



Original article

A mixed methods investigation of emergency communications centre triage in the Government Emergency Medical Services System, Cape Town, South Africa

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ABSTRACT

Introduction: In order to allocate resources in an effective manner, emergency medical services (EMS) systems use dispatch-based triaging to prioritise patients by acuity. Over-triage, wherein patients are assigned a higher priority level than necessary, can serve as a safety measure. However, it places strain on EMS systems, a problem believed to be experienced by South Africa's Western Cape Government EMS system, with almost half of its calls designated at the highest priority level.

To begin improving dispatch within WCG EMS, we aimed to describe the current system by identifying the most common conditions dispatched, and those most perceived to be suffering from over-triage.

Methods: A multi-methods approach was taken: First, a quantitative chart review was used to analyse all calls assigned a dispatch priority by WCG EMS between December 2016 and November 2017. These descriptive data then informed qualitative focus groups to further investigate emergency medical dispatch (EMD). Three focus groups were conducted, each with a convenience sample of staff from: WCG EMS staff, call takers/dispatchers, and call centre managers. Data were reviewed and coded, after which the lead researcher aggregated coded transcripts and conducted thematic content analysis.

Results: Seventy-nine condition categories were identified from 649,544 completed patient records for the study period. Non-specific pain accounted for the greatest proportion of dispatched complaints (16.88%), followed by assault with a weapon (10.00%) and respiratory complaints (9.71%).

Sixteen WCG EMS personnel took part in focus groups, highlighting challenges of the current EMD system, including time constraints, legal risks, communication, overuse of the system, and lack of training. Chest pain, collapsed/unresponsive patients, and vomiting and diarrhoea were frequently noted to be potentially over-triaged conditions. To improve this, participants suggested trainings, modifications to the electronic EMD system, additional protocols, and public education.

Conclusion: This study identified where over-triage is possibly occurring in the WCG EMS dispatch system, as well as potential solutions proposed by those working within the system.

African Relevance

- There are multiple types of effective emergency medical dispatch (EMD) established within high-income countries' emergency medical services (EMS) systems.
- Interaction with EMD is often the first opportunity for the recognition of time-critical conditions within the EMS system and, thus, effective EMDs can improve time-to-care and patient outcomes.
- The African Federation for Emergency Medicine has previously undertaken work to begin describing potentially-effective EMD methods for Africa, but there is no literature regarding existing EMD systems on the continent.
- While research aimed at increasing patient survival probability can focus on any type of resource allocation, our interest specifically lies in the decision-making process of call takers and dispatchers – an area that currently lacks a substantial evidence base in low- and

middle-income countries.

Introduction

Africa bears some of the highest rates of acute injury and illness worldwide [1,2]. Particularly in low- and middle-income countries (LMICs), emergencies are costly to both society and the government [3,4]. Patients often cannot afford the direct costs associated with healthcare, meaning that they delay seeking care until their condition is critical [5]. Emergency care systems are able to manage these acute presentations effectively, and have the potential to reduce mortality in LMICs by half [6,7].

Out-of-hospital emergency care, provided by ambulance personnel in dedicated vehicles and commonly known as emergency medical services (EMS), is often a patient's first point of entry into the emergency care system. EMS care is transient, meant mainly to stabilise a

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patient until a facility is reached, while in-hospital care is typically definitive [8]. In order to optimise patient outcomes, EMS should be well-integrated with facility-based emergency care [9].

The EMS system is typically activated by a layperson using a universal access number (UAN) to call an emergency medical dispatch centre, where call takers use a structured triage process to evaluate urgency for EMS response [10]. The EMS system can be effective if these resources are being used to treat critically ill patients, but increasing numbers of ambulance transports are for patients that are not non-emergent [8,11,12]. This not only strains the hospital system, crowding emergency units (EUs) with non-critical patients, but also limits the effectiveness of already-constrained EMS systems, frequently leaving no more units available to respond to further incoming calls [13].

South Africa is one of few African nations with a functioning EMS service and formally trained prehospital providers [14]. Most South Africans rely solely on the public healthcare system [15]. The Western Cape Government (WCG) provides EMS coverage for approximately 6.5 million people through its 261 ambulances and 1823 staff at 49 bases across the province [16,17].

WCG EMS operates a communications system that includes real-time unit tracking and analytics, allowing dispatchers to strategize vehicle placement and response. Each district of the Western Cape has an Emergency Communications Centre (ECC), to which callers are connected when they dial any of the existing access numbers. These ECCs can be reached by a variety of regional access numbers. ECC call takers do not have formal healthcare credentials but do receive on-the-job training and testing. In 2016, there were 139 call centre agents [17]. The emergency medical dispatch method used at WCG ECCs is considered home-grown, although it has many characteristics of a system known as Criteria Based Dispatch (CBD) [13,12]. Rather than relying on strict protocols for questioning callers, CBD provides a flexible script that is used by dispatchers to identify a patient's key signs and symptoms [18]. While this method allows for a fluid conversation between caller and call taker, it can come at the cost of significant unidentified emergencies or over-triage (also known as over-prioritisation, when a patient's condition is classified as more emergent than it is in reality) if a call taker is not adequately trained [18]. Like most other forms of dispatch, CBD is sensitive to critical conditions, with minimal under-triage [19]; this means that nearly all seriously ill and injured patients are assigned high priority for transport. But this sensitivity comes at a cost: CBD has poor specificity and unacceptably high rates of over-triage [20].

Triage leads to additional burdens on an EMS system and may affect the availability of ambulances for higher-acuity conditions [11,20]. WCG EMS is currently experiencing this problem: In EMS systems with a two-tier priority ranking system, 10% of calls should be P1 ("Priority 1", the highest priority assignment for patients needing urgent care) [20], but reports from WCG EMS suggest 42.5% of calls were P1 in 2016 [17]. Over-triage can serve as a safety measure, so that emergency conditions are consistently identified, but at this level it is likely a hindrance to the system at-large [8].

Current inappropriate use of ambulances is likely decreasing the functionality of the WCG EMS system, but dispatch improvements could help resolve this [13]. Previous studies conducted in high-income regions suggest that improved triage by dispatchers improves EMS resource utilisation and can even go on to decrease EU overcrowding. The high volume of calls being dispatched as P1 in the Western Cape lends motivation to specifically investigate over-triage. Identifying condition categories most prone to incorrect P1 dispatching will provide an opportunity to strategically improve triage guidelines for categories with the highest over-triage. Refining and re-introducing only these category guidelines is a cost- and time-effective approach to the problem. It will lead to improved resource utilisation, which is particularly important to do in LMIC settings.

The overall goal of this project is to determine whether a directed

call taking process can minimise over-triage in EMS. In order to begin this process, this paper aimed to describe the current system by identifying the most common condition categories dispatched in the WCG EMS system, and those likely to be suffering from over-triage.

Methods

We identified high-priority dispatched conditions potentially suffering from over-triage through a mixed methods approach using a combination of quantitative (chart review) and qualitative (focus groups) methods.

WCG EMS has an electronic patient care reporting system that captures each of the province's roughly 1500 responses each day in real-time [17]. Our chart review included information on all patients in the WCG EMS system who were assigned an EMS dispatch priority between December 2016 and November 2017. To determine the most common condition categories (i.e. chief complaints) occurring in the WCG EMS system, condition category data were extracted from the WCG EMS patient records database and de-identified. Records that were missing dispatch complaint and/or priority level were excluded. Data were stored in Microsoft Excel (© Microsoft, Richmond, WA, USA) and descriptively analysed using SAS statistical software (© SAS, Cary, NC, USA).

Information from the chart review informed focus groups to further investigate the status of the EMS system in relation to dispatch. A three-section facilitator guide was developed by the researchers. First, the facilitator built rapport with the group and evaluated general opinions of the WCG EMS and dispatch systems (e.g. describing the current system and their personal experiences within it). Then, a discussion was facilitated surrounding patient conditions. Opinions on the most common patient conditions, as well as those conditions that might suffer the least and most from over-triage, were discussed. After this, the fifteen most common condition categories identified via the quantitative chart review were presented and discussed in relation to potential over-triage.

Three focus groups were conducted in December 2017, each with a convenience sample of staff from a specific part of the system: WCG EMS staff, ECC call takers/dispatchers, and ECC managers. WCG EMS managers identified participants, with instructions to select participants with a range of experience levels; there were no additional criteria set forth for selection. Participants were contacted via telephone to request their participation and confirm availability.

Groups were facilitated in a closed WCG EMS meeting space by a researcher unaffiliated with WCG EMS (JLP); no other researchers or staff were present. Written informed consent was obtained prior to beginning discussions. Participation was voluntary and participants were not compensated for their time. Focus groups were held at neutral locations. A facilitation guide was developed to explore condition categories that the chart review identified as most common in WCG EMS. Participants were encouraged to identify and discuss conditions that, based on their own experience, suffer from over- and under-triage. The discussions were conducted in English and recorded. Each lasted approximately 90 min. All identifiers were removed upon transcription, after which audio files were permanently deleted. Transcripts were not shared with focus group participants for comment or revision. They were stored in encrypted Microsoft Word files on a university-based computer, accessible only by study personnel.

Qualitative analysis was conducted in NVivo (© QSR International Pty Ltd., London, England) by two independent reviewers with knowledge of emergency medical dispatch and EMS. Given the minimal existing information on the topic, an inductive content analysis approach was used to identify key themes all the interviews [21]. All groups were analysed to identify key themes existing in the data surrounding high-priority conditions and potential areas for dispatching improvements.

Ethical approval for this study was obtained from the University of

Table 1

Distribution of dispatched complaints in the WCG EMS system, December 2016–November 2017.

Ranking	Complaint	Frequency	Percent
1	Pain (non-cardiac)	109,667	16.88
2	Assault with weapon	64,948	10.00
3	Respiratory complaint	63,095	9.71
4	Obstetric complaint	39,395	6.07
5	Abdominal complaint	38,441	5.92
6	Vomiting/diarrhoea	35,331	5.44
7	Neurological complaint	31,808	4.90
8	Motor vehicle accident (MVA)	27,160	4.18
9	Convulsions	25,717	3.96
10	Musculoskeletal complaint	25,221	3.88
11	Accidental injury	23,446	3.61
12	Unresponsive patient	19,265	2.97
13	Physical assault	15,950	2.46
14	Forensic pathology	15,930	2.45
15	Bleeding	14,540	2.24
16	All other complaints	99,630	15.34
Total		649,544	100.00

Cape Town Human Research Ethics Committee and WCG Health.

Results

Retrospective chart review

Seventy-nine condition categories were identified from 649,544 completed patient records in the WCG EMS database for the study period. 3477 records (0.54% of all records) were excluded from the study due to missing dispatch complaints and/or priority assignment. The 15 most commonly dispatched complaint categories are detailed in Table 1.

Non-specific pain accounted for the greatest proportion of dispatched complaints throughout the year (16.88%); nearly half (47.36%) of complaints were non-specific, identifying only a region of the body (e.g. abdominal complaint) or major organ system (e.g. respiratory complaint). Pain was cited in nearly one in five calls.

Focus group discussions

We interviewed 16 personnel in the WCG EMS across three focus groups: six WCG EMS staff, five ECC call takers/dispatchers, and five ECC managers.

WCG emergency medical dispatch system

Participants across all groups described the WCG EMS dispatch system similarly. The system has been developed in-house, based loosely on principles from some prominent dispatch systems, such as CBD, but was homegrown because implementing such a system in a low-resource area was not feasible.

The dispatch process begins when an ECC call taker answers an incoming call. After capturing demographic details, location, and signs and symptoms via questioning, call takers classify the call into pre-determined condition categories (such as cardiac arrest or difficulty in breathing). In addition, call takers categorise calls into two priorities: priority one (“P1”, life threatening) and priority two (“P2”, non-emergency). It is unclear how exactly these decisions are made in most instances. While some participants based in rural areas of the province stated that they have a large guideline book that they can refer to (time permitting), the remainder of call takers did not have any written guidelines. A paramedic, whose advice can be sought, is present on each shift but the final priority decision is at the discretion of call taker. The prioritised call is then transmitted to a dispatcher terminal on the computer, where dispatchers can filter priority, vehicle, and other categories on a dispatch console and transmit the call via computer or

radio to an EMS crew for response. Outside of the Cape Town metropole area, the call taker and dispatcher are combined into a dual-function role.

Nearly all participants felt that there were many areas that can be improved to increase dispatch effectiveness, particularly surrounding:

- Time constraints,
- Communication,
- Legal risks,
- Incoming calls,
- System constraints, and
- Complaint categorisation.

Time constraints

Participants described the urgent role that time plays in dispatch:

“The call taker has two minutes to register the call and the dispatcher has three minutes to dispatch the call. Then, if you look at operations side, once the call is dispatched, they have ten minutes for a P1. So, in 15 minutes...from the time the phone rings, the clock starts ticking until the crew gets to the patient's address.”

- ECC Call Taker/Dispatcher

This timeframe creates issues: a call taker has to relay the dispatch and initiate a response before s/he can talk through all of the pertinent questions with the caller. Sometimes, it becomes obvious by the end of that discussion that it's actually a P2, but the call was already dispatched as a P1 a few minutes ago based largely on the initial chief complaint.

Communication

All groups mentioned conflict between call takers/dispatchers and EMS crews; this tension was most commonly cited to occur when a crew was dispatched to a P1 call but arrived to find what was really a P2 patient.

“I think there's a lot of animosity between the operations and dispatching.”

- EMS Staff

Communication between dispatch and EMS crews is challenging. Both call takers/dispatchers and EMS staff mentioned having relationships changed the discourse between the two groups: there was more consultation between the two (e.g. seeking opinions on priority and current location) when they knew who they were speaking with and trusted that person.

Legal risks

Call takers and dispatchers spoke frequently of the legal risk associated with their work: if a patient was prioritised (triaged) incorrectly, the patient could potentially die as a result. With that comes investigation, as well as potential ramifications both at work and in the legal system. Given this pressure, all call takers and dispatchers stated that they prefer to over-triaged patients when uncertain.

Their colleagues in management seemed to understand the challenge that this presents:

“If they do prioritise wrong, or they don't overprioritise, then the patient might die. There could be legal issues and they can't handle that.”

-ECC Manager

“Overprioritisation is always the safe bet, if we want to call it that?”

-ECC Call Taker/Dispatcher

Incoming calls

Calls are often placed by a relative or third party (e.g. passer-by), as opposed to the patient him or herself, meaning that crucial information about the patient is often incorrect or missing; this hinders the ability of

call takers to assign a priority level. Language barriers and frantic callers consume time and again lead to less-than-ideal information gathering.

All groups noted that community members often know what to say to decrease response time, and that is a direct cause of over-prioritisation.

“We are always assigning a P1 because the clever caller says something critical like unresponsive, then the EMS crew arrives to find a P2 and it causes tension and frustration.”

-ECC Call Taker/Dispatcher

“They’re so clever out there. They know already what to say to get that vehicle.”

-EMS Staff

“It was shown that if we take all of the P1s and vehicles do the calls, they find that only 10% of those calls are actually priority one.”

-ECC Manager

System constraints

Overuse of the system - many transports require no medical intervention – was mentioned by all groups; this is compounded by understaffing and a fixed number of vehicles.

“We are understaffed and there are not enough vehicles. There’s no question about that.”

-ECC Call Taker/Dispatcher

Complaint categorisation

There are pre-assigned priorities for some complaints, regardless of severity. Maternity, for example, is a P1; this is a government-enacted protocol due to the burden of maternal mortality in-country. However, an ECC manager noted that these are often not emergencies: because maternity is a stage, pregnant women can present with minor complaints, many of which are often unrelated to the pregnancy. At present, call takers do not have the opportunity to discern between low- and high-risk maternity patients, leading to increased burden on the system.

Training

ECC managers, as well as call taking/dispatching staff themselves, noted that training has decreased substantially over time: at present, most call takers and dispatchers have only first aid training, and all groups felt this was problematic.

“...very few of our staff, maybe 10%, have been medically trained. Most of them are laymen and so... non-medical people are taking the calls, having to interact with professionals. It is a region-wide problem and

probably leads to mis-prioritising calls.”

-ECC Manager

“If you’re medically trained, you can actually ask, you can prompt them to answer certain questions in a certain way because of the medical background...say the patient is unconscious, you will know to ask him to open his eyes. Or ask if he has pain. If he answers that he has pain or opens his eyes, he’s not unconscious. Whereas a person without medical qualification will just believe the guy is unconscious and prioritise it as a P1 unnecessarily.”

-EMS Staff

There is a new internship program in place in some larger ECCs, but it provides only short-term dispatch training and a brief ride-along period. The rest of the time, interns are left to work on their own and feel it is inadequate. Employees are given little training on the EMD system and the technology is a challenge: features are constantly being phased in and out, without notice to staff.

“There are many complaints in the system that we don’t even know exist! Sometimes, I find one on accident or while playing around with the system, but this was never shown to me.”

-ECC Call Taker/Dispatcher

There is no standardised guideline that call takers can use for prioritisation decisions. Two staff members that work in rural ECCs noted that they have some flowchart documents that they rely on; others said that, while their ECCs had some reference books, they were too cumbersome to use during calls.

Over-triage

The following conditions were verbally identified by focus group participants as potentially over-triaged:

- Abdominal pain (ECC call takers/dispatchers and WCG EMS staff)
- Assaults (WCG EMS staff)
- Chest pain (all)
- Collapse/unresponsive (all)
- Maternal patients (ECC call takers/dispatchers and WCG EMS staff)
- Motor vehicle accident (MVA) (WCG EMS staff)
- Pain (ECC call takers/dispatchers and WCG EMS staff)
- Shortness of breath/respiratory complaint (ECC call takers/dispatchers and WCG EMS staff)
- Vomiting and diarrhoea (all)

Participants across all groups felt that there were no under-triaged categories.

Table 2

All proposed solutions to improve dispatching and reduce over-triage in WCG EMS system.

Key solution	Suggested actions
Medical training for ECC call takers/dispatchers	<ul style="list-style-type: none"> ● Paid, continuous training that is scheduled in advance ● Targeted trainings for specific complaints (e.g. pain) that are over-triaged. ● Increased training on guidance given to callers (e.g. telephonic CPR)
Modifications to the electronic EMD system	<ul style="list-style-type: none"> ● Managers encouraging an attitude of self-study, both on and off shift ● Refining categories for call takers to select based on common chief complaints ● Make the system more user-friendly ● Notify staff when changes or updates are made
Cross-training	<ul style="list-style-type: none"> ● Joint trainings on the dispatch system to facilitate mutual trust and understanding between EMS and ECC staff ● ECC staff (both call takers/dispatchers and managerial) participating in ambulance ride-alongs ● EMS staff sitting in on ECC control room shifts to observe call taking/dispatching processes
Protocols	<ul style="list-style-type: none"> ● Identify the complaints that are most problematic (over-triaged and challenging for call takers) ● Well-developed questions and a method of interrogating callers in the given time constraint ● Simple, easy-to-understand flowcharts (as opposed to thick books or guidelines)
Public education	<ul style="list-style-type: none"> ● Create a system that empowers call takers/dispatchers to make priority decisions, while protecting them legally ● Media programmes about how to phone an ambulance ● Send EMS and ECC staff into the community to hold workshops and discussions about using the EMS system

Potential solutions

Participants suggested a range of solutions to both decrease over-triage and improve dispatch in the system at-large (Table 2).

Discussion

Most EMS dispatches across the province from December 2016 to November 2017 involved pain, injury, or respiratory, obstetric, or gastrointestinal issues. These complaints are similar to conditions associated with some of the highest mortality rates in South Africa - chronic obstructive pulmonary disease (COPD), diarrhoeal diseases, interpersonal violence, lower respiratory infections, and tuberculosis are among the top ten causes of death in-country [22] – and thus, likely represent a large burden of the country's disease.

Focus group discussions suggested that there is likely a high rate of over-triage within the province, stemming largely from time and resource constraints, as well as training and legal risks. Participants identified a range of conditions likely to be over-triaged; all three groups mentioned chest pain, unresponsiveness, and gastrointestinal complaints (vomiting and diarrhoea).

Abdominal and general pain, as well as shortness of breath and maternal complaints, were each mentioned by two of three groups. Perhaps the most notable discrepancy is that injuries (both intentional and unintentional) were only suggested by WCG EMS staff. This could indicate that ECC managers and staff are more comfortable in consistently giving these conditions a high priority, possibly due to legal risks and the burden of injury in-country [23].

Although EMS services have existed in South Africa since the 1970's, and EUs since the 1980's, focus on the development of emergency care as a part of the larger healthcare system did not begin until the early 2000's [24]. Only in recent years has emergency care begun to be integrated into the health systems of other sub-Saharan African nations, meaning that there are not yet any comparable EMS systems on the continent and minimal literature exists for relevant comparison. Only one similar study was found: a 2005 EMS dispatch focus group in Zimbabwe that also suggested dispatcher training was one of the biggest barriers to a successful system [25].

2015 consensus recommendations from the African Federation for Emergency Medicine align with many of the solutions suggested by focus group participants, including:

- continuous training for dispatchers,
- phone-based instructions to callers,
- public education, and
- scripted questions [26].

The use of retrospective data to identify commonly-dispatched complaint categories comes with inherent limitations: we were not able to confirm the accuracy of this data, and there may have been other unmeasurable biases in the dataset, particularly surrounding misclassification. In our study, selection bias is likely minimal, as only 0.54% of calls were excluded but we cannot determine whether the missing information that caused exclusion (missing dispatch complaint and/or priority level) is related to other factors of the call that may influence over-triage. Given that our dataset spanned a full year, there is minimal concern about seasonality of certain conditions.

Information provided during focus groups may also have limitations: managerial staff were not given explicit criteria when asked to select participants, introducing the potential for the selection of participants more or less likely to provide favourable responses (i.e. responses that reflect positively on WCG EMS or their specific cadre). The use of an external focus group facilitator in a location separated from supervisors was intended to reduce the impact of such a possibility.

The focus groups were also limited by the potential for subjectivity in analysis. To minimise the likelihood of introducing personal bias during the analysis stage, each transcription was doubly coded by

independent reviewers using a predetermined method for qualitative data analysis.

This study has identified where over-triage is potentially occurring within the ECC dispatch system, as well as key issues contributing to the issue. Future studies will continue this work: we will conduct an analysis of the mismatch between dispatch priority (urgency of response) and triage categorisation (urgency of clinical need), after which priority-based dispatch questions will be derived to maximise “true positive” dispatch rates for high-priority conditions. Improvements will also be made via a series of discussions surrounding proposed solutions to improve dispatching and reduce over-triage in WCG EMS system, such as cross-training and public awareness campaigns.

Dissemination of results

Findings of this study were shared with relevant stakeholders, including WCG EMS.

Authors' contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: MFA contributed 60%; JLP 25%; and LA contributed 15%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing interest

Prof Lee Wallis is an editor of the African Journal of Emergency Medicine. Prof Wallis was not involved in the editorial workflow for this manuscript. The African Journal of Emergency Medicine applies a double blinded process for all manuscript peer reviews. The authors declared no further conflict of interest.

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