred to the program and agreed to participate may be systematically different from patients who chose not to participate in the program. Our

data are also limited to what PG collected during the program and may not be capturing factors or exposures that are important and significant in terms of EMS utilization, such as education or income. Finally, the length of the MIH intervention is another limitation. The efforts to address the types of chronic illnesses, comorbidities and risk factors prevalent in the target population require long-term, collaborative and multidisciplinary approaches and interventions. Moreover, these interventions must address the broader social determinants of health, including health behaviors, rather than focus on health determinants alone.

Conclusions

This study showed that age, marital status, sex, fall risk, the number of medications, psychiatric/behavioral illness, asthma/COPD, CHF, stroke and medication compliance may be good predictors of EMS use in an MIH setting. The reduction of EMS calls and transports during the intervention period indicates that an MIH program can be effective in managing utilization of emergency services. Appropriate support for these programs, including operational, financial and political support, will determine their sustainability and long-term success.

Declarations

Ethics approval and consent to participate.

This study was submitted and considered exempt from IRB review by the University of Maryland Institutional Review Board (HP-00086030).

Consent for publication:

This study was submitted and considered exempt from IRB review by the University of Maryland Institutional Review Board (HP-00086030).

Availability of data and material:

The dataset used for this study is available from the corresponding author on reasonable request.

Competing interests:

No competing interests were identified by any of the study authors.

Funding:

No funding was used to support this study.

Authors' contributions:

Pinet-Peralta: study conception; methodology, statistical analysis and results.

Sanna: background and results.

Frankel: study conception and results.

Lindqvist: background and results

Gloss: methodology and results.

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References

1. Tang N, Stein J, Hsia RY. Trends and Characteristics of US Emergency Department visits, 1997–2007. JAMA. 2010; 304(6):664–670. Doi;10.1001/jama.2010.1112.
2. EMS Mobile Integrated Health Care Interventions in the United States
   10.1089/pop.2018.0114
   Abbey G, Tutek J, Leatherwood MD, Crawford W, Friend R, Crowther M, McKinney R. Systematic Review of Community Paramedicine and EMS Mobile Integrated Health Care Interventions in the United States. 2019. Population Health Management. 2019;22(3). doi:https://doi.org/10.1089/pop.2018.0114.
3. Raven MC, Lowe RA, Maselli J. Comparison of Presenting Complaint vs Discharge Diagnosis for Identifying "Nonemergency". Emergency Department Visits JAMA. 2013;309(11):1145–53. doi:10.1001/jama.2013.1948.
4. Kang EJ, Kim SH. Risk factors related to unnecessary emergency medical services transports for pediatric patients. J Int Med Res. 2019;47(1):335–44.
5. Weaver MD, Moore CG, Patterson PD, Yealy DM. Medical Necessity in Emergency Medical Services Transports. Am J Med Qual. 2012;27(3):250–5.
6. Abrashkin KA, Poku A, Ramjit A, Washko J, Zhang J, Guttenbert M, Smith KL. Community paramedics treat high acuity conditions in the home: a prospective observational study. BMJ Supportive & Palliative Care Epub ahead of print. 2018;0:1–8. doi:10-1136/bjmspcare-2018-001746.
7. Lerner EB, Maio RF, Garrison HG, Spaite DW, Nichol G. Economic value of out-of-hospital emergency care: A structured literature review. Ann Emerg Med. 2006;47(6):515–24.
8. Morley C, Unwin M, Peterson GM, Stankovich J. Emergency department crowding: A systematic review of causes, consequences and solutions. PLoS ONE. 2018;13(8):1–42. doi:.org/10.137/journal.pone.0203316.
9. Hoikka M, Silfvast T, Ala-Koko TI. A high proportion of prehospital emergency patients are not transported by ambulance: a retrospective cohort study in Northern Finland. Acta Anaesthesiol Scand. 2017;61:549–56.
10. Monks S, Kushner I, Vargas A, Wells R. Patient perceptions of the ED: Factors that lead to overcrowding. The Journal of Practice Management. 2019;34(4):221–5.
11. 10.2139/ssrn.2839785
    Webb E, Mills A. Incentive-Compatible Prehospital Triage in Emergency Medical Services (April 19, 2019). Forthcoming in Production and Operations Management; Kelley School of Business Research Paper No. 16–65; Baruch College Zicklin School of Business Research Paper No. 2019-04-05. Available at SSRN: https://ssrn.com/abstract=2839785 or http://dx.doi.org/10.2139/ssrn.2839785.
12. CMS. Ambulance Fee Schedule. Retrieved from https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AmbulanceFeeSchedule/. Accessed August 2, 2019.
13. Ostermayer DG, Brown CA, Fernandez WG, Couvillon E. Areas of Potential Impact of the Patient Protection and Affordable Care Act on EMS: A Synthesis of the Literature. Western Journal of Emergency Medicine. 2017;18(3):446–53.
14. Nejtek VA, Aryal S, Talari D, Wang H, O'Neill L. A pilot mobile integrated healthcare program for frequent utilizers of emergency department services. Am J Emerg Med. 2017;35:1702–5.
15. Bureau of Labor Statistics. Standard Occupational Classification. Retrieved May 17. 2019 from https://www.bls.gov/soc/2018/major_groups.htm#29-000011.
16. Health Resources and Services Administration. HPSA Find. Retrieved May 17, 2019 from Health Resources & Services Administration: https://data.hrsa.gov/tools/shortage-area/hpsa-find.
17. Shah MN, Glushak C, Karrison TG, Mulliken R, Walter J, Friedmann PD, Hayley DC, Chin MH. Predictors of Emergency Medical Services Utilization by Elders. Acad Emerg Med. 2003;10(1):52–8.

18. Sun R, Karaca Z, Wong HS. (2018). Trends in hospital emergency department visits by age and payer, 2006–2015. HCUP Statistical Brief #238. Rockville, MD: Agency for Healthcare Research and Quality. Retrieved Aug 3, 2019 from https://www.hcup-us.ahrq.gov/reports/statbriefs/sb238-Emergency-Department-Age-Payer-2006-2015.pdf.

Tables

Table 1. Demographic, insurance and medical characteristics of MIH patients

		All (n = 110)			HF group (n = 45)			LF group (n = 65)			
		N°	*%*	*μ*	*N°*	*%*	*μ*	*N°*	*%*	*μ*	*P* [d]
Sociodemographic	Age (years)										
	19-33	12	*10.9%*	60.3	5	*11.1%*	58.2	7	*10.8%*	61.8	0.538
	34-48	14	*12.7%*		5	*11.1%*		9	*13.8%*		
	49-64	35	*31.8%*		18	*40.0%*		17	*26.2%*		
	65-78	34	*30.9%*		13	*28.9%*		21	*32.3%*		
	79+	15	*13.6%*		4	*8.9%*		11	*16.9%*		
	Race/Ethnicity										
	White	26	*23.6%*		9	*20.0%*		17	*26.2%*		0.613
	Asian	1	*0.9%*		1	*2.2%*		0	*0.0%*		
	African American	81	*73.6%*		34	*75.6%*		47	*72.3%*		
	Hispanic	2	*1.8%*		1	*2.2%*		1	*1.5%*		
	Sex										
	Male	56	*50.9%*		19	*42.2%*		37	*56.9%*		0.929
	Female	54	*49.1%*		26	*57.8%*		28	*43.1%*		
	Marital Status [c]										
	Single	69	*67.6%*		28	*66.7%*		41	*68.3%*		0.873
	Married	25	*24.5%*		12	*28.6%*		13	*21.7%*		
	Divorced	5	*4.9%*		1	*2.4%*		4	*6.7%*		
	Widowed	3	*2.9%*		1	*2.4%*		2	*3.3%*		
	Persons living in residence			2.2			2.2			2.2	0.236
	Means of first contact										
	Door knock/cold call	1	0.9%		1	*2.3%*		0	*0.0%*		0.482
	Hospital visit	5	4.5%		2	*4.5%*		3	*4.6%*		
	Phone call	104	94.5%		42	*95.5%*		62	*95.4%*		
Assessments & medications	Fall risk score (n = 87) [a]										
	Low	64	*73.6%*	2.5	28	*71.8%*	2.8	36	*75.0%*	2.4	0.645
	High	23	*26.4%*		11	*28.2%*		12	*25.0%*		
	Compliance with medications										
	Never	10	*9.1%*		6	*13.3%*		4	*6.2%*		0.171
	Sometimes	35	*31.8%*		17	*37.8%*		18	*27.7%*		
	Always	65	*59.1%*		22	*48.9%*		43	*66.2%*		
	Number of										

medications [b]										
1-3	12	*11.9%*	12.3	5	*11.1%*	12.1	7	*12.1%*	12.5	0.973
4-6	8	*7.9%*		4	*9.3%*		4	*6.9%*		
7-9	4	*4.0%*		1	*2.3%*		3	*5.2%*		
10-12	20	*19.8%*		10	*23.3%*		10	*17.2%*		
13-15	18	*17.8%*		7	*16.3%*		11	*19.0%*		
16-18	34	*33.7%*		14	*32.6%*		20	*34.5%*		
19+	5	*5.0%*		2	*4.7%*		3	*5.2%*		

HF = High frequency users

LF = Low frequency users

[a] Includes only patients who were considered at risk for falls

[b] Includes only patients with reported number of medications

[c] Eight (8) observations with “No response”

[d] significance = .05

Table 1a. Demographic, insurance and medical characteristics of MIH patients (cont.)

		All (n = 110)			HF group (n = 45)			LF group (n = 65)			
		N°	*%*	*μ*	*N°*	*%*	*μ*	*N°*	*%*	*μ*	*P*
Insurance/Access	Has a PCP										
	Yes	102	*92.7%*		42	*93.3%*		60	*92.3%*		0.839
	No	8	*7.3%*		3	*6.7%*		5	*7.7%*		
	Has insurance										
	Yes	110	*100.0%*		45	*100.0%*		65	*100.0%*		
	No	0	*0.0%*		0	*0.0%*		0	*0.0%*		
	Dual eligible?										
	Yes	18	*16.4%*		10	*22.2%*		8	*12.3%*		0.167
	No	92	*83.6%*		35	*77.8%*		57	*87.7%*		
	Primary insurance										
	Private	14	*12.7%*		4	*8.9%*		10	*15.4%*		0.439
	Medicaid	35	*31.8%*		17	*37.8%*		18	*27.7%*		
	Medicare	61	*55.5%*		24	*53.3%*		37	*56.9%*		
	Travel times to PCP										
	0-9 min	9	*8.2%*	22.8	4	*8.9%*	22.4	5	*7.7%*	23.1	0.989
	10-19 min	34	*30.9%*		15	*33.3%*		19	*29.2%*		
	20-29 min	41	*37.3%*		16	*35.6%*		25	*38.5%*		
	30-39 min	16	*14.5%*		6	*13.3%*		10	*15.4%*		
	40 min or longer	10	*9.1%*		4	*8.9%*		6	*9.2%*		
Clinical/Chronic illness	Asthma/COPD										
	No	73	*66.4%*		29	*64.4%*		44	67.7%		0.723
	Yes	37	*33.6%*		16	35.6%		21	32.3%		
	Hypertension										
	No	35	31.8%		16	35.6%		19	29.2%		0.484
	Yes	75	68.2%		29	64.4%		46	70.8%		
	Hypercholesterolemia										
	No	81	73.6%		32	71.1%		49	75.4%		0.617
	Yes	29	26.4%		13	28.9%		16	24.6%		
	Chronic Heart Failure										
	No	84	76.4%		31	68.9%		53	81.5%		0.125
	Yes	26	23.6%		14	31.1%		12	18.5%		
	Stroke/CVA										
	No	85	77.3%		35	77.8%		50	76.9%		0.916
	Yes	25	22.7%		10	22.2%		15	23.1%		

Psychiatric/Behavioral								
	No	70	63.6%	25	55.6%	45	69.2%	0.143
	Yes	40	36.4%	20	44.4%	20	30.8%	
Diabetes								
	No	64	58.2%	28	62.2%	36	55.4%	0.475
	Yes	46	41.8%	17	37.8%	29	44.6%	

HF = High frequency users

LF = Low frequency users

[d] significance = .05

Table 3. Average 911 calls and transports before and after first MIH visit, 2016-2018

		Total sample (110)	HF group (n=45)	LF group (n=65)
		N°	*N°*	*N°*
Call data	Base calls	*5.4*	*9.7*	*2.5*
	At 30 days	*1.3*	*2.4*	*1.9*
	At 4 months	*4.8*	*8.2*	*2.6*
	At 6 months	*6.7*	*10.4*	*4.1*
Transport data	Base transports	*3.8*	*6.6*	*1.9*
	At 30 days	*0.8*	*1.4*	*0.4*
	At 4 months	*3.2*	*5.2*	*1.8*
	At 6 months	*4.5*	*6.3*	*3.2*

HF = High frequency users

LF = Low frequency users

Table 2. Poisson regression, MIH program (n=73)

911 Calls		IRR	Std. Err.	z	P>|z|	95% CI	
Age category							
	19-33 (ref)						
	34-48 Years	1.119	0.272	0.46	0.644	0.695	1.802
	49-64 Years	0.887	0.207	-0.51	0.608	0.561	1.402
	65-78 Years**	0.514	0.121	-2.83	0.005	0.324	0.815
	79+***	0.080	0.032	-6.4	0.000	0.037	0.173
Marital status							
	Single (ref)						
	Married***	0.358	0.061	-6.06	0.000	0.257	0.499
	Divorced***	0.495	0.102	-3.42	0.001	0.331	0.740
	Widowed**	4.097	1.943	2.97	0.003	1.617	10.381
Sex							
	Female (ref)						
	Male***	2.067	0.230	6.52	0.000	1.662	2.572
Race							
	White (ref)						
	Asian	0.000	0.005	-0.02	0.983	0.000	.
	Black***	1.896	0.327	3.71	0.000	1.352	2.660
	Hispanic***	7.652	2.208	7.05	0.000	4.347	13.472
Fall risk category							
	High risk***	2.795	0.389	7.39	0.000	2.128	3.671
Persons living in the residence							
	1 (ref)						
	2	0.989	0.142	-0.08	0.939	0.746	1.311
	3***	2.467	0.463	4.81	0.000	1.708	3.564
	4**	2.380	0.831	2.49	0.013	1.201	4.717
	6***	2.642	0.746	3.44	0.001	1.519	4.594
	7	0.503	0.282	-1.22	0.221	0.167	1.512
Asthma/COPD							
	Yes***	2.693	0.398	6.71	0.000	2.016	3.598
Hypertension							
	Yes**	1.482	0.237	2.45	0.014	1.082	2.028
High cholesterol							
	Yes	0.774	0.111	-1.79	0.073	0.584	1.025

CHF							
	Yes**	0.682	0.093	-2.82	0.005	0.523	0.890
CVA/Stroke							
	Yes**	1.499	0.198	3.06	0.002	1.157	1.943
Psychiatric and/or Behavioral							
	Yes***	1.580	0.195	3.71	0.000	1.241	2.011
Diabetes							
	Yes	1.100	0.128	0.81	0.416	0.875	1.382
Compliance with medications							
	Never (ref)						
	Sometimes	1.258	0.253	1.14	0.255	0.847	1.867
	Always	1.236	0.212	1.23	0.218	0.882	1.731
Number of medications***		1.044	0.010	4.42	0.000	1.024	1.064
Primary insurance							
	Private (ref)						
	Medicaid***	0.297	0.067	-5.42	0.000	0.191	0.461
	Medicare	1.101	0.184	0.57	0.566	0.793	1.529
Travel times							
	0-9 min (ref)						
	10-19 min***	5.793	1.502	6.78	0.000	3.485	9.628
	20-29 min***	2.837	0.765	3.87	0.000	1.673	4.812
	30-39 min***	17.027	5.595	8.63	0.000	8.942	32.421
	40 min and longer***	10.200	3.303	7.17	0.000	5.407	19.243
Dual eligible							
	Yes***	0.511	0.089	-3.87	0.000	0.363	0.717
_cons		0.000	0.000	-35.49	0.000	0.000	0.000
logPop		1	(offset)				

* significance at p <.05; ** significance at p < .01; *** significance at p < ..001

Table 2a. Poisson regression, MIH program (n=73)

911 Transports		IRR	Std. Err.	z	P>|z|	95% CI	
Age category							
	19-33 (ref)						
	34-48 Years	1.374	0.386	1.13	0.258	0.793	2.382
	49-64 Years	0.548	0.150	-2.19	0.028	0.320	0.938
	65-78 Years	0.587	0.157	-2.00	0.046	0.348	0.990
	79+***	0.094	0.047	-4.74	0.000	0.035	0.249
Marital status							
	Single (ref)						
	Married***	0.286	0.068	-5.30	0.000	0.180	0.454
	Divorced**	0.441	0.120	-3.02	0.003	0.259	0.750
	Widowed***	10.206	5.675	4.18	0.000	3.432	30.351
Sex							
	Female (ref)						
	Male***	2.412	0.335	6.33	0.000	1.837	3.168
Race							
	White (ref)						
	Asian	0.000	0.020	-0.01	0.988	0.000	.
	Black**	1.998	0.458	3.02	0.002	1.276	3.131
	Hispanic***	3.675	1.353	3.53	0.000	1.785	7.564
Fall risk category							
	High risk	1.700	0.316	2.86	0.004	1.181	2.447
Persons living in the residence							
	1 (ref)						
	2	0.966	0.174	-0.19	0.846	0.678	1.375
	3*	1.620	0.377	2.08	0.038	1.027	2.556
	4**	3.509	1.555	2.83	0.005	1.472	8.365
	6***	4.903	1.668	4.67	0.000	2.517	9.552
	7	2.105	1.268	1.24	0.217	0.646	6.855
Asthma/COPD							
	Yes***	4.346	0.820	7.78	0.000	3.002	6.291
Hypertension							
	Yes	0.840	0.182	-0.81	0.419	0.549	1.284
High cholesterol							
	Yes**	1.749	0.346	2.83	0.005	1.187	2.578

CHF							
	Yes***	0.454	0.081	-4.42	0.000	0.320	0.644
CVA/Stroke							
	Yes*	1.443	0.262	2.02	0.044	1.010	2.060
Psychiatric and/or Behavioral							
	Yes***	1.833	0.298	3.73	0.000	1.333	2.522
Diabetes							
	Yes***	1.940	0.274	4.69	0.000	1.471	2.560
Compliance with medications							
	Never (ref)						
	Sometimes**	1.949	0.494	2.63	0.008	1.186	3.203
	Always	1.505	0.332	1.85	0.064	0.977	2.320
Number of medications***		1.045	0.013	3.68	0.000	1.021	1.071
Primary insurance							
	Private (ref)						
	Medicaid	0.599	0.179	-1.72	0.086	0.334	1.075
	Medicare**	2.192	0.554	3.11	0.002	1.336	3.597
Travel times							
	0-9 min (ref)						
	10-19 min***	5.934	1.684	6.27	0.000	3.402	10.350
	20-29 min***	3.669	1.082	4.41	0.000	2.059	6.539
	30-39 min***	8.748	3.275	5.79	0.000	4.200	18.221
	40 min and longer***	15.094	5.664	7.23	0.000	7.234	31.495
Dual eligible							
	Yes***	0.295	0.072	-5.03	0.000	0.184	0.475
_cons		0.000	0.000	-30.29	0.000	0.000	0.000
logPop		1	(offset)				

* significance at p <.05; ** significance at p < .01; *** significance at p < ..001

Figures

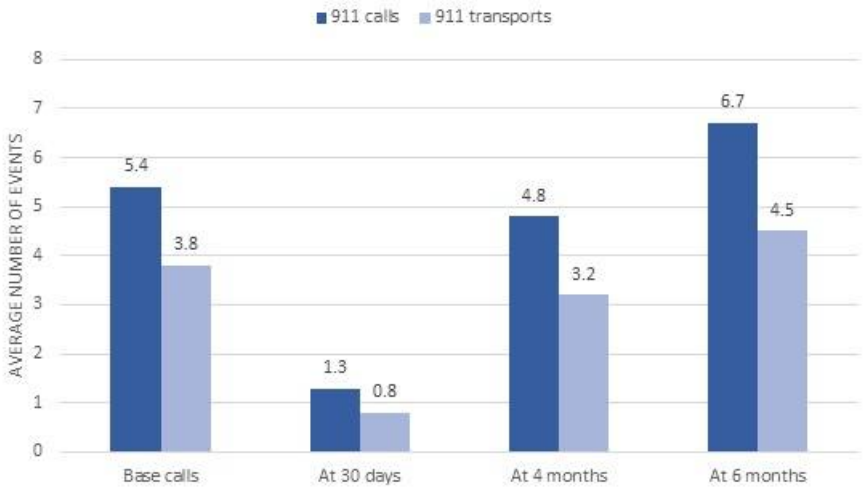

Figure 1

Average EMS calls and transports before and after first MIH visit, 2016-2018