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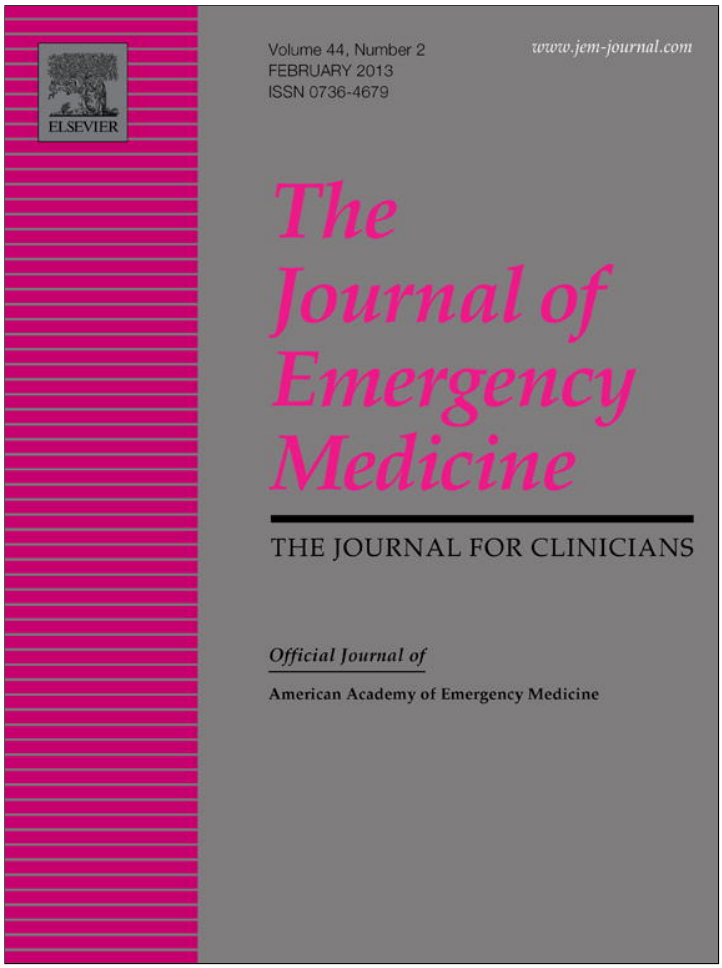

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Selected Topics: Prehospital Care

HOW WELL DO EMERGENCY MEDICAL DISPATCH CODES PREDICT PREHOSPITAL MEDICATION ADMINISTRATION IN A DIVERSE URBAN COMMUNITY?

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□ **Abstract—Background: The Medical Priority Dispatch System (MPDS) is an emergency medical dispatch (EMD) system that is widely used to prioritize 9-1-1 calls and optimize resource allocation. MPDS is a computer-based EMD system that uses callers' responses to scripted questions to categorize cases into groups and subgroups, based on complaint and perceived acuity. Objective: This study evaluates the ability of MPDS codes to predict prehospital use of medications. Methods: All transported prehospital patients assigned a subgroup by MPDS from January 1, 2009 to December 31, 2009 in a diverse urban community were matched with their prehospital electronic patient care records. The records of transported patients dispatched through EMD were queried for prehospital interventions and matched to their MPDS classifications. Only MPDS subgroups with 10 or more calls were included in the analysis. Results: A total of 38,005 patients met inclusion criteria. Patients with chest pain, breathing problems, heart problems, and diabetic problems received the most medications. Medications were administered in 19% of all calls. The individual MPDS subgroup with the highest rate of medication administration was 6E1A (breathing problems, 76%). Higher rates of Advanced Life Support (ALS) interventions in higher-acuity categories (e.g., Alpha, Bravo, Charlie) were seen in several EMD categories, including unconscious/fainting, breathing problems, and abdominal pain; but this was not observed in many other categories, including seizure, sick person, traumatic injury, and hemorrhage/lacerations. Conclusions: Medications were administered in 19% of all calls. There were higher rates of ALS interventions in higher-acuity categories that were not observed in many other categories.** © **2013 Elsevier Inc.**

□ **Keywords—ambulances/utilization; emergencies/classification; Emergency Medical Dispatch; Emergency Medical Service communication systems/standards; risk assessment; triage**

INTRODUCTION

Emergency Medical Dispatch (EMD) is an internationally utilized system of categorizing and prioritizing emergency calls to send an appropriate and timely prehospital response. A variety of studies in differing systems with both health and non-health trained dispatchers have been published using a variety of different clinical measures to gauge success (1–14).

The Medical Priority Dispatch System (MPDS; Medical Priority Consultants, Salt Lake City, UT) is a computer-based or card-based emergency medical dispatch system that uses callers' responses to scripted questions to categorize cases into numerical complaint-based categories, which are then assigned a priority (Omega, Alpha, Bravo, Charlie, Delta, or Echo) based on their perceived acuity. These priority categories also can be subdivided by various clinical modifiers. An example would be 6D1A, composed of a category of breathing problems

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(6), with the dispatch priority of Delta (D), and the modifier of a known history of asthma (1A).

Several studies have examined the predictive accuracy of MPDS and other EMD systems for a variety of outcomes, including paramedic-assigned acuity score, physician diagnosis of an acute illness, cardiac arrest, "Code 3" or "lights and sirens" return, and the need for Advanced Life Support (ALS) intervention (9,15–20). Most research has demonstrated that MPDS and other EMD systems identify most, but not all, urgent calls with a considerable degree of overtriage (7–9,11,16,18,21,22).

The MPDS system attempts to predict the need for either ALS or Basic Life Support (BLS) assessment as well as the required timeliness (Hot or Cold response). Alpha calls are to be dispatched as BLS Cold, Bravo as BLS Hot, Charlie as ALS Cold, and Delta as ALS Hot. Omega calls represent those calls that are not time dependent (poison control center consults and those with obvious death). Echo calls are the sickest patients who require the most rapid response. This is accomplished by a variety of methods, such as an engine response or police vehicle with an automatic external defibrillator.

Several studies have demonstrated that measuring the need for prehospital procedures such as an advanced airway or chest decompression is an excellent proxy for patients in cardiac arrest or other similar severe medical condition (11,13,14). In this study, we measured the need for prehospital medication among MPDS categories. The need for prehospital medication is a reasonable proxy for ALS treatment but may not predict the need for ALS assessment. Calls with higher acuity (Delta or Echo response) should have higher rates of medication use than those with lower acuity (Alpha or Bravo).

METHODS

The city of San Francisco is an urban area with a population of 800,000 and a size of 47 square miles that receives approximately 68,000 calls for emergency medical assistance annually. All calls receive an ALS response. High priority or "code 3" calls receive a "lights and sirens" response consisting of a fire department engine (staffed with one paramedic) and an ambulance staffed with at least one paramedic. Most ambulances are staffed by fire department personnel, but a small percentage of calls receive private paramedic-staffed ambulances.

Our dispatch center primarily uses the computerized version of the MPDS. MPDS Card sets are used for episodes of computer failure or a monthly card exercise. Our dispatch center is a fully certified MPDS center with an active quality improvement program, but is currently not a Center of Excellence. Emergency Medical Services (EMS) calls are each assigned a dispatch code using the MPDS (Version 11.3, Medical Priority Consultants) when adequate information is available. The computer-aided dispatch system records general information regarding each call, including date, time, and location of call, dispatch time, dispatch code, and disposition. An electronic prehospital care record is generated for each patient receiving medical attention and includes data on patient demographics, medical history, signs and symptoms, and clinical interventions. The computer-aided dispatch system creates a unique number that is used to link the dispatch record with the patient care record. An Access query was created to link these two records and measure the use of a prehospital medication.

Using the MPDS system, callers' responses to scripted questions are used to categorize cases into numerical complaint-based categories called protocols, which are further assigned a priority (Alpha, Bravo, Charlie, Delta, or Echo) based on their perceived acuity. Alpha and Bravo represent the lowest acuity calls; these calls generally receive a "no lights and sirens" or "code 2" response in our system. Charlie, Delta, and Echo represent higher-acuity calls that receive a "lights and sirens" or "code 3" response in our system. Calls may be further assigned a numerical subgroup and a modifier that provide responders with more specific details about the call. Together, the numerical protocol, priority (Alpha through Echo), subgroup, and modifier (when present) make up the MPDS subgroup. For example, a call may be assigned to the MPDS subgroup 12D3E. The number 12 is the complaint-based category for seizure; D (or Delta) represents priority; 3 is a subcategory that informs prehospital providers that the patient has irregular breathing; and E is a modifier that indicates the patient has a history of epilepsy.

In this 1-year retrospective cohort study, we analyzed all calls for EMS care in San Francisco between January 1 and December 31, 2009. The following EMS calls were excluded from analysis: 1) calls not processed with the use of EMD, most commonly due to law officer request or language barrier; 2) calls in which patient transport did not occur (no patient was found on EMS arrival or the patient declined transport against the advice of the paramedic); and 3) calls in which the electronic prehospital care record could not be matched with the EMD code, usually occurring due to a mismatch between the dispatch-generated run number and the number entered by the paramedic. By an a priori decision, we chose to evaluate those EMD codes that were used at least 10 times in the 1-year study period.

For the purpose of analysis, each call was categorized as receiving either one or more medications, or none. Medications available in the San Francisco EMS system include nitroglycerin, aspirin, adenosine, albuterol, amiodarone, atropine, epinephrine, dopamine,

diphenhydramine, naloxone, glucagon, valium, sodium bicarbonate, dextrose 50%, morphine, and activated charcoal. Oxygen was not included as a medication. The University of California, San Francisco Committee on Human Research approved this study.

RESULTS

A total of 68,299 medical calls were dispatched during our study period. After the exclusion of non-transported patients (14,843), non-EMD'ed calls (12,655), and those from categories with fewer than 10 uses (2796), there were 38,005 patients available for study. All of these patients were matched to their EMD codes (Figure 1, Table 1). There were over 200 EMD categories that were used <10 times in 1 year.

The data with all subcategories were compressed into Alpha, Bravo, Charlie, Delta, or Echo categories (Figures 2–4). The same data, presented by individual subgroups, can be seen in the Appendix (Figures 5–10). Overall, medications were administered to 19.0% of patients. Patients with the following EMD codes received the most medications: 10 (chest pain, 47.0%), 6 (breathing problems, 38.2%), 19 (heart problems, 36.0%); 13 (diabetic problems, 34.4%); and 9 (cardiac arrest, 28.4%) (Figures 2–4). Those subcategories with the highest rates of medication administration included several within the breathing problems category: 6E1A (ineffective breathing with asthma history, 76%), 6D2A (not alert with asthma history, 65%), and 6C1A (abnormal breathing with asthma history, 58%) (Appendix Figure 5). Additional subgroups with high rates of medication administration include 10C2 (chest pain with cardiac history, 57%); 13D1 (diabetic problems and unconscious, 56%); and 19C3 (heart problems with chest pain and older than 35 years, 53%) (Appendix Figures 5,8,10).

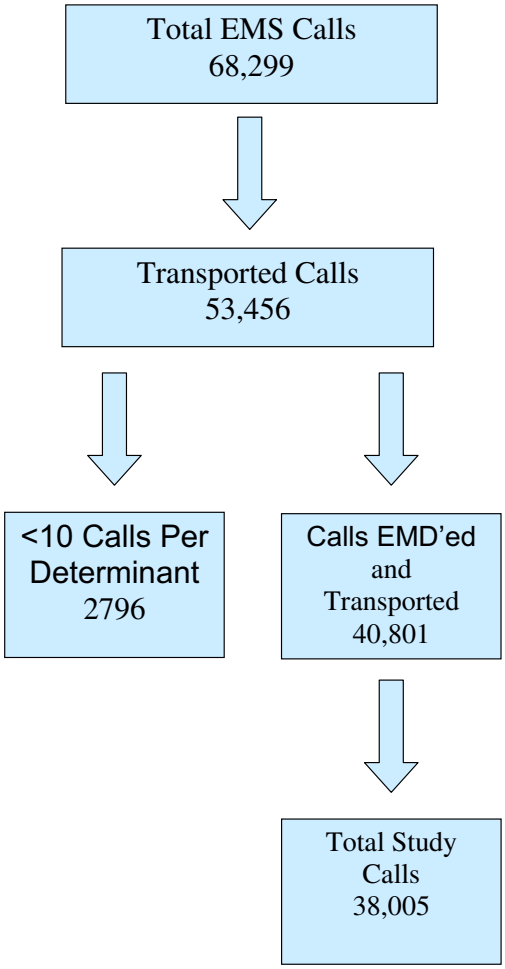

Figure 1. Flow of emergency medical calls in the study. EMS = Emergency Medical Services; EMD = Emergency Medical Dispatch.

In theory, high-priority EMD codes (those with a Charlie, Delta, or Echo designation) should have a higher medication rate than low-priority codes (those with Alpha or Bravo designations). This pattern was seen in a number of EMD codes, including unconscious/fainting (Figure 4), breathing problems (Figure 2), abdominal pain (Figure 2), and traffic/transportation accidents (Figure 4). However, this expected pattern was not seen in many codes, including seizures (Figure 3), sick person (Figure 4), traumatic injuries (Figure 4), hemorrhage/lacerations (Figure 3), and pregnancy (Figure 4).

DISCUSSION

This study has demonstrated an inconsistent ability of the EMD system to predict which patients will require an ALS medication among all EMD codes. This is similar to past research showing that this process identifies most but not all urgent calls with considerable overtriage (7–9,11,16,18,21,22). The MPDS system is designed to sort out which patients will require ALS-level assessment. The authors are unaware of a standardized definition for the need for ALS assessment, so we have used a process measure, the need for a prehospital medication, as a proxy for the need for ALS assessment (9,11,13,14).

The MPDS system is designed such that Alpha calls are to be dispatched as BLS Cold, Bravo as BLS Hot, Charlie as ALS Cold, and Delta as ALS Hot. Our all-ALS system does not use the MPDS system for this designation. This difference would likely increase the use of medications in low-priority patients.

If the MPDS system functions to predict need for ALS assessment, then there should be a clear pattern of increasing medication administration from Alpha to Echo. This pattern was seen in only a portion of EMD categories.

Table 1. MPDS Categories and Percentage of Calls Receiving Medications

MPDS	Description	Total # Calls	% Meds
1A1	ABDOMINAL PAINS - NOT ALERT	624	8%
1C1	Abdominal pain - fainting or near fainting ≥50 y/o	62	11%
1C2	Abdominal pain - females with fainting or near fainting 12–50 y/o	32	16%
1C3	Abdominal pain - males with pain above navel ≥35 y/o	172	10%
1C4	Abdominal pain - females with pain above navel ≥45 y/o	117	4%
1C5	ABDOMINAL PAIN/SHOCK male 35 y/o	121	9%
1C6	ABDOMINAL PAIN/SHOCK female 45 y/o	81	6%
1D1	Abdominal pain - not alert	120	9%
2A1	Allergies/envenomations - no difficulty breathing or swallowing	34	6%
2C1	Allergies/envenomations - special medications or injections used	44	23%
2C2	Allergies/envenomations - difficulty breathing or swallowing	24	8%
2D1	Allergies/envenomations - severe respiratory distress	20	30%
2D2	Allergies/envenomations - not alert	43	21%
2D3	Allergies/envenomations - condition worsening	34	12%
4A1	Assault/sexual assault - not dangerous body area (extremity injury)	54	11%
4B1	Assault/sexual assault - possibly dangerous body area	598	1%
4B2	Assault/sexual assault - serious hemorrhage	32	0%
4B3	Assault/sexual assault - unknown status (3rd-party caller)	97	6%
4D1	Assault/sexual assault - unconscious or arrest	98	3%
4D2	Assault/sexual assault - not alert	139	2%
4D3	Assault/sexual assault - abnormal breathing	26	0%
4D4	Assault/sexual assault - dangerous body area	15	0%
5A1	Back pain - non-traumatic back pain	197	12%
5A2	Back pain - non-recent traumatic back pain (≥6 h)	24	8%
5D1	Back pain - not alert	14	7%
6C1	Breathing problems - abnormal breathing	752	28%
6C1A	Breathing problems - abnormal breathing, asthma	226	58%
6C2	Breathing problems - cardiac history	88	34%
6C2A	Breathing problems - cardiac history, asthma	39	46%
6D1	Breathing problems - severe respiratory distress	1719	28%
6D1A	Breathing problems - severe respiratory distress, asthma	688	55%
6D2	Breathing problems - not alert	1211	34%
6D2A	Breathing problems - not alert, asthma	569	65%
6D3	Breathing problems - color change	137	19%
6D3A	Breathing problems - clammy, asthma	47	36%
6D4	SOB clamminess	140	26%
6D4A	SOB - asthma clammy	58	45%
6E1	Breathing problems - ineffective breathing	219	42%
6E1A	Breathing problems - ineffective breathing, asthma	71	76%
7A1	Burns - burns <18% body area	12	33%
9B1	Cardiac or respiratory arrest/death - obvious death	143	1%
9D1	Cardiac or respiratory arrest/death - ineffective breathing	91	20%
9E1	Cardiac or respiratory arrest/death - workable arrest, not breathing	442	38%
9E2	Cardiac or respiratory arrest/death - workable arrest, breathing uncertain	137	33%
9E3	Cardiac or respiratory arrest/death - workable arrest, hanging	10	20%
10A1	Chest pain - breathing normally <35 y/o	54	17%
10C1	Chest pain - abnormal breathing	517	50%
10C2	Chest pain - cardiac history	350	57%
10C4	Chest pain - breathing normally ≥35 y/o	632	44%
10D1	Chest pain - severe respiratory distress	428	44%
10D2	Chest pain - not alert	579	48%
10D3	Chest pain - clammy	273	43%
10D4	Chest pain clamminess	374	48%
11A1	CHOKING - breathing	21	5%
11D1	Choking - not alert	68	12%
11D2	Choking - abnormal breathing	18	11%
11E1	Choking - ineffective breathing	18	17%
12A1	Convulsions/seizures - not seizing and breathing regularly	278	6%
12A1E	Convulsions/seizures - not seizing and breathing regularly, epilepsy	198	5%
12A3E	Convulsions/seizures - post seizure, epilepsy	25	4%
12B1	Convulsions/seizures - breathing regularly not verified <35 y/o	89	9%
12B1E	Convulsions/seizures - breathing regularly not verified <35 y/o, epilepsy	32	9%
12C1	Convulsions/seizures - pregnancy	22	0%
12C1E	Convulsions/seizures - pregnancy, epilepsy	15	7%
12C2	Convulsions/seizures - diabetic	10	20%

(*Continued*)

Table 1. Continued

MPDS	Description	Total # Calls	% Meds
12C2E	Convulsions/seizures - diabetic, epilepsy	11	0%
12C3	Convulsions/seizures - cardiac history	19	5%
12C3E	Convulsions/seizures - cardiac history, epilepsy	33	18%
12D1	Convulsions/seizures - not breathing	11	0%
12D2	Convulsions/seizures - continuous or multiple seizures	500	10%
12D2E	Convulsions/seizures - continuous or multiple seizures, epilepsy	474	6%
12D3	Convulsions/seizures - irregular breathing	77	6%
12D3E	Convulsions/seizures - irregular breathing, epilepsy	59	3%
12D4	Convulsions/seizures - breathing regularly not verified ≥35 y/o	310	7%
12D4E	Convulsions/seizures - breathing regularly not verified ≥35 y/o, epilepsy	82	11%
13A1	Diabetic problems - alert and behaving normally	168	11%
13C1	Diabetic problems - not alert	297	50%
13C2	Diabetic problems - abnormal behavior	135	24%
13C3	Diabetic problems - abnormal breathing	78	15%
13D1	Diabetic problems - unconscious	108	56%
16A	Eye problems/injuries - eye injury or medical eye problem	46	0%
17A1	Falls - not dangerous body area	440	26%
17A1G	FALL on ground	230	35%
17A2	Falls - non-recent (≥6 h) injuries (without priority symptoms)	166	12%
17A2G	FALL	27	4%
17A3	FALL EVAL public assist no injuries	27	4%
17A3G	FALL	13	0%
17B1	Falls - possibly dangerous body area	942	8%
17B1G	FALL	414	9%
17B2	Falls - serious hemorrhage	28	29%
17B2G	FALL	17	0%
17B3	Falls - unknown status (3rd-party caller)	439	11%
17B3G	FALL	209	12%
17D1	Falls - dangerous body area	220	4%
17D2	Falls - Long fall (≥6 feet/2 meters)	214	12%
17D3	Falls - unconscious or not alert	679	9%
17D4	Falls - abnormal breathing	75	13%
17D5	FALL long fall 10–20 ft	175	13%
17O1	Falls - public assist (no injuries and no priority symptoms)	26	12%
18A1	Headache - breathing normally	41	5%
18C1	Headache - not alert	17	0%
18C2	Headache - abnormal breathing	39	8%
18C3	Headache - speech problems	15	0%
18C4	Headache - sudden onset of severe pain	53	0%
19B1	Heart problems/AICD - unknown status (3rd-party caller)	22	23%
19C2	Heart problems/AICD - abnormal breathing	79	43%
19C3	Heart problems/AICD - chest pain ≥35 y/o	80	53%
19C4	Heart problems/AICD - cardiac history	104	26%
19C6	Heart problems/AICD - heart rate <50 beats/min or ≥130 beats/min (without priority symptoms)	10	40%
19C7	HEART PROBLEMS/AICD – CHEST PAIN unknown status	50	32%
19D1	Heart problems/AICD - severe respiratory distress	96	33%
19D2	Heart problems/AICD - not alert	123	36%
19D3	Heart problems/AICD - clammy	60	38%
19D4	CARDIAC clammy	89	34%
21A1	Hemorrhage/laceration - not dangerous hemorrhage	158	3%
21B1	Hemorrhage/laceration - possibly dangerous hemorrhage	380	3%
21B2	Hemorrhage/laceration - serious hemorrhage	128	2%
21B3	Hemorrhage/laceration - bleeding disorder or blood thinners	12	8%
21D1	Hemorrhage/laceration - dangerous hemorrhage	123	4%
21D2	Hemorrhage/laceration - not alert	169	4%
21D3	Hemorrhage/laceration - abnormal breathing	182	4%
21D4	CRITICAL BLEED abnormal breathing	63	10%
23B0	CODE 2 ALS AMB	20	0%
23B1	Overdose/poisoning - overdose (without priority symptoms)	18	28%
23B1I	Overdose/poisoning - overdose, intentional	72	43%
23C1	Overdose/poisoning - violent (police must secure)	54	22%
23C1A	Overdose/poisoning - violent, accidental overdose	38	16%
23C1I	Overdose/poisoning - violent, intentional overdose	88	26%
23C2	Overdose/poisoning - not alert	18	11%

(*Continued*)

Table 1. Continued

MPDS	Description	Total # Calls	% Meds
23C2A	Overdose/poisoning - not alert, accidental	45	24%
23C2I	Overdose/poisoning - not alert, intentional	71	21%
23C3A	Overdose/poisoning - abnormal breathing, accidental	17	12%
23C3I	Overdose/poisoning - abnormal breathing, intentional	10	50%
23C7	Overdose/poisoning - acid or alkali (lye)	30	40%
23C7I	Overdose/poisoning - acid or alkali (lye), intentional	31	32%
23C8	Overdose/poisoning - unknown status (3rd-party caller)	13	46%
23C8I	Overdose/poisoning - unknown status (3rd-party caller), intentional	19	21%
23D1	Overdose/poisoning - unconscious	16	44%
23D1A	Overdose/poisoning - unconscious, accidental	20	30%
23D1I	Overdose/poisoning - unconscious, intentional	53	30%
23O1A	Overdose/poisoning - poisoning (without priority symptoms), accidental	35	14%
24A1	Pregnancy/childbirth/miscarriage - 1st trimester hemorrhage or miscarriage	10	0%
24B1	Pregnancy/childbirth/miscarriage - Labor (delivery not imminent, ≥20 weeks)	22	0%
24B2	Pregnancy/childbirth/miscarriage - Unknown status (3rd-party caller)	17	0%
24C1	Pregnancy/childbirth/miscarriage - 2nd trimester hemorrhage or miscarriage	12	0%
24C2	Pregnancy/childbirth/miscarriage - 1st trimester serious hemorrhage	18	6%
24D3	Pregnancy/childbirth/miscarriage - imminent delivery (≤20 weeks)	62	2%
24D4	Pregnancy/childbirth/miscarriage - 3rd trimester hemorrhage	19	0%
24D5	Pregnancy/childbirth/miscarriage - high risk complications	16	6%
25A1	Psychiatric - non-suicidal and alert	54	7%
25A2	Psychiatric - suicidal (not threatening) and alert	10	10%
25B1	Psychiatric - serious hemorrhage	19	0%
25B2	Psychiatric - non-serious or minor hemorrhage	11	0%
25B3	Psychiatric - threatening suicide	39	26%
25B6	Psychiatric - unknown status (3rd-party caller)	56	21%
25D1	Psychiatric - not alert	73	11%
25D2	Psychiatric - dangerous hemorrhage	17	6%
26A1	Sick person - no priority symptoms	1509	7%
26A10	Sick person - deafness	114	11%
26A11	Sick person - defecation/diarrhea	174	4%
26A2	Sick person - boils	65	12%
26A28	Sick person - wound infected	14	7%
26A3	Sick person - bumps (non-traumatic)	119	6%
26A4	Sick person - can't sleep	77	6%
26A5	Sick person - can't urinate (without abdominal pain)	90	4%
26A6	Sick person - catheter	68	7%
26A7	Sick person - constipation	43	5%
26A8	Sick person - cramps/spasms/joint pain	23	4%
26A9	Sick person - cut-off ring request	11	0%
26B1	Sick person - unknown status (3rd-party caller)	228	7%
26C1	Sick person - cardiac history	601	10%
26C2	EVAL-CARDIAC Pt abnormal breathing	468	12%
26C3	EVAL-CARDIAC Pt sickle cell crisis	11	9%
26D1	Sick person - not alert	840	10%
26O11	SICK-EVAL diarrhea	13	0%
27B4	Stab/gunshot/penetrating trauma - unknown status (3rd-party caller)	25	0%
27D1	Stab/gunshot/penetrating trauma - unconscious or arrest	29	3%
27D2	Stab/gunshot/penetrating trauma - not alert	76	3%
27D3	Stab/gunshot/penetrating trauma - central wounds	235	2%
27D4S	Stab/gunshot/penetrating trauma - multiple wounds, stab	12	0%
28B1	Stroke - unknown status	10	0%
28C1	Stroke - not alert	367	16%
28C2	Stroke - abnormal breathing	118	14%
28C3	Stroke - speech or movement problems	231	7%
28C4	Stroke - numbness or tingling	152	3%
29A1	Traffic/transportation accidents - extremity injury	29	0%
29B1	Traffic/transportation accidents - injuries	590	2%
29B2	Traffic/transportation accidents - multiple victims	27	0%
29B3	Traffic/transportation accidents - multiple victims (additional units)	23	0%
29B4	Traffic/transportation accidents - serious hemorrhage	126	2%
29B5	Traffic/transportation accidents - other hazards	14	7%
29B6	Traffic/transportation accidents - unknown status (3rd-party caller)	102	2%
29D1	Traffic/transportation accidents - major incident	31	3%

(*Continued*)

Table 1. Continued

MPDS	Description	Total # Calls	% Meds
29D2	Traffic/transportation accidents - high mechanism	556	6%
29D2L	MVA-OTHER bike motorcycle accident	352	7%
29D2M	MVA-OTHER pedestrian	306	6%
29D2N	MVA-OTHER ejection	37	8%
29D2P	MVA-OTHER rollover	75	0%
29D4	Traffic/transportation accidents - pinned victim	78	1%
29D5	Traffic/transportation accidents - not alert	96	2%
30A1	Traumatic injuries - not dangerous body area	277	30%
30A2	Traumatic injuries - non-recent injuries (≥6 h)	93	12%
30B1	Traumatic injuries - possibly dangerous body area	197	13%
30B2	Traumatic injuries - serious hemorrhage	27	4%
30D1	Traumatic injuries - dangerous body area	32	0%
30D2	Traumatic injuries - unconscious or not alert	41	7%
30D3	Traumatic injuries - abnormal breathing	24	25%
31A1	Unconscious/fainting - single or near fainting episode and alert <35 y/o	295	4%
31A3	fainting alert less 35 y/o no cardiac hx	83	5%
31C1	Unconscious/fainting - alert with abnormal breathing	309	12%
31C2	Unconscious/fainting - cardiac history	182	12%
31C3	Unconscious/fainting - multiple fainting episodes	73	3%
31C4	Unconscious/fainting - single or near fainting episode and alert ≥35 y/o	198	10%
31D1	Unconscious/fainting - unconscious	858	19%
31D2	Unconscious/fainting - severe respiratory distress	1096	19%
31D3	Unconscious/fainting - not alert	1378	11%
31D4	FAINTED change in color	13	15%
32B1	Unknown problem (man down) - awake	265	10%
32B2	Unknown problem (man down) - medical alert notifications	109	13%
32B3	Unknown problem (man down) - unknown status (3rd-party caller)	295	11%
32B4	MAN-DWN language barrier	22	5%
32D1	Unknown problem (man down) - life status questionable	419	14%

MPDS = Medical Priority Dispatch System; Meds = medications; y/o = years old; Abd = abdominal; SOB = shortness of breath; EVAL = evaluation; AICD = automatic implantable cardioverter defibrillator; ALS = Advanced Life Support; AMB = ambulance; Pt = patient; MVA = motor vehicle accident; hx = history; DWN = down.

This inconsistency in information from 911 callers has caused many systems to use an "eyes on the patients first" approach to evaluating the need for time-dependent care. The MPDS has multiple advantages, including its computerization, and the consistency of the education and usage, as well as its quality improvement process. Prior studies have demonstrated its ability to improve the diagnosis of cardiac arrest (2).

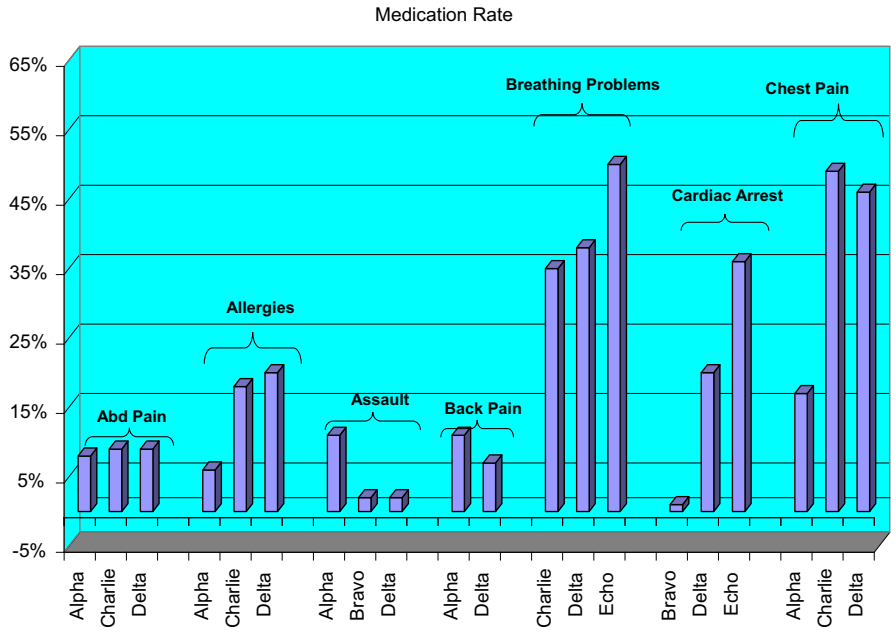

Figure 2. Medication rate by compressed Emergency Medical Dispatch category.

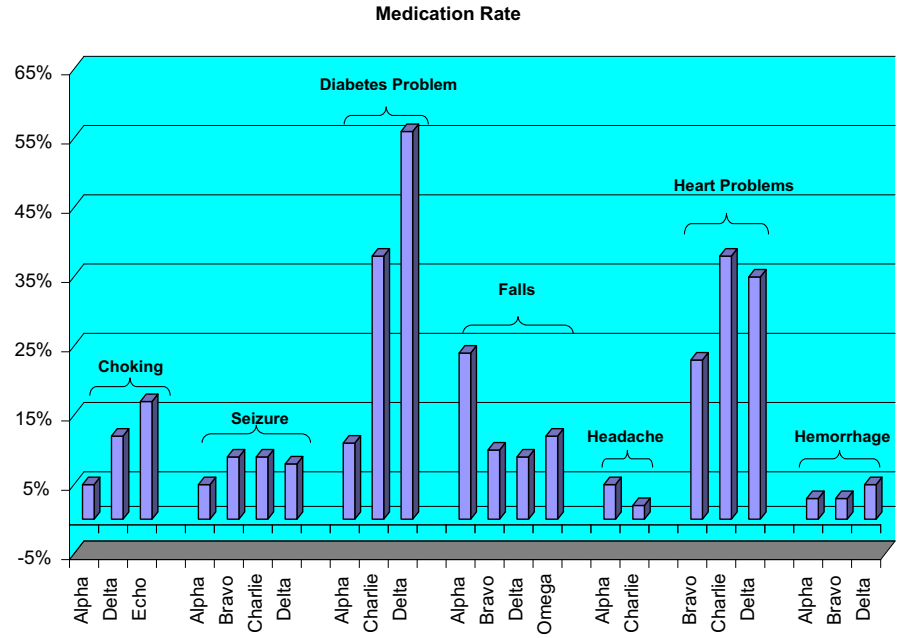

Figure 3. Medication rate by compressed Emergency Medical Dispatch category.

We believe that EMS Medical Directors can use a similar analysis of their EMS system to fine tune their dispatch protocols. Information on the rate of cardiac arrest, the rate of medication administration, and which medications are being given would be useful in deciding the level of response. For example, unknown problem (man down) – life status questionable (32D1) has a cardiac arrest rate of 0.5% and a medication rate of 11% (13). Most of those medications were aspirin, naloxone, and dextrose. This information may allow some systems to downgrade this to a "no lights and sirens" response. Similarly, a 7% rate of midazolam use among those patients with a seizure and breathing problems verified (12A1) might lead some to upgrade to a "lights and sirens" response. This level of detailed analysis in a specific system can allow for unprecedented local control.

Limitations

A number of limitations of our study must be noted. A major limitation is the fact that all of our calls receive an ALS response. It is possible that this response leads

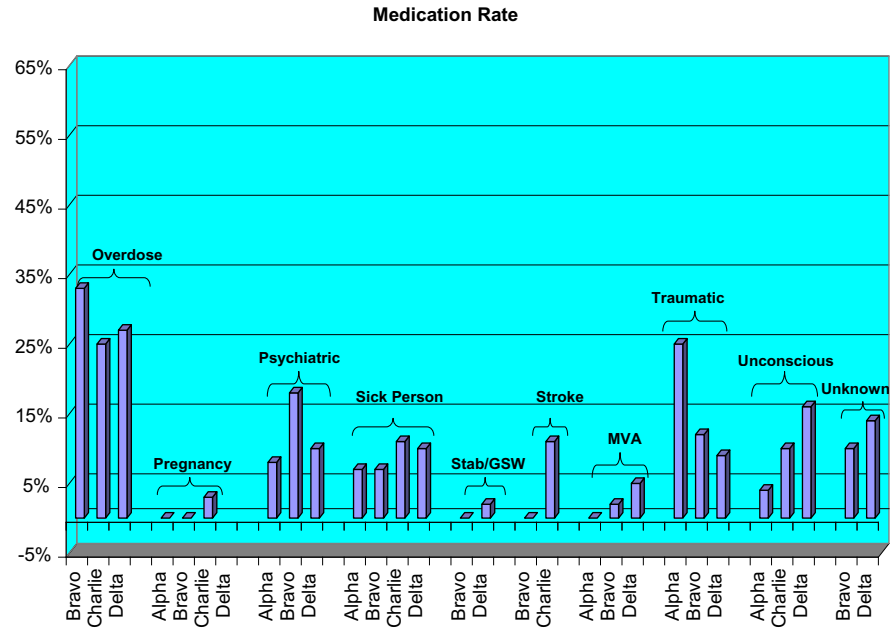

Figure 4. Medication rate by compressed Emergency Medical Dispatch category.

to higher delivery of medications even when they may not be indicated or time dependent. The findings in our single-tiered EMS system may thus differ from those derived in multi-tiered EMS systems. Those patients who received intravenous fluids also were not counted, and this could be leading to an undercounting of our medication rates. This study was unable to measure protocol compliance with the use of medications.

Patients who were dispatched through EMD and not transported were not included in this study, as this would have likely decreased the rate of medication administration for most subcategories. Similarly, a large percentage of calls were not subject to the EMD process, as seen in other systems. This may have affected our data analysis. Finally, our analysis did not look at what specific medication was administered and we were not able to comment on the time sensitivity of the medication.

CONCLUSION

Patients with chest pain, breathing problems, heart problems, and diabetic problems received the most medications. Medications were administered to 19% of all calls. Higher rates of ALS interventions in higher-acuity categories (e.g., Alpha, Bravo, Charlie) were seen in several EMD categories, including unconscious/fainting, breathing problems, and abdominal pain. This was not observed in many categories, including seizure, sick person, traumatic injury, and hemorrhage/lacerations. The rate of prehospital medication administration by EMD subgroup may be useful in deciding the need for a "lights and sirens" response and could help optimize the utilization of our prehospital resources.

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ARTICLE SUMMARY

1. Why is this topic important?

Emergency Medical Dispatch is used in multiple countries to optimize the dispatch of prehospital resources, and there have been only a few studies of its effectiveness.

2. What does this study attempt to show?

The administration of a prehospital medication was used as a proxy for a patient encounter that required Advanced Life Support level care. We examined the differing percentages of patients in each category, expecting a stepwise increase in medication administration rates for Alpha, Bravo, Delta, and Echo calls.

3. What are the key findings?

A stepwise increase of Advanced Life Support interventions was seen in several categories (unconscious/fainting, breathing problems, and abdominal pain) but not in most categories.

4. How is patient care impacted?

Emergency Medical Dispatch is only able to modestly predict the use of medications in prehospital calls. Emergency Medical Systems will need to continue to send personnel to evaluate most patients who call 911 for medical assistance.

APPENDIX

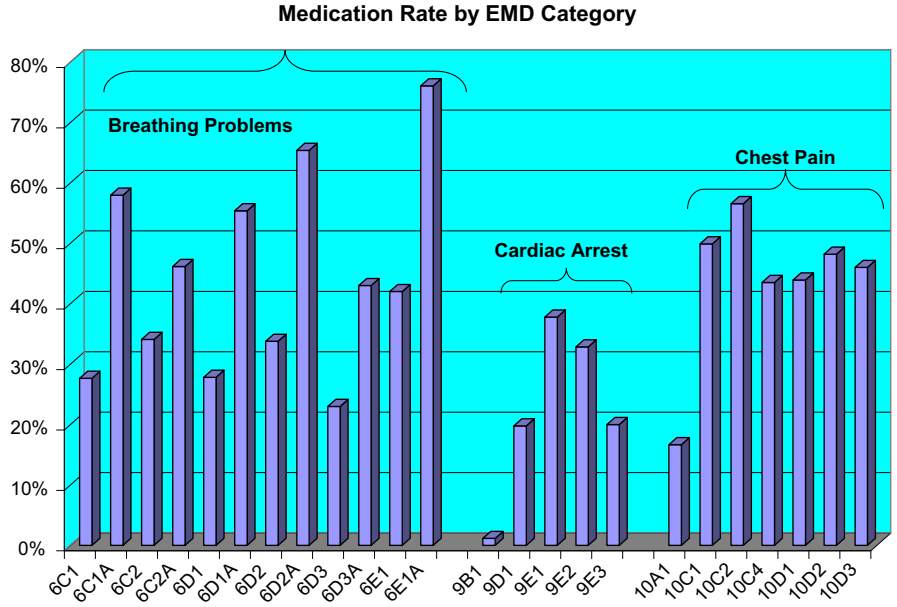

Figure 5. Medication rate by Emergency Medical Dispatch (EMD) categories of Breathing Problems, Cardiac Arrest, and Chest Pain.

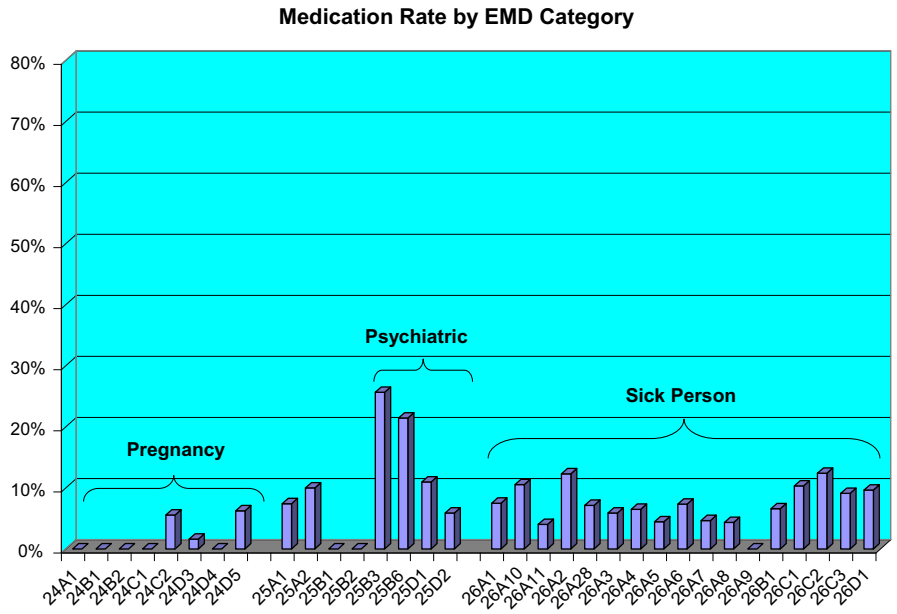

Figure 6. Medication rate by Emergency Medical Dispatch (EMD) categories of Pregnancy, Psychiatric, and Sick Person.

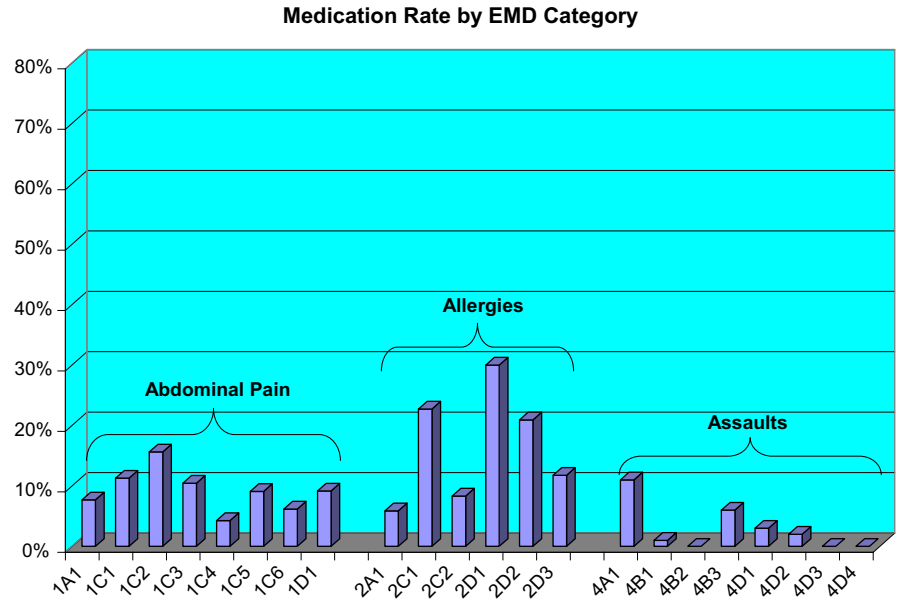

Figure 7. Medication rate by Emergency Medical Dispatch (EMD) categories of Abdominal Pain, Allergies, and Assaults.

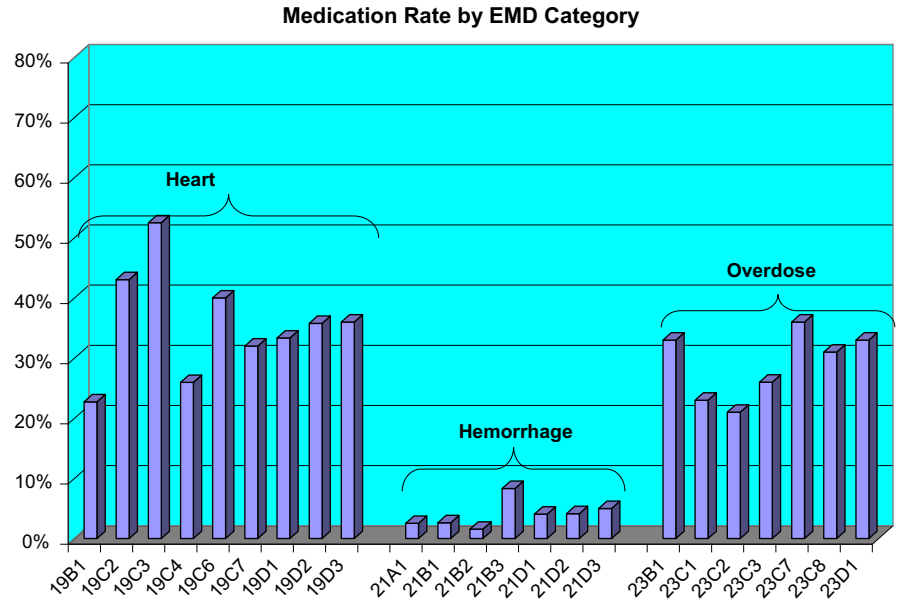

Figure 8. Medication rate by Emergency Medical Dispatch (EMD) categories of Heart Problems, Hemorrhage, and Overdose.

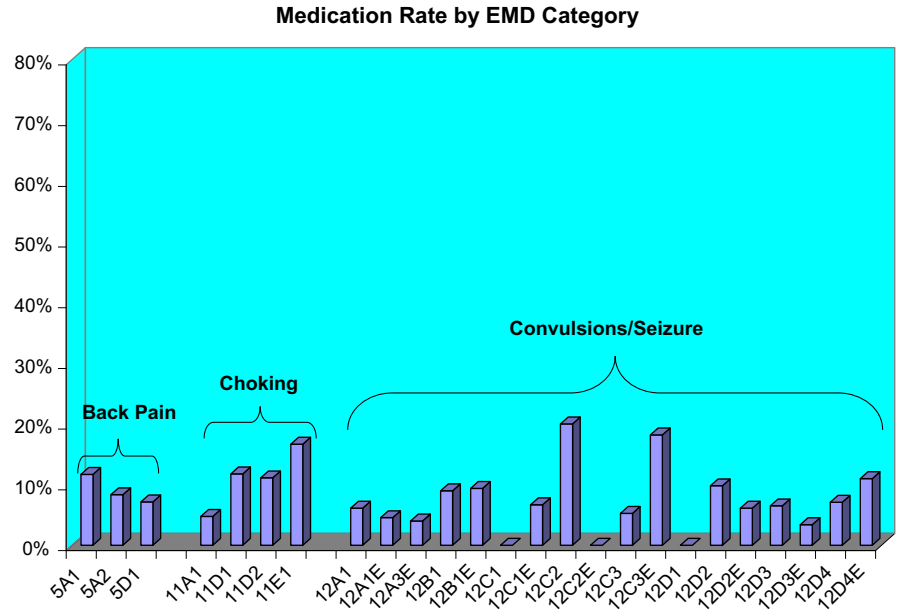

Figure 9. Medication rate by Emergency Medical Dispatch (EMD) categories of Back Pain, Choking, and Convulsions/Seizure.

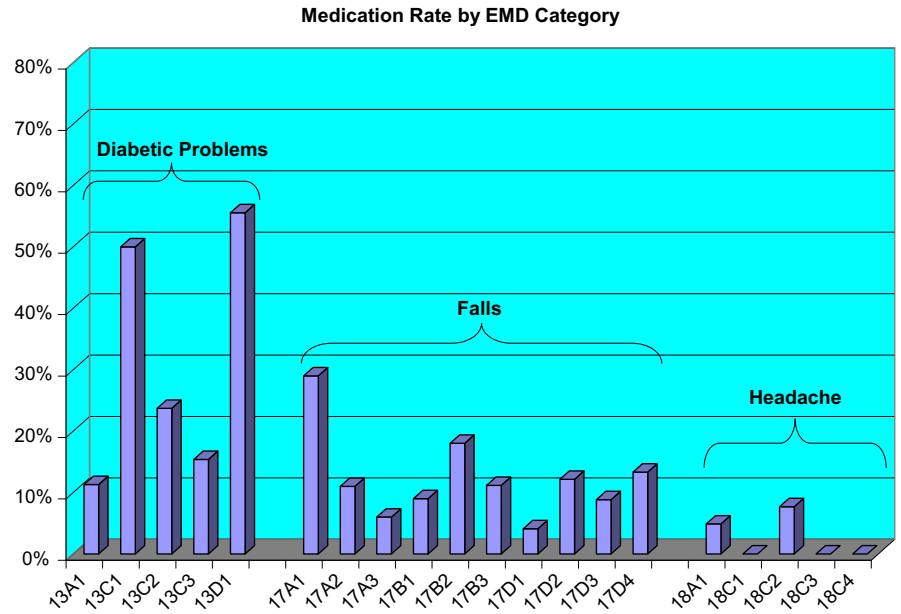

Figure 10. Medication rate by Emergency Medical Dispatch (EMD) categories of Diabetic Problems, Falls, and Headache.