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Comparison of the Medical Priority Dispatch System to an Out-of-hospital Patient Acuity Score

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Abstract

Background: Although the Medical Priority Dispatch System (MPDS) is widely used by emergency medical services (EMS) dispatchers to determine dispatch priority, there is little evidence that it reflects patient acuity. The Canadian Triage and Acuity Scale (CTAS) is a standard patient acuity scale widely used by Canadian emergency departments and EMS systems to prioritize patient care requirements.

Objectives: To determine the relationship between MPDS dispatch priority and out-of-hospital CTAS.

Methods: All emergency calls on a large urban EMS communications database for a one-year period were obtained. Duplicate calls, nonemergency transfers, and canceled calls were excluded. Sensitivity and specificity to detect high-acuity illness, as well as positive predictive value (PPV) and negative predictive value (NPV), were calculated for all protocols.

Results: Of 197,882 calls, 102,582 met inclusion criteria. The overall sensitivity of MPDS was 68.2% (95% confidence interval [CI] = 67.8% to 68.5%), with a specificity of 66.2% (95% CI = 65.7% to 66.7%). The most sensitive protocol for detecting high acuity of illness was the breathing-problem protocol, with a sensitivity of 100.0% (95% CI = 99.9% to 100.0%), whereas the most specific protocol was the one for psychiatric problems, with a specificity of 98.1% (95% CI = 97.5% to 98.7%). The cardiac-arrest protocol had the highest PPV (92.6%, 95% CI = 90.3% to 94.3%), whereas the convulsions protocol had the highest NPV (85.9%, 95% CI = 84.5% to 87.2%). The best-performing protocol overall was the cardiac-arrest protocol, and the protocol with the overall poorest performance was the one for unknown problems. Sixteen of the 32 protocols performed no better than chance alone at identifying high-acuity patients.

Conclusions: The Medical Priority Dispatch System exhibits at least moderate sensitivity and specificity for detecting high acuity of illness or injury. This performance analysis may be used to identify target protocols for future improvements.

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Keywords: emergency medical services, emergency medical service communication systems, triage

The Medical Priority Dispatch System (MPDS, Priority Dispatch Corporation, Version 11.1, Salt Lake City, UT) consists of 33 protocols that are widely used by more than 2,300 emergency medical services (EMS) agencies (Greg Scott, Priority Dispatch Corporation, personal communication, 2005) to interrogate 9-1-1 callers, provide prearrival instructions, determine incident priority, and assign appropriate resources to the call. However, a recent systematic review found that there was very little high-quality literature on criteria-based dispatch protocols. Only two articles in this review concluded that dispatch protocols improved patient outcome (in one case, by increasing rates of bystander cardiopulmonary resuscitation).[1,2] Although MPDS has been reported to decrease advanced life support (ALS) ambulance utilization,[3] it is unclear whether scripted interrogation protocols can accurately identify acuity of illness or injury.[4,5] A recent conference on development of criteria to define medical necessity in EMS highlighted the need to develop outcome-based benchmarks for dispatch protocols.[6]

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Table 1
Medical Priority Dispatch System Priority Levels, Showing Type of Responder and Target 90th Percentile Response Intervals Used by Toronto Emergency Medical Services

MPDS Priority	Responder Type and Target Response Time
Echo	Mandatory Advanced Life Support (ALS) response, firefighter tiered response; 8 min, 59 s
Delta	ALS response if possible, tiered response, 8:59
Charlie	ALS response if possible, 8:59
Bravo	BLS response, 10:59
Alpha	BLS response, 20:59

There is also an Omega response option (not shown), in which an ambulance response is not required.

The MPDS dispatch priority consists of a five-point nonlinear scale that is used to determine resource allocation to calls. After asking several case-entry questions, the dispatcher identifies the type of call described by the 9-1-1 caller and uses an appropriate protocol for that call type. Although MPDS is a tool for determining which types of EMS units to send to a call, in general terms, a higher dispatch priority represents a suspected higher severity of illness or injury. Specific resources sent to each type of call may vary depending on the type of responders available in different EMS systems. In our jurisdiction (Toronto, Ontario, Canada), Alpha and Bravo calls represent routine or so-called cold responses by basic life support (BLS) units, whereas Charlie, Delta, and Echo calls are progressively more urgent calls requiring ALS ambulances. Types of responders and target response intervals used in Toronto for each MPDS priority are shown in Table 1.

As with MPDS, the Canadian Triage and Acuity Scale (CTAS) is a five-level ordinal scale. It was originally developed for use by emergency departments (EDs) to classify patient acuity with respect to target time interval to be seen by a physician.[7] Use of CTAS is nearly universal in Canadian EDs. In Ontario, a large province with a population of more than 12 million, CTAS is used by all 167 EDs (Dr. Michael Schull, Institute for Clinical and Evaluative Sciences, personal communication, 2005). CTAS has been shown to predict the need for laboratory testing and correlates with ED length of stay,[8,9] the need for radiographic studies,[9,10] and hospital admission rates from the ED.[9,11] Definitions of the CTAS levels are shown in Table 2.

All Ontario emergency medical technicians (EMTs) and paramedics (EMT-Ps) are trained to determine patient CTAS. CTAS exhibits high rates of interobserver agreement among physicians and nurses.[12] Interrater agreement in Ontario between ED nurses and paramedics has been reported in abstract form, with a probability of agreement of 0.62 and agreement within one CTAS level in 96% of all cases.[13]

All ambulance calls in our system resulting in patient transport are assigned an MPDS priority at time of dispatch, and a CTAS level is determined upon patient transport. Although MPDS and CTAS represent conceptually different scales, a general goal of dispatch prioritization of calls is to distinguish high-priority calls with a potential for requiring ALS from low-priority calls for which it is safe and appropriate to send BLS ambulances. The determination of both MPDS and CTAS on all patients in our EMS system affords a unique opportunity to evaluate the relationship between dispatch priority and EMT or EMT-P assessment of patient acuity and can be used to evaluate the performance of MPDS as a screening tool to identify patients with a need for more urgent EMS response and ALS resources.

Accordingly, our objective was to assess the performance of MPDS protocols by comparing the dispatch assessment of patient acuity (as predicted by MPDS dispatch priority) with paramedic assessment of patient acuity (measured by the out-of-hospital CTAS level).

Table 2
Canadian Triage and Acuity Scale (CTAS) Level Definitions

Time to Physician Assessment by CTAS Level	Definition
1: Immediate	Resuscitation Conditions that are threats to life or limb (or imminent risk of deterioration) requiring immediate aggressive interventions.
2: ≤15 min	Emergent Conditions that are a potential threat to life, limb, or function, requiring rapid medical intervention or delegated acts.
3: ≤30 min	Urgent Conditions that could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or affecting ability to function at work or activities of daily living.
4: ≤1 hr	Less urgent (Semiurgent) Conditions that related to patient age, distress, or potential for deterioration or complications that would benefit from intervention or reassurance within 1–2 hrs.
5: ≤2 hrs	Nonurgent Conditions that may be acute but nonurgent, as well as conditions that may be part of a chronic problem, with or without evidence of deterioration. The investigation or interventions for some of these illnesses or injuries could be delayed or even referred to other areas of the hospital or health care system.

Adapted from Beveridge R, Clarke B, Janes L, et al. Implementation Guidelines for the Canadian ED Triage & Acuity Scale (CTAS). Available at: http://www.caep.ca/002.policies/002-02.CTAS/CTAS-guidelines.htm. Accessed Oct 18, 2004.

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METHODS

Study Design

This retrospective observational study was conducted on all emergency ambulance calls in Toronto, Canada from March 1, 2003 until February 29, 2004. Study protocols were approved by the Sunnybrook Health Sciences Center Research Ethics Board.

Study Setting and Population

Toronto has a single, multitiered, municipally based EMS provider. Various combinations of firefighter BLS first responders, EMT-staffed BLS ambulances, and EMT-P–staffed ALS ambulances respond to calls for medical assistance. Toronto EMS dispatchers interrogate callers by using the MPDS protocols to assign a dispatch priority. Each priority is associated with a specific response level (i.e., type of emergency responders), and response mode (i.e., lights-and-siren vs. routine).

Study Protocol

The Toronto EMS VisiCAD database (version 1.9, Tri-Tech Software Systems, San Diego, CA) was searched to obtain all emergency calls for the study period. Duplicate calls, calls with incomplete data, and interfacility-booked transfers were excluded. Calls canceled before making contact with a patient or as a result of patient refusal of transport were excluded, because no CTAS was recorded for these calls.

Data Analysis

Although it is possible to directly compare the five-point MPDS scale with the five-point CTAS scale, we dichotomized both the MPDS and CTAS into high- and low-acuity categories. A 2 × 2 contingency table showing appropriate categorization of each CTAS level with respect to dispatch priority is shown in Figure 1. For analysis, true-positive cases were those in which high CTAS acuity (CTAS 1, 2, or 3) was prioritized by MPDS as high acuity (Charlie, Delta, or Echo), corresponding with ALS responses to these calls. True-negative cases were those calls in which low CTAS acuity (CTAS 4 or 5) was prioritized as low MPDS acuity (Alpha or Bravo), which receive BLS responses. The sensitivity and specificity for detecting high acuity of illness (assigning MPDS priority Charlie to Echo to CTAS 1 to 3 patients) as well as 95% confidence intervals (CIs) were calculated for each individual MPDS protocol and for MPDS as a whole. Similarly, positive predictive values (PPV) and negative predictive values (NPV) and 95% CIs were calculated for each individual MPDS protocol and for MPDS as a whole. All calculations were performed by

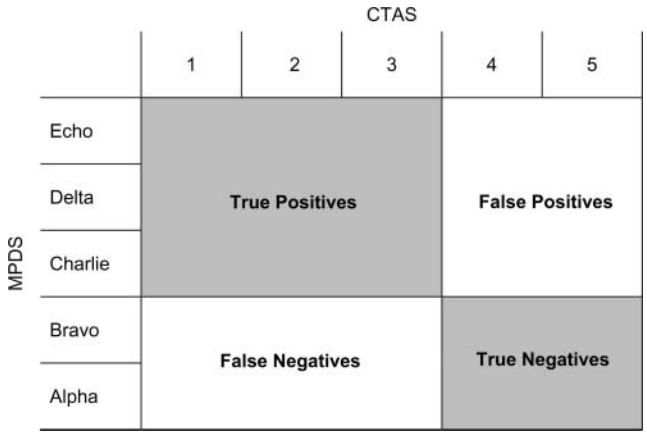

Figure 1. 2 × 2 Table showing assignment of high–patient acuity calls (CTAS Level 1 to 3) to high dispatch priority (Charlie, Delta, or Echo). CTAS 4 and 5 patients were less urgent and merited a lower priority response. Sensitivity was calculated as true positives/(true positives + false negatives); specificity, as true negatives/(false positives + true negatives). Positive predictive value was calculated as true positives/(true positives + false positives); negative predictive value, as true negatives/(true negatives + false negatives). CTAS = Canadian Triage and Acuity Scale; MPDS = Medical Priority Dispatch System.

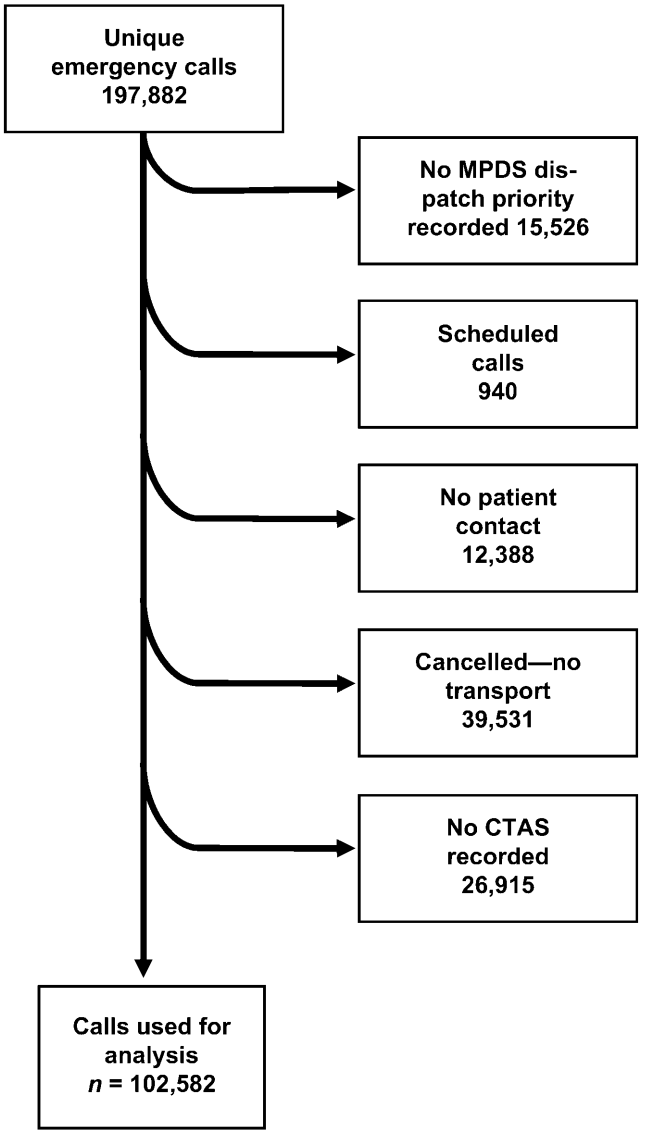

Figure 2. Diagram of calls used in the study, showing those excluded from analysis. MPDS = Medical Priority Dispatch System; CTAS = Canadian Triage and Acuity Scale.

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Table 3
Call Types, MPDS Priority, and CTAS Levels for All Calls from March 1, 2003 to February 29, 2004 (Ranked in Order of Number of Calls)

Call Type	Number (%) of Total Calls	Number (%) of Alpha, CTAS 5	Number (%) of Bravo, CTAS 4	Number (%) of Charlie, CTAS 3	Number (%) of Delta, CTAS 2	Number (%) of Echo, CTAS 1
Breathing problems	15,364 (15)	0	0	2,772 (18)	12,300 (80)	292 (1.9)
		548 (3.6)	2,063 (13)	7,239 (47)	5,180 (33)	334 (2.2)
Falls	11,763 (11)	4,406 (37)	5,700 (48)	0	1,657 (14)	0
		1,197 (10)	4,390 (37)	5,533 (47)	579 (5.0)	64 (0.5)
Sick person	10,814 (11)	7,652 (71)	159 (1.5)	2,103 (19)	900 (8.3)	0
		1,620 (15)	3,744 (34)	4,789 (44)	634 (5.9)	27 (0.2)
Chest pain	10,418 (10)	246 (2.4)	0	4,423 (42)	5,749 (55)	0
		337 (3.2)	1,368 (13)	4,778 (46)	3,853 (37)	82 (0.8)
Unconscious or fainting	9,466 (9.2)	360 (3.8)	0	3,545 (37)	5,508 (58)	53 (0.6)
		358 (3.8)	1,558 (16)	5,011 (53)	2,165 (23)	374 (4.0)
Traffic accidents	5,484 (5.3)	155 (2.8)	3,368 (61)	0	1,961 (36)	0
		588 (11)	1,668 (30)	2,778 (51)	403 (7.3)	47 (0.9)
Abdominal pain	5,213 (5.1)	3,141 (60)	0	1,985 (38)	87 (1.7)	0
		494 (10)	1,613 (31)	2,899 (56)	199 (3.8)	8 (0.1)
Convulsions or seizures	4,300 (4.2)	1,449 (34)	121 (2.8)	239 (5.6)	2,491 (58)	0
		120 (2.8)	599 (14)	2,736 (64)	770 (18)	75 (1.7)
Hemorrhage or lacerations	4,203 (4.1)	696 (17)	2,528 (60)	42 (1.0)	937 (22)	0
		436 (11)	1,221 (29)	2,140 (51)	369 (8.8)	10 (0.2)
Psychiatric or suicidal	3,290 (3.2)	831 (25)	2,355 (72)	0	104 (3.2)	0
		872 (27)	1,233 (38)	1,074 (33)	109 (3.3)	2 (0.1)
Traumatic injuries	2,886 (2.8)	1,467 (51)	1,109 (38)	0	310 (11)	0
		531 (18)	1,114 (39)	1,146 (40)	91 (3.1)	4 (0.0)
Unknown problem	2,760 (2.7)	0	2,556 (93)	0	204 (7.4)	0
		325 (12)	747 (27)	1,253 (45)	393 (14)	42 (1.5)
Stroke	2,648 (2.6)	0	12 (0.5)	2,636 (100)	0	0
		53 (0.2)	345 (13)	1,609 (62)	625 (24)	16 (0.1)
Overdose or poisoning	2,571 (2.5)	0	652 (25)	1,693 (66)	226 (8.8)	0
		211 (8.2)	553 (22)	1,192 (46)	582 (23)	33 (0.1)
Assault or sexual assault	2,004 (1.9)	278 (14)	1,412 (70)	0	314 (16)	0
		396 (20)	758 (38)	719 (36)	124 (6.2)	7 (0.0)
Diabetic problems	1,813 (1.8)	422 (23)	0	1,105 (61)	286 (16)	0
		66 (3.6)	309 (17)	1,020 (56)	401 (22)	17 (0.1)
Back pain	1,553 (1.5)	1,483 (95)	0	57 (3.7)	13 (0.8)	0
		256 (17)	656 (42)	611 (39)	28 (1.8)	2 (1.0)
Heart problems	1,111 (1.1)	67 (6.0)	79 (7.1)	431 (39)	534 (48)	0
		48 (4.3)	171 (15)	602 (54)	284 (26)	6 (0.1)
Pregnancy or childbirth	1,070 (1.0)	94 (8.8)	350 (33)	217 (20)	409 (38)	0
		34 (3.2)	121 (11)	672 (63)	237 (22)	6 (0.1)

Call types accounting for less than 1% of calls in the database are not shown. Percentages may not add up to 100 as a result of rounding. MPDS = Medical Priority Dispatch System; CTAS = Canadian Triage and Acuity Scale.

using Microsoft Excel 2002 Service Pack 2 (Microsoft Corp., Redmond, WA).

RESULTS

Of 197,882 emergency calls handled by Toronto EMS between March 1, 2003 and February 29, 2004, 102,582 patient transports met inclusion criteria for analysis. Figure 2 shows reasons for exclusion of calls from the dispatch database. Table 3 shows the number, MPDS priority, and CTAS level of the call types in the dispatch database meeting inclusion criteria.

The sensitivities, specificities, PPVs, NPVs, and their respective 95% CIs are reported in Table 4. The overall sensitivity of MPDS was 68.2% (95% CI = 67.8% to 68.5%), with a specificity of 66.2% (95% CI = 65.7% to 66.7%).

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Table 4
Sensitivity (Sens), Specificity (Spec), Positive Predictive Value, and Negative Predictive Value (NPV) for Each Dispatch Protocol

Protocol	Calls (*n*)	Sens	Spec	PPV	NPV
Abdominal pain	5,213	44.9	67.9	67.4	45.6
		43.2, 46.7	65.9, 69.9	65.3, 69.4	43.8, 47.3
Allergies	858	85.3	39.9	74.8	56.6
		82.1, 88.1	34.1, 46.0	71.3, 78.0	49.4, 63.6
Animal bite	86	10.0	100.0	100.0	78.6
		1.8, 33.1	93.1, 100.0	19.8, 100.0	68.0, 86.5
Assault	2,004	21.9	88.9	59.2	60.7
		19.2, 24.8	86.9, 90.6	53.6, 64.7	58.3, 63.0
Back pain	1,553	5.4	95.9	47.1	59.0
		3.6, 7.2	94.4, 97.1	35.2, 59.4	56.4, 61.5
Breathing problem	15,364	100.0	0	83.0	NA
		99.9, 100.0	0.0, 0.2	82.4, 83.6	
Burns	194	42.2	80.9	87.3	30.9
		34.2, 50.6	66.3, 90.4	76.8, 93.7	23.0, 40.0
CO inhalation	63	81.6	24.0	62.0	46.2
		65.1, 91.7	10.2, 45.5	47.2, 75.0	20.4, 73.9
Cardiac arrest	708	99.1	0	92.6	0
		97.9, 99.6	0, 8.6	90.3, 94.3	0, 48.3
Chest pain	10,418	98.5	6.8	84.4	47.2
		98.2, 98.7	5.6, 8.1	83.7, 85.1	40.8, 53.6
Choking	360	86.3	46.7	76.4	62.9
		81.1, 90.2	37.6, 56.0	70.4, 79.6	52.0, 72.7
Convulsion	4,300	65.5	46.4	63.5	85.9
		63.9, 67.0	42.8, 50.2	62.0, 64.9	84.5, 87.2
Diabetic problem	1,813	82.7	46.1	85.4	41.0
		80.6, 84.6	41.0, 51.3	83.5, 87.3	36.3, 45.9
Drowning	15	44.4	66.7	66.7	44.4
		15.3, 77.3	24.1, 94.0	24.1, 94.0	15.3, 77.3
Electrocution	33	100.0	0	78.8	NA
		84.0, 100.0	0, 43.9	60.6, 90.4	
Eye problem	165	0.0	99.0	0.0	62.8
		0, 7.4	94.0, 99.9	0, 94.5	54.9, 70.1
Fall	11,763	20.4	92.9	76.1	51.4
		19.4, 21.4	92.2, 93.6	13.5, 14.7	50.4, 52.3
Headache	875	75.8	43.6	66.7	54.6
		71.8, 79.3	38.4, 49.0	62.6, 70.4	48.6, 60.5
Heart problem	1,111	88.9	21.5	82.2	32.2
		86.6, 90.9	16.3, 27.6	79.6, 84.5	24.8, 40.5
Heat or cold injury	85	25.5	88.2	76.5	44.1
		14.8, 39.9	71.6, 96.2	49.8, 92.2	32.2, 56.6
Hemorrhage	4,203	30.0	86.8	77.2	45.3
		28.2, 31.9	85.0, 88.3	74.4, 79.8	43.5, 47.1
Industrial injury	62	45.5	77.8	83.3	36.8
		30.7, 61.0	51.9, 92.6	61.8, 94.5	22.3, 54.0
Overdose	2,571	78.4	34.2	73.8	40.0
		76.4, 80.2	30.8, 37.7	71.7, 75.7	36.2, 43.9
Pregnancy or birth	1,079	61.1	56.8	89.3	19.8
		57.8, 64.3	48.6, 64.6	86.5, 91.6	16.3, 23.9
Psychological problem	3,290	5.5	98.1	62.5	64.8
		4.3, 7.0	97.5, 98.7	52.4, 71.6	63.2, 66.5
Sick person	10,814	37.4	82.0	67.8	56.3
		36.1, 38.7	80.9, 83.0	66.1, 69.5	55.2, 57.4
Stabbing or penetrating	347	77.3	42.9	87.5	26.7
		72.0, 81.9	30.0, 56.7	82.7, 91.2	18.1, 37.2
Stroke	2,648	99.6	0.5	85.0	16.7
		99.2, 99.8	0.1, 2.0	83.5, 86.3	2.9, 49.1
Traffic accident	5,484	41.7	72.7	68.6	46.6
		40.0, 43.4	70.8, 74.5	66.4, 70.6	44.9, 48.2
Trauma or injury	2,886	17.0	94.0	68.1	60.0
		15.0, 19.2	92.7, 95.1	62.5, 73.2	58.1, 61.9
Unconscious	9,466	97.5	9.1	80.9	48.6
		97.2, 97.9	7.9, 10.5	80.1, 81.7	43.4, 53.9
Unknown	2,760	8.9	95.0	73.5	39.8
		7.6, 10.4	93.4, 96.2	66.8, 79.3	37.9, 41.8
All MPDS cards	102,582	68.2	66.2	80.3	50.7
		67.8, 68.5	65.7, 66.7	80.0, 80.7	50.2, 51.1

95% confidence intervals are indicated immediately below each calculated value. CO = carbon monoxide; MPDS = Medical Priority Dispatch System; PPV = positive predictive value; NA = not available.

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The overall PPV for MPDS was 80.3% (95% CI = 80.0% to 80.7%), and the overall NPV was 50.7% (95% CI = 50.2% to 51.1%). Aside from the protocol for electrocutions, which has wide confidence intervals because of a low number of calls, the protocol with the highest sensitivity for detecting high acuity of illness was the breathing-problem protocol, with a sensitivity of 100.0% (95% CI = 99.9% to 100.0%). Aside from the protocol of animal bites (which accounted for only 0.08% of calls), the most specific protocol was the one for psychiatric problems, with a specificity of 98.1% (95% CI = 97.5% to 98.7%). The protocol with the highest PPV was cardiac arrest (PPV 92.6%, 95% CI = 90.3% to 94.3%), and the protocol with the highest NPV was convulsions (NPV 85.9%, 95% CI = 84.5% to 87.2%). The best performing protocol overall was the cardiac arrest protocol, with the highest proportion of true positives and true negatives (91.8% of all cases were identified correctly as high acuity). The protocol with the overall poorest performance was the one for unknown problems, with only 42.3% of cases identified correctly as true positives or true negatives. Sixteen of 32 protocols had sensitivities of less than 50%.

DISCUSSION

Determining the performance of emergency medical dispatch systems is a challenge. No standards or benchmarks currently are defined that can be used as a yardstick to measure dispatch performance.[6] An ideal system would mobilize EMS resources in a manner that is timely and appropriate to patient acuity and would have the ability to positively influence patient outcomes. This would be balanced by the ability to ration scarce resources and limit the use of so-called hot lights-and-siren responses.

The Medical Priority Dispatch System is a widely used series of dispatch protocols that is used to identify calls requiring urgent responses or ALS resources. Previous studies examining the ability of MPDS to identify patients not requiring ALS care have shown mixed results.[14,15]

Various illness-acuity markers have been defined that correlate with the patient's need for acute intervention and outcomes. CTAS is a consensus guideline and was developed to define a patient's need for ED evaluation and management and was based on the relationship between patient presentation and ED discharge diagnosis.[7]

Because CTAS is routinely collected for all patients transported in our EMS system, it is ideally suited as a benchmark with which to compare MPDS priority. However, a direct correlation between the two scales has limitations, because they are instruments designed for different purposes and would not be expected to exhibit a high degree of agreement. Insofar as high patient acuity could be expected to need a higher level of provider expertise or perhaps out-of-hospital intervention, it is reasonable to expect that a dispatch tool to determine need for type of emergency responder also should detect those patients who are acutely ill. Therefore, both MPDS and CTAS were dichotomized into high-acuity and low-acuity categories for this analysis. By using CTAS as the gold standard (i.e., high or low acuity in the judgment of paramedics), the performance of dispatch protocols to detect high patient acuity was described in terms of sensitivity, specificity, PPV, and NPV.

Dispatch protocols for breathing problems, psychiatric problems, cardiac arrest, and convulsions performed well in identifying patients with high acuity of illness or in ruling out high acuity. These protocols represent only about 20% of patient transports in our database. Sixteen of the 32 protocols (the interfacility transfer protocol was excluded from the analysis) performed no better than chance at detecting high patient acuity.

The strength of the current study is that these methods could highlight areas for improvement of the dispatch protocols. Priority Dispatch Corporation, the producer of MPDS, engages in frequent revisions of their product. Future studies could use these methods to assess the sensitivity and specificity of each particular question on the dispatch protocol and to identify those questions that are most or least useful in identifying high or low patient acuity.

This study is one of a very limited number of studies that attempt to link dispatcher assessment of severity of illness with patient acuity measured by EMTs and EMT-Ps. The strengths of the present study are the use of a large data set and the ability to compare the MPDS dispatch priority to out-of-hospital CTAS. Other studies conducted in this area use non-MPDS dispatch algorithms or nonstandard patient severity scores.[16,17] The MPDS is widely used and represents an important target for study. Linkage of MPDS to CTAS is possible in our system because both scores are routinely collected on all ambulance transports.

LIMITATIONS

This was a retrospective observational study and had inherent limitations in its design. EMTs and EMT-Ps were not blinded to the MPDS priority, and their determination of CTAS level may have been contaminated by this knowledge. However, this has the potential to bias the results toward higher levels of sensitivity and specificity. To the best of our knowledge, the only studies examining the external validity of CTAS scores are published in abstract form, and there are as yet no reports in refereed clinical journals on its correlation with other outcomes. A comparison between MPDS and either ED CTAS level (by a blinded triage nurse) or eventual outcomes, such as length of stay, admission rate, or death rate, would have provided a better index of dispatch performance. The logistical effort involved in obtaining and reviewing hospital records from more than 20 EDs for the thousands of patients involved was not feasible. Either the MPDS dispatch priority or CTAS level was not recorded for 21.4% of calls. It is unknown whether the missing data was a possible source of bias.

The Toronto EMS dispatch center is not currently accredited by the National Academy of Emergency Dispatch, and MPDS priority assignment may have been affected by dispatcher compliance with protocols. Accreditation by the National Academy of Emergency Dispatch requires review of a minimum of 3% of calls, in which a total compliance score of 90% is achieved. During 2003–2004, 0.31% of all calls in Toronto were reviewed for quality assurance purposes. A query of the Toronto EMS

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dispatch quality assurance database (AQUA version 3.4, build 18, Priority Dispatch Corporation, Salt Lake City, UT) has documented a 91.2% total compliance score (Mark Toman, Toronto Emergency Medical Services, personal communication, 2005).

A secondary disadvantage of using CTAS as the criterion standard with which to compare dispatch priority is that the acuity (and hence CTAS) of some illnesses may change substantially after out-of-hospital intervention (for example, improvement in level of consciousness after cessation of seizures or correction of hypoglycemia). Although this type of call mandates a high priority response, the out-of-hospital intervention sometimes may substantially decrease the patient acuity score, and this may falsely have lowered the specificity of some protocols. Finally, our findings were obtained in a large urban setting with a single third-service municipal EMS provider and therefore may not be applicable to other settings.

CONCLUSIONS

The comparison of MPDS to CTAS represents a novel method of evaluating dispatch protocols. MPDS exhibits at least moderate sensitivity and specificity for detecting high acuity of illness or injury. Protocols for breathing problems, psychiatric problems, convulsions, and cardiac arrest performed well at identifying acutely ill patients. Sixteen protocols performed no better than chance alone at identifying high-acuity patients. This type of analysis can be used to select target protocols for future revisions of the MPDS.

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References

1. Wilson S, Cooke M, Morrell R, Bridge P, Allan T. A systematic review of the evidence supporting the use of priority dispatch of emergency ambulances. Prehosp Emerg Care. 2002; 6:42–9.
2. Eisenberg MS, Hallstrom AP, Carter WB, Cummins RO, Bergner L, Pierce J. Emergency CPR instruction via telephone. Am J Public Health. 1985; 75:47–50.
3. Bailey ED, O'Connor RE, Ross RW. The use of emergency medical dispatch protocols to reduce the number of inappropriate scene responses made by advanced life support personnel. Prehosp Emerg Care. 2000; 4:186–9.
4. Neely KW, Norton RL, Schmidt TA. The strength of EMS dispatcher questions for identifying patients with important clinical field findings. Prehosp Emerg Care. 2000; 4:322–6.
5. Kennedy JD, Sweeney TA, Roberts D, O'Connor RE. Effectiveness of a medical priority dispatch protocol for abdominal pain. Prehosp Emerg Care. 2003; 7: 89–93.
6. Schmidt TA, Cone DC, Mann NC. Criteria currently used to evaluate dispatch triage systems: where do they leave us? Prehosp Emerg Care. 2004; 8:126–9.
7. Beveridge R, Clarke B, Janes L, et al. Implementation Guidelines for the Canadian ED Triage & Acuity Scale (CTAS). Available at: http://www.caep.ca/002.policies/002–02.CTAS/CTAS-guidelines.htm. Accessed Oct 18, 2004.
8. Jiménez JG, Murray MJ, Beveridge R, et al. Implementation of the Canadian emergency department triage and acuity scale (CTAS) in the Principality of Andorra: can triage parameters serve as emergency department quality indicators? Can J Emerg Med. 2003; 5:315–22.
9. Stenstrom R, Grafstein E, Innes G, Christenson J. The predictive validity of the Canadian Triage and Acuity Scale (CTAS) [abstract]. Can J Emerg Med. 2003; 5: 184.
10. Murray MJ, Levis G. Does triage level (Canadian Triage and Acuity Scale) correlate with resource utilization for emergency department visits? [abstract]. Can J Emerg Med. 2004; 6:180.
11. Spence JM, Beaton DE, Murray MJ, Morrison LJ. Does the Canadian emergency department triage and acuity scale correlate with admission to the hospital from the emergency department? [abstract]. Can J Emerg Med. 2004; 6:180.
12. Manos D, Petrie DA, Beveridge RC, Walter S, Ducharme J. Inter-observer agreement using the Canadian emergency department triage and acuity scale. Can J Emerg Med. 2002; 4:16–22.
13. Murray MJ, Bondy S. The reliability of the Canadian emergency department triage and acuity scale in the prehospital setting: interrater agreement between paramedics and nurses [abstract]. Can J Emerg Med. 2002; 4:128.
14. Shah MN, Bishop P, Lerner EB, Czapranski T, Davis EA. Derivation of emergency medical services codes associated with low-acuity patients. Prehosp Emerg Care. 2003; 7:434–9.
15. Michael GE, Sporer KA. Validation of low-acuity emergency medical services dispatch codes. Prehosp Emerg Care. 2005; 9:429–33.
16. Glasser J. Reliability of the medical priority dispatch system in a large urban center [abstract]. J Emerg Med. 2001; 20:321–2.
17. Myers JB, Hinchey P, Zalkin J, Lewis R, Garner D Jr. EMS dispatch triage criteria can accurately identify patients without high acuity illness or injury [abstract]. Prehosp Emerg Care. 2005; 9:119.

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