‘The Rates of Pre-Hospital Over-Triage and the Reasons Behind Them in a Cape Town Setting’

by

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Abbreviations

ALS	-	Advanced Life Support
AFEM	-	African Federation of Emergency Medicine
BAA	-	Basic Ambulance Assistant
BLS	-	Basic Life Support
CBD	-	Criteria Based Dispatch
CTAS	-	Canadian Triage Acuity Scale
CTECC	-	Cape Town Emergency Call Centre
CTG	-	Cape Town Group
CTS	-	Cape Triage Score
ECC	-	Emergency Call Centre
EMD	-	Emergency Medical Dispatch
EMS	-	Emergency Medical Services
HIV	-	Human Immuno-Virus
IAED	-	International Academies for Emergency Dispatch
ILS	-	Intermediate Life Support
LMIC	-	Lower Middle Income Countries
MEWS	-	Modified Early Warning Score
METTS-A	-	Medical Emergency Triage and Treatment System A
MPDS	-	Medical Priority Dispatch System
MVA	-	Motor Vehicle Accident
NACA	-	National Advisory Committee on Aeronautics
NEWS	-	National Early Warning Score
P1	-	Priority One
P2	-	Priority Two
PVA	-	Pedestrian Vehicle Accident
SATS	-	South African Triage Score
WHO	-	World Health Organisation

Part A: Literature Review

Objectives

- Establish rates of over and under triage internationally
- Find out if guidelines and targets for over and under triage exist
- Describe pre-hospital triage tools used by on-scene personnel and call-takers
- Establish where the triage tool used in Cape Town originated from and whether it has been validated
- Establish which triage tools are most effective internationally and which have been validated for pre-hospital use
- Establish what literature exists regarding the role and efficiency of the call-takers
- Establish the benefits of an efficient pre-hospital service
- Find out the role of pre-hospital care in under-resourced settings
- Identify barriers to pre-hospital care in the under-resourced setting
- Describe the health challenges faced by the Western Cape
- Describe the pre-hospital system of the Western Cape

Literature Search Strategy

The search aimed to identify all relevant articles by using a systematic search of all relevant databases. These databases included: Pubmed (including Medline), SCOPUS (EMBASE), CINAHL and Cochrane. For grey literature, Google Scholar and the Google search engine were used. Search terms varied for different sections of the research but were broadly divided into: rates of over-triage, pre-hospital triage tools, pre-hospital systems in lower-middle income countries,

emergency call / dispatch centre systems.

Inclusion criteria: all studies that conveyed any relevance to the research questions at hand for the period 1990 to 2018 and written in the English language. As the research questions encompassed a variety of topics, no single set of search terms was used. These studies were evaluated for relevance and, in order to attain an in-depth knowledge of the subject matter, studies of all levels were looked at. This was done with the knowledge of the hierarchy of levels of evidence and greater gravitas was given to the more robust studies. The bibliographies of the most relevant articles were analysed for any other relevant articles.

Exclusion criteria: there were few exclusion criteria used, given the wide scope of the search. However, those that were excluded were studies that analysed the call-takers triage tool and not the call-taker (of which there were many) and studies looking at call-takers not working within a health system.

Summary and Interpretation of Literature

The Population

Cape Town is a city in South Africa with just under six million residents (1). These people are served by a total of 104 ambulances for a ratio of 0.26 ambulances per 10,000 people that assist in transferring this population to any of the 143 health facilities (1). According to the nation's Constitution, each of these people is entitled to health care that is both timely and appropriate as determined by the patient's need (2). Achieving this is largely dependent on both the resources at hand and the demand for services. While Cape Town and, indeed South Africa as a whole, is better

resourced than a number of other African countries, it is still considered a lower-middle income country (LMIC) by the World Bank and needs to be viewed within this context (3). According to the Western Cape Governments Mortality Report in 2013, the Western Cape has a relatively high all-cause mortality rate of 842 deaths per 100,000 people (4). Amongst women the highest rates of premature mortality were due to Human Immuno Virus (HIV) and amongst men, it was interpersonal violence while non-communicable diseases remained the leading cause overall (4). Thus it can be seen that this 'triple-burden' of disease exacts a heavy toll on the Western Cape health service as a whole.

In 2014, Mayosi et al looked at the broad socio-economic challenges facing South Africa's health care system, which largely echoed the findings in the Western Cape Mortality Report, that the health of the populace is constantly strained by the high levels of communicable and non-communicable diseases, interpersonal violence and persisting social disparities (5). The paper noted that medium-term goals for the attainment of improved healthcare for all include 'to improve access to sustainable and effective healthcare'. This sustainability relies on the health services effectively 'doing better with less'.

A simulation model run by Stein et al which looked at the effect of additional ambulances on ambulance response times concluded that a 'ceiling' – or optimal number – is eventually reached where after the addition of more ambulances had little effect on response times (6). In the model used, the greatest improvements in mean response times were seen when the total ambulance number increased from 53 to 106 – producing a reduction in mean response time of between 26.9 and 35.9% After this, the mean response time was only marginally improved by

increasing ambulance numbers. As Cape Town currently has 104 ambulances, it may be at the point that it is considered at the 'ceiling' indicated by the study. From this it may be extrapolated that the Western Capes population would perhaps not be better served not by more ambulances but by the more effective use of the existing fleet and that it needs to essentially 'do better with less'.

The Importance of Pre-Hospital Care

The importance of pre-hospital care can by seen from information that predominantly relates to the trauma patient but can, for the most part, be extrapolated to any unwell patient. WHO states that 'regardless of how simple or sophisticated a given pre-hospital trauma care system might be, certain elements are essential in order to decrease preventable morbidity and mortality - these elements include, at a minimum, prompt communication and activation of the system, the prompt response of the system, and the assessment, treatment and transport of injured people to formal health-care facilities when necessary' (7). Trunkey noted, in his frequently cited paper, that trauma follows a tri-modal pattern of death: immediate, early and late (8). Immediate deaths are usually unpreventable and due to massive, non-survivable injuries on scene. The second 'early' peak of deaths that occur within a few hours are usually preventable, and these are the patients whose timely access to health care will be the difference between between living and dying (7). 'Late' deaths are those that occur weeks to months later and therefore relate more to in-hospital than pre-hospital care. Thus an effective pre-hospital system saves lives.

Pre-hospital Care in the Under-Resourced Setting

The recent systematic review by Kironji et al looked at factors hindering out-of-hospital

emergency care in a number of LMIC's (9). It found that ambulances were the most frequently cited mode of transportation to hospital but that they were frequently unavailable and often slow to arrive. Similarly, a lack of a coordinated and integrated Emergency Medical Services (EMS) system was another frequently cited hindrance, as was lack of adequate training of pre-hospital personnel. It can thus be seen that in order to tackle the country's significant health burden, both an effective EMS system and timeous access to ambulances are required. The Western Cape is fortunate to have a fully integrated and functional EMS – a rarity in Sub-Saharan Africa – nonetheless we need to be mindful of these potential pitfalls (10).

Pre-Hospital Care in Cape Town

The Western Cape public sector ambulance network, and the pre-hospital transport service as a whole, are managed by the Western Cape Government Health: EMS. Emergency calls are made to the Cape Town Emergency Call Centre (CTECC) where they are received by any of the call-takers on duty. These call-takers need to make a decision regarding whether to dispatch a Priority 1 (P1) ambulance with lights and sirens with the aim to arrive within fifteen minutes, or a less urgent Priority 2 (P2) ambulance with a guideline of arriving within sixty minutes if the call is made in an urban area (6, 11). The health personnel on scene then examine the patient and apply the South African Triage Score (SATS) which utilises vital signs and discriminators to allocate a triage 'colour' denoting the severity of the patient's condition. From least to most urgent is green, yellow, orange and red. Blue denotes a dead-on-arrival case. These triage 'colours' will then give an indication of the patient's severity and dictate which type of unit the patient should be transferred to. In the in-hospital setting 'reds' need to be seen immediately, 'oranges' within ten minutes, 'yellows' within an hour and 'greens' within four hours (12). The SATS also makes

provisions for ‘discriminators’ such as severe pain or high-impact trauma that may result in a patient being ‘up-triaged’ despite not having grossly abnormal vital signs.

Triage Scores and the SATS

The SATS score was developed by the Cape Triage Group (CTG) in 2006 out of a need to have a robust but user-friendly triage tool for use in in-hospital environments (13). At the time more informal systems of triage were used and, after witnessing improvements in flow and patient care at GF Jooste Hospital where the United Kingdom’s Modified Early Warning System (MEWS) was in use, the group convened to form the Cape Triage Score (CTS) which later became the SATS (14), largely based on the parameters set by the MEWS. This tool has been validated for use in adults and children in the in-hospital setting but to date no literature has validated it’s use in the pre-hospital setting (15, 16). Nor has its use been validated as a triage tool for call-takers in the EMS call-centres. It is important to note here that a large meta-analysis performed in 2013 of all existing pre-hospital triage scores showed that there was, in fact, too little available information not only to make a recommendation about which score was most effective, but about what effects pre-hospital triage had on patient outcomes at all (17). This finding has had a particularly important bearing on the available literature on pre-hospital triage. Due to the fact that no single method has been found to be superior, a host of different triage tools are currently being used – often within the same country – making comparisons of findings particularly difficult. Likewise, while the SATS is a largely objective score, the use of ‘discriminators’ does mean it will be utilized slightly differently by different EMS personnel leading to a degree of subjectivism. Hence it becomes important to look at the levels of training of these call-takers.

Pre-Hospital Training and Triage Tools in South Africa

The most basic qualification is a three week Basic Life Support (BLS) course which qualifies the candidate as a Basic Ambulance Assistant (BAA) (18). One level up is the Intermediate Life Support (ILS) provider which requires an eight week course as well as acceptable levels of on-road experience. The most highly qualified are the the Advanced Life Support (ALS) providers that require either a four year Bachelors Degree or a two year National Certificate. It is particularly important to note that the call-takers themselves have no minimum course requirements at all. Literature on the effective training of call-takers is scanty and largely out of date. In the early 2000's the majority of well-resourced countries adopted computerized 'triage tools' to assist the call-taker (19, 20). As a result literature tends to look at the system rather than the person. This is a notable knowledge-gap for the predominantly LMIC who do not make use of triage tools and rely heavily on the performance of the call-takers themselves.

The most commonly used triage-tools are the Medical Priority Dispatch System (MPDS) used predominantly in North America and the United Kingdom; and the Criteria Based Dispatch (CBD) used predominantly in Europe (20). These comprise a set of algorithms for various presenting complaints that prompt the call-taker to ask further relevant questions and advise on level of urgency of ambulance dispatch. This largely removes the 'human-element' from call-taker triage, which may or may not be beneficial. While it certainly leads to a level of standardisation of responses, Normark notes in her analysis of increasingly computerised pre-hospital triage that the systems are good at interpreting facts but – just as important – it ignores the local context, values and intuition (21). In South Africa no formal triage tool is used and the call-taker relies on a

combination of the SATS, personal experience and in-service training and monitoring. There is certainly further scope for research in this area – looking at whether a lower-cost form of triage tool (possibly involving paper-card versions) performs better than the current system.

No literature could be found comparing the use of triage tools to the non-use of triage tools. Nor was there consensus at a meeting of thirty one EMS specialists about which pre-hospital triage system was most effective (22). As a result, there is no standardised pre-hospital triage system world wide. It can be seen therefore that, although current practice in a number of countries, the current literature is not substantial enough to recommend the use of any specific triage tool over the training and experience of the call-taker - as is practiced in South Africa.

What Goals Should Be Aspired To

It currently remains unclear what rates of over-triage (over prioritisation of an ambulance) and under-triage (under prioritization of an ambulance) should be aspired to. No formal guidelines currently exist as guidance. There is, therefore, no universally accepted definition of what constitutes ‘over ‘and ‘under triage’. (22).

Current Literature on Over and Under Triage

The current literature on levels of over and under triage comes predominantly out of the well-resourced settings of Scandinavia and North America. Eight studies of relevance were found and six of these found similar rates of over triage of between 64% and 78% with under triage rates of 4% to 16% (Table 1) (20, 24-29). These studies all shared the conclusion that the rates were unacceptably high and resulted in ‘overloading of the Emergency Department and have a negative impact on ambulance availability’ (27).

The two outliers were studies by Feldman et al and Neely et al (25, 30). In the study by Neely this discrepancy can be seen to be due to two factors: the first is that the study sample was a relatively small one with 1040 cases reviewed, the second is that both the call takers and healthcare personnel on scene had a strong predilection for allocating a case as 'urgent' (30). Of the 1040 cases, just 24 were allocated as 'non-urgent' by the call-taker (30). The on-scene personnel also did not need to follow a protocolised triage-based decision, they simply stated whether they agreed with the call-taker or not – potentially lending itself to anchoring bias. The study by Feldman et al compared the five-category MPDS with the five-category Canadian Triage Acuity Scale (CTAS) and elected to exclude from their rates of over triage those patients with a CTAS score of 3 which includes patients 'in significant discomfort' or where the condition 'affects ability to work' (25). This is clearly a very broad category and would include a number of patients that would be classified as 'non-urgent' by other scoring systems and therefore would have been over triaged in other studies.

Table 1: Rates of over and under-triage by respective research studies

Paper	Over-triage	Under-triage
Hoikka et al	78.3%	9.2%
Dami et al	78.0%	4.6%
Ek et al	84.6%	4.1%
Khoram-Manesh at al	73.0%	3.5%
Sporer et al	64.0%	16.0%
Feldman et al	33.8%	31.8%
Lu et al	72.9%	8.1%
Neely et al	29.0%	5.4%

Problems with the Comparisons

In the majority of these studies the triage tools used by the call-takers and the crew that they dispatched were different. This makes a direct comparison between them difficult. As an an example, the following were all triage tools used at the call centres in different studies: MPDS, CBD, Medical Emergency Triage and Treatment System-A (METTS-A), Finnish EMS Protocol and Severity Code scores. While the personnel on scene used any of the NEWS, National Advisory Committee on Aeronautics (NACA), Canadian Triage and Acuity Scale (CTAS) and others. As previously mentioned, the fact that such a wide array of triage tools was used comes down to the fact that no single tool has been shown to be any better than any others (22). While these scores all have the ultimate aim of establishing the level of urgency the patient requires, they are not necessarily directly equivalent to each other. Five of the studies, with the exception of those performed by Ek, Neely and Khoram-Manesh, had the same limitation of comparing two different triage tools with each other – the one used by the call-taker and the one used by the on-scene personnel (20, 25, 26, 28, 29). Equivalency is then decided by the investigator and can have a profound impact on the outcome of the study, as was seen in the study by Feldman et al (25). It is also worth noting that none of these triage scores have been validated for pre-hospital use, calling into question whether these studies themselves are entirely valid.

A particular problem seen in these studies was in allocating the patient triaged on scene with a ‘mid-range’ severity score. These are the patients with grossly normal vitals but have a condition or symptom of concern – thus creating a large ‘grey area’ of whether the call-out was appropriate or not. In the case of Feldman’s study – as mentioned above – a CTAS score of 3 was included as an appropriate call out and includes ‘patient discomfort’ as one of criteria; this as opposed to the

study by Dami which excluded a NACA score of 3 which includes pain and fractures, among other things, in its criteria (20, 25). The choice of which pre-hospital triage score is equivalent to an urgent ambulance call-out is a major variable affecting the outcomes of these studies and seems to be done largely at the discretion of the lead investigator.

It would be of significant benefit if a single triage tool for both the call-takers and healthcare personnel on scene was standardised and utilised world-wide and that this triage tool was validated for use in the pre-hospital setting. This would undoubtedly lead to more robust data being made available which, in turn, would lead to more informed decision-making about where pre-hospital care could be improved. Further research and group consensus is needed to reach this point.
Of the six studies with similar over-triage rates, the study by Lu et al had the smallest sample size with only 175 ALS call-outs made out of 5433 calls (28). This is a small study sample and, although the figures were found to be broadly in line with those of the other studies, they need to be interpreted carefully and in this light. The study by Khoram-Manesh is potentially the most robust – with a good study sample size of 9208 P1 call outs and a direct 'like-for-like' comparison with the on-scene crew who also allocated scores based on the priority system (27).

Over Triage in the African Setting

No literature could be found assessing rates of over and under triage in the South African setting, nor any other LMIC setting. This is likely due to the dual problems of absent or poorly integrated EMS systems as well as poor, non-computerised record keeping (9, 31). Encouragingly, however, in sub-Saharan Africa there is a new and emerging drive to research and establish better pre-hospital services. In 2014 a working group was established between the African Federation for

Emergency Medicine (AFEM) and the International Academies of Emergency Dispatch (IAED) to provide various recommendations for the establishment and maintenance of Emergency Medical Dispatch (EMD) units in Sub-Saharan Africa where such units are both rare and immature in their development (31). That same year 135 emergency medicine leaders from 32 different countries – including 18 African countries – convened for the Consensus Conference with the aim of identifying hindrances to, and providing a path forwards for, Emergency Medicine in the resource constrained setting (32). The outcome of both of these conferences was a roadmap for the further development of effective pre-hospital care and the steps needed to achieve it. It was noted that a major obstacle to all of this was a general lack of data regarding these systems. It is hoped that the information contained within this study can contribute in some way to the advancement of pre-hospital care on the African continent.

Conclusion

Pre-hospital medicine in Africa is a new and rapidly evolving field. As such, there is a strong need to identify barriers to its utilisation and to establish where systems are functioning well and where there is room for improvement. The Western Cape has a well-established EMS service that is relatively well-resourced compared to other LMIC regions but nonetheless is constantly stretched by the extensive health-burden of communicable disease and trauma in South Africa. To date no literature exists, in any setting, looking at the role of the call-takers themselves in the efficiency of the pre-hospital system. Likewise, there is currently no literature on rates of over and under triage in any LMIC setting. There is therefore a need to look at these factors in order to identify areas for improvement and to make the most of these stretched resources. This, in turn, could lead to improved pre-hospital care and greater access to healthcare within Cape Town and, potentially,

the African continent as a whole.

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Part B: Thesis

For submission to International Journal of Emergency Medicine

'The rates of pre-hospital over-triage and the reasons behind them in a Cape Town setting'

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Abstract - Open

Introduction: Inappropriate dispatch of urgent ambulances by call centre personnel causes an unnecessary drain on existing resources. How often these urgent dispatches are inappropriate has not been evaluated in any lower middle income countries, nor have factors been assessed that contribute to these decisions.

Problem: The study aims to establish rates of pre-hospital over-triage in Cape Town, South Africa and to assess the call centre factors around these decision-making processes.

Methods: This was a retrospective study examining a single calendar month of all urgent ("lights and sirens") ambulance dispatches made from a large public sector ambulance call centre in Cape Town. On-scene, the ambulance field crew assessed these patients using the South African Triage Score (SATS) and these assessments were correlated with the prioritization of these dispatches by the call centre to determine which patients were 'over-triaged' by the call-taker. Contributory factors were also analysed and included time of day, nature of presenting complaint; and call-taker training and experience - all of which may have affected rates of over-triage.

Results: In the course of one month in 2017, 4169 urgent calls were assessed: of these 2701 were over-triaged (58.48%). Over-triage was similar between day (58.02%) and night (59.11%). The most regularly over-triaged complaint was obstetric & gynaecological (84.87%) followed by motor vehicle accidents (65.70%); the lowest rate was for cardiac call-outs (47.12%). We reviewed the 38 highest workload call-takers, and found subtle, but non-statistically significant, trends towards higher over-triage rates with higher levels of training (ILS 62.16%, no medical training

59.42%; p=0.67), more years as a call-taker (< 2 years 59.32%, > 5 years 60.23%; p=0.93) and more years working in the field (0 years 59.36%, > 5 years 63.66%; p=0.31).

Conclusion: Rates of pre-hospital over-triage in Cape Town are marginally lower than those described internationally. The nature of the complaint had a strong impact on these rates, notably trauma and gynaecological issues. More experienced call-takers may tend to over-triage more frequently, however the small sample size made these findings uncertain. These findings do however suggest the potential for improvement for better efficiency without compromising patient safety.

Thesis

Background

South Africa has a healthcare system under pressure from the triple burden of high levels of communicable & non communicable diseases and inter-personal violence(1, 2). As a result, it is essential for emergency services to achieve a balance between servicing those most in need of urgent medical care and providing the most benefit for the most number of people (3). Many unwell South Africans rely on the Emergency Medical Services (EMS) as their primary method of accessing health services, placing EMS at the forefront of equitable access to healthcare. It therefore becomes important to examine if this service is being optimally utilized and to look at both systemic and human factors that might affect its efficiency.

In Cape Town both a public and private ambulance service exists. For the purpose of this study only the public service was looked at. Within this system, when an emergency call for an ambulance is made, a call-taker based in an emergency call centre (ECC) makes a rapid decision on the urgency of the ambulance dispatch. In urban areas, the most urgent calls are allocated by the call-taker as 'Priority 1' (P1) and an ambulance is dispatched with lights and sirens with the aim of arriving at the patient within 15 minutes. 'Priority 2' (P2) is allocated for the less urgent cases with the aim of arriving within 60 minutes. Extensive resources are required to enable this prompt P1 response time - especially since the proportion meeting the 15 minute target is used as the primary performance indicator; it is therefore important to examine the accuracy of the decision to dispatch a P1 ambulance. Are a large number of urgent ambulances being incorrectly dispatched to relatively well patients – known as 'over-triage' – at the expense of the service as a whole?

The majority of international studies conducted thus far have shown over-triage rates of between 64% and 84.6% (4-9); the exception being two North American outlying studies showing lower rates of 33.8% and 29%, which can be accounted for by very narrow criteria for over-triage and small sample size respectively (10, 11). No guidelines currently exist from which to set goals for either over- or under-triage (4, 12, 13). Hence it remains uncertain what rates of over-triage are acceptable or should be aspired to. No studies to date have looked at this in lower middle income settings such as South Africa. The majority of information on over-triage comes out of well-resourced settings where the call-takers make use of computerised triage tools – following a protocolised set of questions based on the patient's presenting complaint (9, 10, 14). Many current studies focus on the efficacy of these protocolised triage tools rather than on the call-takers themselves (4, 14-16).

In Cape Town the majority of call-takers are not trained medical personnel and they do not have a protocolised triage tool to follow – they use a combination of using elements from the South African Triage Score (SATS), rough guidelines, prior experience and in-service training (17, 18). As such it becomes important to look not only at whether they are making the correct decisions but also at factors that may lead to a call-taker that triages more appropriately, more often.

This study aimed to assess what the levels of over-triage were in the Cape Town setting and to identify whether presenting complaints, time of day, and level of call-taker training and experience had an effect on over-triage rates.

Methods

Study Population: The study looked at all calls made in a calendar month to the Cape Town ECC which fields all calls for the public sector EMS service for the metropol. Information was obtained from a digital call centre database, as was information about the call-takers on duty during the study period. All call-takers who fielded 20 or more P1 calls for the month were included; excluded were those with less calls or whose relevant information was incomplete.

Study Design. There is no exact equivalency between the call centre triage of P1/P2 and the SATS triage colour used by the ambulance crew on scene. This study allocated all those P1 cases subsequently triaged as 'green' or 'yellow' as being 'non-urgent' and therefore 'over-triaged' by the call taker. This decision was based on the fact that – in hospital – those patients with SATS colours 'red' and 'orange' should be seen within ten minutes of arriving; a P1 call aims to arrive within fifteen minutes (19). 'Yellow' patients should be seen within an hour and 'green' patients within four hours; a P2 call aims to arrive within sixty minutes. Hence a relative equivalency can be seen.

The study looked for other factors, which might affect call-taker allocation accuracy. The time of day was recorded as either 'night shift' or 'day shift' comprising 19h00 to 0700 and 0700 to 19h00 respectively. These reflect the 12 hour shifts worked by both call centre and ambulance personnel. The nature of the presenting complaint was grouped from the the EMS database classifications – as recorded by the call-takers - into larger categories, chosen at the investigators' discretion (table 1) and the rates of over-triage for each of these groups was looked at.

Table 1: Groupings of EMS classifications

Category	EMS classification
Trauma (other)	Accidental injury, Assault, Burns and Corrosives, Self-harm, Weapon
Trauma (MVA/PVA)	Bus/Taxi, Cyclist, Motorcyclist, Pedestrian, Train and Railway Accident, Truck/Heavy vehicle
Abdominal	Abdominal complaint, Dehydration, Diarrhoea and Vomiting
Cardiac	Cardiac chest pain, Cardiac complaint, CPR in progress
Respiratory	Respiratory complaint, Unable to breathe
Obstetric and Gynaecological	Gynaecological problem, Obstetric problem
Neurological (convulsions)	Convulsions
Neurological (other)	Confusion, Neurological complaint
Unresponsive	Unresponsive
Other	Fever, Envenomation, Wilderness search, Allergy, Non-traumatic bleeding, Self-harm poisoning, Dermatological, Non-cardiac pain, Industrial, Informal Structures, Residential, Musculoskeletal pain

Abbreviations: MVA = Motor Vehicle Accident, PVA = Pedestrian Vehicle Accident

Information collected about the call-taking personnel included their levels of medical training: whether they had none at all (simply six weeks of in-service training), had passed a four-week

Basic Ambulance Assistance (BAA) course or whether they had a six month Intermediate Life Support (ILS) qualification. Their years of experience working as EMS crew and years working in the call centre were also examined, together with the available data to assess if any particular set of call-taker characteristics lead to lower rates of over-triage.

Statistics. Descriptive statistics including 95% confidence intervals are reported where appropriate (Dell Statistica 2015 Version 13.0 (Dell, Round Rock, Texas)). Differences in the mean rate of over-triage between categories of call-takers were analysed using one-way ANOVA. Chi-square tests were used to determine if the proportion of over-triaged calls was different between night and day shifts, and between complaint categories. Statistical significance was accepted at $p<0.05$.

Results

The study looked at a convenience sample of 44,139 calls made within Cape Town over the month of August 2017, chosen because August represents an 'ordinary' month, free from the confounders of school holidays and tourism spikes. Once the relevant exclusion criteria were applied (Flowchart 1) the final sample size was 4,619 P1 cases. Of these, 2,701 were coded on scene as 'green' or 'yellow' for an overall call-taker over-triage rate of 58.48% (p-value 0.068). The number of correctly triaged cases ('red' or 'orange') was 1918 for a rate of 41.52%. More P1 dispatches took place during the day shift at 2,506 (54.25%) versus 2,113 (45.75%) at night and there was no significant difference in the distribution of over-triaged calls between the day (58.02%) and night (59.11%) shifts compared to expected values ($X^2=0.215$, n=2703, p=0.643).

Flowchart 1: exclusion criteria of received calls – see page 43

There was a significant difference in the distribution of over-triaged calls across presenting complaints (X^2=51.326, n=2701, p<0.0001). Over-triage rates were lower than expected in cardiac (47.12%) and neurological (49.66%) complaints, and higher than expected in trauma (65.70%) and gynaecological (84.87%) complaints (table 2). The maximum number of P1 calls allocated were for respiratory complaints at 1,297 cases and the least number were for abdominal complaints at 63.

Table 2: percentages of over and correct triage by presenting complaint and total number of cases

Presentation	**% over triaged**	**% correctly triaged**	**Total number of cases**	**% of all P1s**
Gynaecological Complaint	84.87%	15.13%	238	5.15%
Trauma: MVA/PVA	65.70%	34.30%	551	11.93%
Abdominal Complaint	63.49%	36.51%	63	1.36%
Other	61.29%	38.71%	217	4.70%
Trauma: Other	59.65%	40.35%	793	17.17%
Respiratory Complaint	58.21%	41.79%	1297	28.08%
Unresponsive	55.16%	44.84%	281	6.08%
Confusion, Neurological complaint	49.66%	50.34%	441	9.55%
Convulsions	49.42%	50.57%	522	11.30%
Cardiac Complaint	47.12%	52.88%	278	6.02%

Abbreviations: MVA = Motor Vehicle Accident, PVA = Pedestrian Vehicle Accident

Of the 96 call-takers that fielded P1 calls, 40 had fielded the 20 or more calls required to meet inclusion criteria. The number 20 was selected to minimize the confounders that smaller numbers of fielded calls would bring. Of these 40, the study was unable to gain sufficient information on – and therefore excluded – two of them for a final total of 38 call-takers. Their levels of medical training, years of experience in the call-centre and years working in ambulances are set out in Table 3.

Table 3: Call-taker medical training, call-centre experience and experience working as ambulance crew

	Number	**%**
Medical training		
none	19	50
BAA	14	37
ILS	5	13
Experience in call-centre		
<2 years	5	13
2-5 years	13	34
> 5 years	20	53
Experience as ambulance staff		
0 years	28	74
0-2 years	3	8
2-5 years	3	8
> 5 years	4	10

Abbreviations: BAA = Basic Ambulance Assistant, ILS = Intermediate Life Support

In terms of rates of over triage, the mean over-triage rate of the 38 call-takers examined was 59.88% (slightly higher than the overall over triage rate of 58.48% once looking at just the 38 selected call takers).

We examined subgroups within the 38 call-takers. When their levels of basic medical training were examined, there was a trend towards higher rates of over triage with increased levels of training (figure 1.1). Those with no further qualifications over-triaged at the rate of 59.08%, those with a BAA qualification at 60.68% and those with ILS at 60.24%. This trend was not, however, statistically significant (p-value 0.67).

Similarly, there was a subtle trend towards over-triage with an increase in years of experience as a call-taker (figure 1.2). Call-takers with less than two years experience over-triaged at a rate of 60.57%, those with two to five years experience at 64.13% and those with more than five years experience at 59.86%. This was also lacking in statistical significance (p-value 0.93).

When the study looked at years working in the field, the lowest rates of over-triage were seen in the group with 0 to 2 years experience at 59.13%, however all 3 other groups examined showed the same trend towards higher rates of over-triage with higher levels of experience – zero to two years experience had rates of 61.06%, two to five years had rates of 67.07% and those with more than five years had rates of 60.24% (figure 1.3). This, however, also lacked statistical significance (p-value 0.30).

Figures 1.1, 1.2, 1.3: Percentage of over triage by call-taker levels of training, years of experience and years working as ambulance crew – see page 44.

When various aspects of all three sub groups were combined to look for the combination resulting in the lowest rates of over triage, the results were mixed. The group of traits with the lowest rates of over triage at 56.48% were those with no medical qualification, no time working as EMS crew and 2-5 years call taker experience. The worst performing group, at 63.66% were those with ILS and > 5 years working on the road. In between these, no clear grouping of factors could be identified with lower rates of over triage (figure 2). The numbers involved in these results were too small to test for statistical significance.

Figure 2: Groupings of call-taker characteristics and percentage of over-triage – see page 44.

Discussion

The study aimed to identify rates of over-triage which would give an idea of the efficiency of the pre-hospital service. By identifying factors associated with this, steps could be taken to optimise both the EMS systems and the role of the call-takers.

The main study findings show that, in the Cape Town setting, rates of over-triage by call-takers were generally lower than the majority of those seen internationally (64 – 85%) (4-9). Given that the call-takers in most international studies made use of triage tools, this could be interpreted as superiority of call-takers who do not make use of these tools over those that do, in not over-triaging patients. When we consider the reasons for the comparatively lower rate of over-triage, they are

likely manifold. Primarily, the triage tools used in well-resourced settings are likely more conservative, so as to avoid the potential under-triage of a sick patient. While over-triage results in an unnecessary strain on the system, under-triage has the potential to result in patient morbidity and mortality. This more conservative approach would therefore be at the expense of increased rates of over-triage. It is the balance between these two considerations that is largely determined by the resources at hand and the policies of individual organisations.

When observing factors contributing to rates of over-triage, it could be seen that consistency existed across day and night shifts with little difference between the two. This parameter has not been looked at in any other previous studies so it is uncertain if this is to be expected or not. Certain presenting complaints had far higher levels of over-triage than others. Gynaecological conditions had the highest rates of over-triage by a considerable margin, likely indicating both call-taker caution concerning issues around potential pregnancies as well as governments' ongoing drive to reduce perinatal mortality – a continually measured yardstick of a regions healthcare system (20). MVA's and PVA's were over-triaged by 30% more compared to the targets set by the American College of Surgeons – probably reflecting the difficulties involved in assessing the severity of a poly-trauma case over the phone and possibly also due to the inclination of call-takers towards trauma (12). The least over-triaged presentation was for cardiac complaints, also seen in other studies, and likely reflects the ambulance personnel's reticence to triage a chest pain as 'non-urgent' despite potentially normal vitals (10, 19).

There was a trend towards over-triage with increasing experience both as a health practitioner and a call-taker. This may reflect that those with greater knowledge learn to anticipate the worst –

which is an important trait in the hospital setting but may not be ideal pre-hospital. Where a back ache might receive a P2 dispatch as simple mechanical back pain from an inexperienced call-taker, one with greater knowledge might worry about a leaking aortic aneurysm and urgently dispatch a P1. Further qualitative research would be needed to establish the true reasons for this. The sample size of call-takers was also small and therefore these trends were not statistically significant. Further quantitative research on a larger cohort of call-takers would be needed to establish if these are genuine trends or not.

Limitations

The study had several limitations. The first of these relates to the lack of equivalency between the triage systems used by the EMS call-takers and those used by the health providers on scene. While it makes intuitive sense that a P1 call should be viewed in the same 'urgent' category as those triaged 'red' and 'orange', the fact that the study is comparing two distinct prioritization systems is potentially problematic. This is a similar issue seen in the majority of studies on this topic.

SATS has not been validated for pre-hospital use so it's effectiveness in this setting has not yet been established making it an imperfect tool to measure by (18, 21, 22). The study also did not look at whether the health-personnel on scene were correctly applying the SATS nor the accuracy of their categorization: incorrect assessments on scene might skew the data towards higher levels of over-triage. By looking at 30 and 90 day follow-up as well as patients with call-back to EMS within the following 72 hours, these patients could potentially be identified.

This study was purely a quantitative look at a potentially qualitative process. Examining the calls themselves would have been useful in ascertaining the reasons behind call-taker's decisions in over-triaging certain cases. The extent to which language barriers and cultural differences affect individual calls is something that has been established in recent papers, however its effect on the accuracy of pre-hospital triage remains uncertain (23, 24). Likewise, it is unclear if some cases of over-triage are due to the person making the call exaggerating the clinical picture in order to get a faster ambulance. Further qualitative research in this field would shed light on this issue.

Another limitation faced by the study was in grouping presenting complaints logged on the EMS data sheet into smaller coherent groups. Certain presentations cannot easily be attributed to a single system (for example 'unresponsive' and 'confusion' can both be due to pathology in any number of organ systems); similarly, certain categories within the EMS database were difficult to place at all such as 'industrial', 'self-harm' and 'non-cardiac pain'. Misallocating these complaints can certainly cause confounders in the results. Similarly, age was not documented in the EMS data so how this may affect the call-taker's decision is not understood. In particular, it is uncertain if calls made about children received higher prioritization than those about adults. Improved data capture and categorization is needed to better examine these important issues.

Finally, the study did not look at the equally important levels of under-triage to assess if non-urgent ambulances are being dispatched for acutely ill individuals and causing delayed access to healthcare for them. This balance between low levels of both over- and under-triage is very much the crux of pre-hospital dispatch and certainly warrants further research.

Conclusion

Rates of over triage within the Western Cape, South Africa are generally lower than those found in better resourced settings as far as the study was able to compare. While these figures are certainly encouraging for the efficiency of the service as a whole, an absence of international guidelines makes it uncertain if these are, independently, acceptable or not. As such there should be a continual drive to improve the ability of the call-takers to make accurate decisions. Wide variations in rates of over-triage based on the primary complaint is certainly an area that could be targeted and investigated for further improvement. Although this study was not able to determine with any certainty which characteristics make up the most effective call-taker, this is potentially an easy target for improvement to reduce the rates of over-triage and to enable the pre-hospital service as a whole to become more efficient. Existing policy encourages over-triage of gynaecological and certain other patients, so a re-think of such specific policies is another area where efficiency could be improved. Finally, another potential area for consideration would be to develop new, or implement existing, prompting systems to aid call-takers in their questioning around the most commonly over-triaged complaints.

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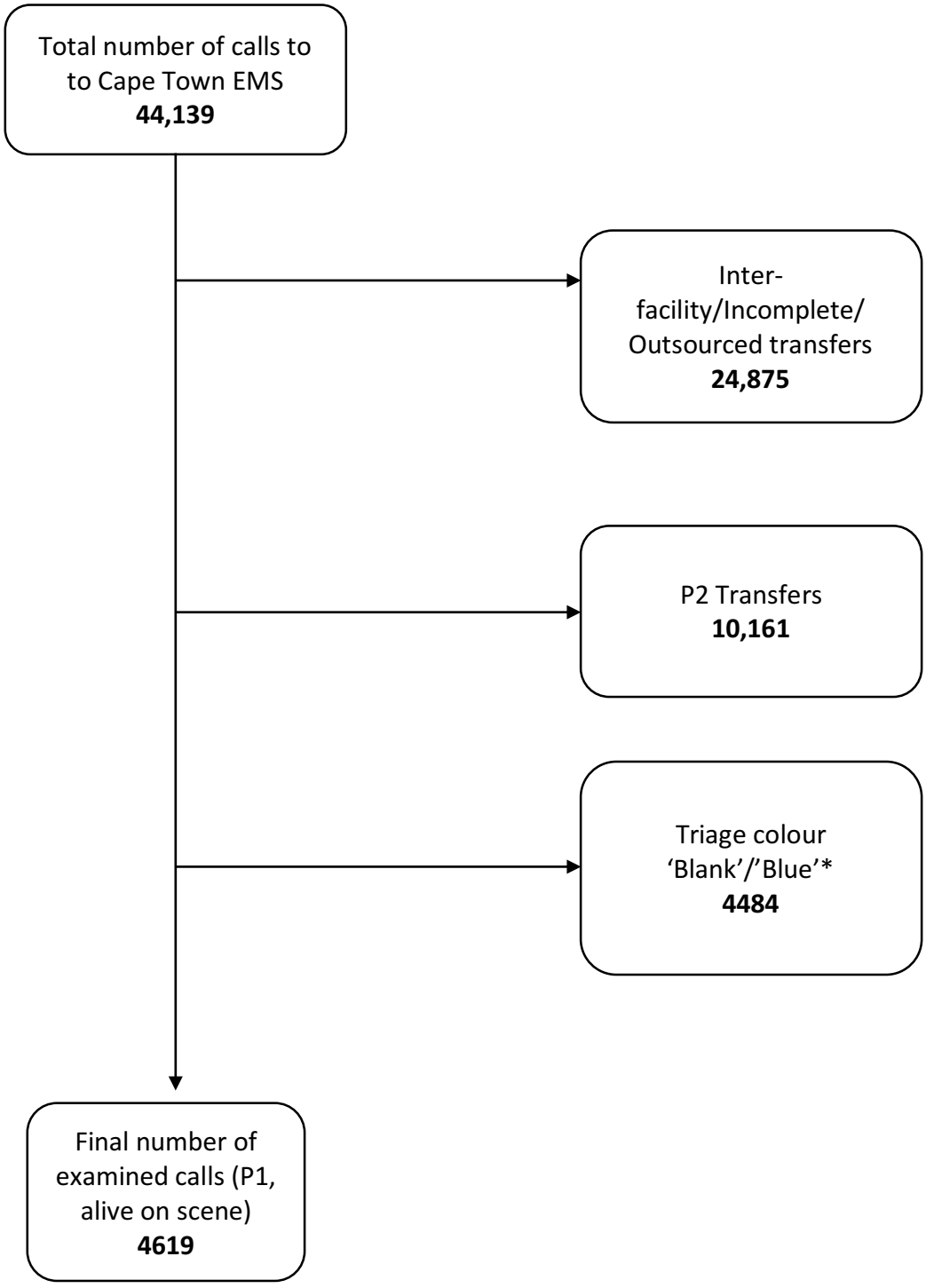
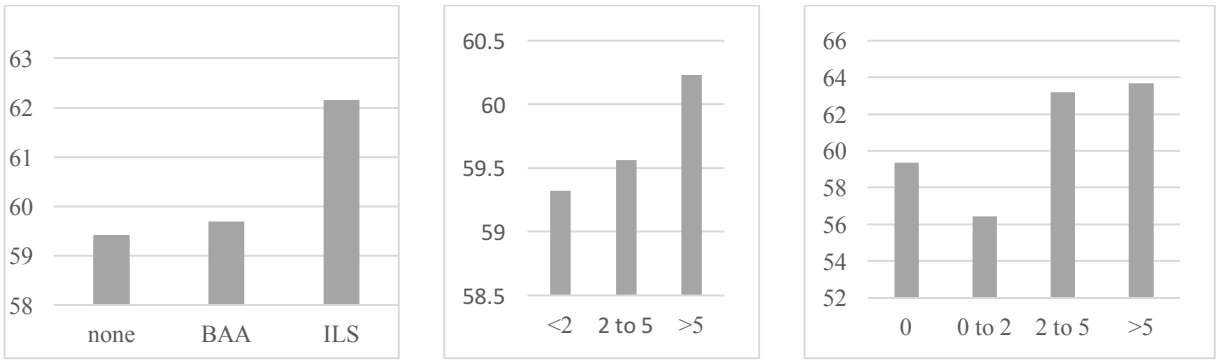


Flowchart 1: exclusion criteria of received calls
* *Dead on arrival*



Figures 1.1, 1.2, 1.3: Percentage of over triage by call-taker levels of training, years of experience and years working as ambulance crew.

Abbreviations: BAA = Basic Ambulance Assistant, ILS = Intermediate Life Support

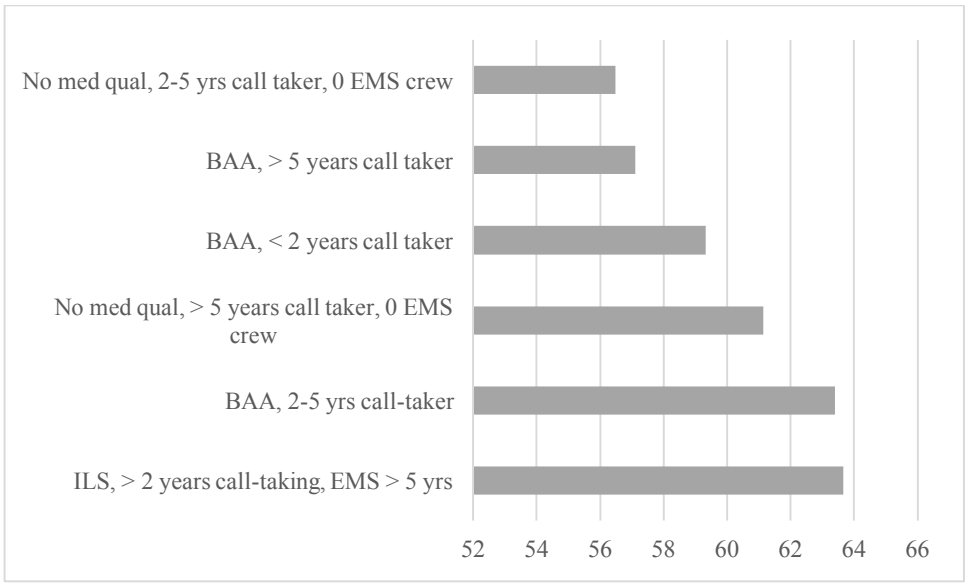


Figure 2: Groupings of call-taker characteristics and percentage of over-triage

Abbreviations: BAA = Basic Ambulance Assistant, ILS = Intermediate Life Support, EMS = Emergency Medical Services, med qual = medical qualification

Part C: Declarations

Ethics

I declare that this research was conducted with the ethical approval from HREC (reference number 849/2017) and was conducted in a fully ethical manner. HREC approval letter attached as Addendum 2.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available as they contain personal identifying patient information. The research approval was also limited to the information being released to the research team and not to be made public. The datasets may be made available from the corresponding author on reasonable request.

Competing Interests

I declare that none of the authors – DM, JF, PH – have any financial or non-financial competing interests in the conduction of this research.

Funding

All research was self-funded by DM.

Authors Contributions

DM as the primary author collected, collated and analysed the data and was the primary contributor to the writing of the manuscript.

PH was substantially involved in the conception and design of the study, assisted in the acquisition of the data and was involved in regularly revising and contributing to the manuscript.

JF was involved in aspects of the study design, acquisition of the data and in giving input to the manuscript.

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Authors information

David McAlpine is an Emergency Medicine Trainee at the University of Cape Town. After studying medicine in Cape Town he spent four years in Accident and Emergency in London's busiest units. He returned home with the hope of becoming an Emergency Physician and combining his knowledge of the NHS with the resource-scarce units in South Africa. He has a passion for both emergency medicine and critical care and spends his time outside of his units travelling to wherever he can get to.

Part D: Addenda

1) Research Proposal (as approved by University of Cape Town Human Research Ethics Council)

A descriptive study of EMS high priority calls and their correlation with ambulance crew assessment in a Cape Town pre-hospital setting

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Background

South Africa is a country that carries a significant health burden, spending 9.4% of its annual budget on healthcare (1). According to the country's Constitution each citizen is entitled to healthcare that is timely and appropriate as determined by the persons need (2). The medical requirements and urgency of any individual requiring an ambulance in the Cape Town public sector is determined by the call-takers at the Emergency Medical Services (EMS) dispatch call centre who are required to make rapid decisions about the type of transport the person will receive. The options are: Priority One, Two or Planned Transfer. A Priority One (P1) is an emergency ambulance utilising lights and sirens to get to the person in as short a space of time as possible with the national norm of crew arrival within fifteen minutes of call arrival. Priority Two (P2) dispatches are non-urgent and the ambulance will be dispatched when available but aiming to arrive within sixty minutes of the call. Planned Transfers, also known as Healthnet, is a scheduled transfer of a generally well patient between health facilities. A great deal of resources are required to enable prompt response to P1 calls, and this is also an important metric EMS uses to measure its performance – so there is a great deal of focus on meeting the P1 time margins. It is therefore important to look at whether the decisions that are being made by the call centre regarding these prioritisations are correct and are resulting in the optimal use of scarce health resources.

There is currently no international consensus on what constitutes acceptable levels of over and under prioritization by the call centre. 'Over-triage' is when the call centre dispatches a crew with a higher level of prioritization than the crew on scene assesses is required. An

example of this would be an urgent P1 ambulance dispatched to a patient with an episode of collapse and the crew on scene finds a well, conscious patient with entirely normal vitals and therefore scores them a non-urgent (green) triage score. Conversely 'under-triage' is when the call centre dispatches an ambulance at a lower priority than what the crew assesses on scene. Guidelines exist for trauma patients, citing 30-50% over triage rates and 1-5% under triage rates as acceptable however outside of trauma no standardized targets exist (3,4). Despite the absence of standardised targets, there is a good deal of research in well-resourced settings examining rates of over and under triage by emergency call centres. Rates of over-triage varied from 29% to 78.3% and under triage from 3.5% to 31.8% (5-12). Table 1 shows these studies and figures. The majority of these studies, including those with the lower rates of over triage, concluded that call-centre prioritization needed much improvement.

Paper	**Over-triage**	**Under-triage**
Hoikka et al	78.3%	9.2%
Dami et al	78.0%	4.6%
Ek et al	84.6%	4.1%
Khoram-Manesh at al	73.0%	3.5%
Sporer et al	64.0%	16.0%
Feldman et al	33.8%	31.8%
Lu et al	72.9%	8.1%
Neely et al	29.0%	5.4%

Table 1: Research papers and their findings on rates of over and under-triage (5-12)

No South African or resource-constrained setting studies could be found examining the question of call-centre prioritisation. The most relevant South African study used computer modeling to examine the effect of extra ambulances on paramedic response times (13). It concluded that additional ambulances would be of limited benefit to improve response times and that the key to this is to optimise vehicle utilization and efficiency.

Research Question

PICO: POPULATION INTEREST COMPARISON OUTCOME

In emergency calls to a Cape Town Emergency Communications Centre (CTECC), what proportion of P1 calls are ultimately determined to reflect urgent calls as judged by the triage classification of the responding ambulance crew?

Aim

The study aims to looks at the proportion of dispatches the EMS call centre staff at the CTECC are prioritizing correctly and the proportion that they are over-triaging. The study will also look at various factors that may influence this decision and lead to either appropriate prioritization or over-triaging by the call-takers. Rates of under triage will not be examined in this study.

Objectives

- To sample and collect a calendars month's data from the EMS database and digital PCR forms

- To analyse the data and describe what proportion of ambulances that are sent out as P1's by the CTECC and are subsequently triaged by the medical personnel on scene as 'red' and 'orange' (urgent) or 'yellow' and 'green' (non-urgent).

- To look at and describe certain characteristics within the groups of correctly and incorrectly allocated P1's that might have a statistically significant bearing on the decisions being made. The characteristics looked at will include:
    1. The nature of the complaint as described by the call centre, divided into broad diagnostic categories.
    2. The time of day the call was received.
    3. The qualification and experience of the EMS call taker
    4. Outcome and destination health facility type

Methodology

Study Design

The study will be a descriptive, quantitative, retrospective study.

Study setting and population

The study population will be all P1 callouts for the month of August 2017 fielded by the CTECC which receives calls for the greater Cape Town metropole (estimated 10,000 P1 calls a month). August was chosen as the given month as it represents an average month in the Western Cape calendar with no school holidays or tourism-spikes to which might confound number and acuity of cases.

Inclusion Criteria:

- Any EMS call as classified by the call taker as P1
- Location anywhere in the greater Cape Town metropole, Paarl and Stellenbosch served by the CTECC call centre.
- Call made at any time during the month of August 2017

Exclusion Criteria:

- Cases designated by the call taker as P2's
- Duplicate cases
- Cases cancelled by caller
- Ambulance diverted or unable to find patient location
- Inter-hospital transfers
- Incomplete data in the database
- PCR data incomplete

<u>Sampling Method</u>

The study will make use of the EMS database that logs and tabulates a large amount of data from every case phoned in to the call centre. This data includes information on whether the case was designated P1 or P2, what the presenting problem was assessed as by the call taker and the times of pick-up and drop-off of the patient as well as the identity of the call taker. This data is available in the form of a Microsoft Excel spreadsheet and each case can be tracked and identified by its Incident Number. Data not included in the database includes the EMS crews triage classification and this will be obtained via a separate database that logs their relevant Patient Care Reports (PCR). With the assistance of the EMS information management (IM) department, the triage classification for each transfer will be extracted from the corresponding PCR data and will be available to compare and describe the various parameters set out in the study. Using all of the above-mentioned inclusion and exclusion criteria, the data within the Excel spreadsheet will be filtered down until only those cases fulfilling the necessary requirements are used and analysed. With the assistance of the EMS human resources department, the years of experience and background medical qualifications of the call-takers will likewise be established.

Data Analysis

Data will be cleaned, coded and analysed by the primary researcher. The relevant data will be filtered and extracted from both the EMS database and the PCR forms and inserted into an Excel spreadsheet in a large table of categorical variables. This table will consist of two major groups – the correctly prioritized P1's and the incorrectly prioritized P1's. 'Correctly prioritized P1s' will consist of those dispatches triaged as orange or red on scene by the ambulance crew. 'Incorrectly prioritized P1s' will be those that are triaged as green or yellow

on scene. Within these two groups will be the categorical variables of nature of complaint, time of day of call, qualifications of call taker, years of experience of call taker and outcome and destination of dispatch. The relationship between these categorical variables will be assessed using standard descriptive and comparative statistics such as chi-squared testing. They will be described using 95% confidence intervals and figures will be used to illustrate the important aspects of the study. A post-hoc power analysis will be conducted to establish if adequate power exists for inferences to be acceptable.

Limitations

The study will only look at a sample of patients within the greater Cape Town area and whether this sample can be extrapolated to other parts of South Africa is uncertain. This sample will also be from a single month and, while the study has attempted to select an average month to minimize confounding factors, there is likely to be significant month-to-month variations in EMS call outs. The study also assumes that the ambulance crew on-scene will correctly triage the patient, which may not necessarily be the case and the accuracy of this may vary from crew-to-crew. The ambulance crews also triage using the South African Triage Score (SATS), which has not been validated for out-of-hospital triage and has merely been extrapolated from hospital systems. Conversely the P1 dispatch might have been appropriate despite the crew ultimately triaging them as ‘green’ or ‘yellow’. Examples of these might be a collapsed and unresponsive patient that returns to baseline prior to the crew’s arrival, or a hypoglycaemic patient that responds to oral glucose at home. The study will also only look at certain broad characteristics of the P1 cases and it is possible that characteristics not studied may have an impact on the findings. These might include the

location of the patient, how long into the call-takers shift the decision is made, as well as basic human factors such as bias and language difficulties. The study is also purely quantitative and, in order to gain a fuller understanding of the decisions made by the call takers, a qualitative aspect looking at the calls themselves would be very useful but is beyond the scope of this particular study.

Data Safety and Monitoring

All data will be kept on a password-protected and physically secured laptop by the primary researcher. Original data will be kept in accordance with UCT policy and deleted when no longer needed once the 5 year storage time has lapsed. Any patient, call-taker or specific facility-identifying data will be coded and kept securely for the duration of the study and none of it will make it into findings or be reported on. No patient identifying information is on the EMS data besides the patient's address which will not be incorporated into the findings. Call taker's identity will be used purely to classify the call taker according to their qualifications and experience and this data will be coded and not identified to individuals.

Ethical Considerations

The EMS database has already been registered with the Human Research and Ethics Council. An ethics application will therefore be made within this registry and following this a formal application to conduct this study will be made to EMS Western Cape. There will be certain patient identifying data provided and keeping this information confidential is the primary

ethical consideration of this study. As stated above, this will be handled securely for the duration of the study.

Dissemination

Study findings will be submitted to the University of Cape Town Emergency Medicine Division as part of the requirements for the MMed and Emergency Medicine degree. No raw data will be disseminated.

The findings of the study will also be fed back directly to EMS Western Cape. The organization may choose to use the findings in any way it sees fit, however, the researchers hope the information will be used to try and improve accuracy of ambulance dispatches and therefore the overall efficiency of their service.

The researchers hope to have the paper published in an Emergency Medicine or Pre-hospital journal. Given that there is a lack of local information in this field, it is hoped that the research will be of interest to any number of publications.

It is hoped that this study will lead onto a number of other research projects in the field of EMS call-outs. These studies could look at larger sample sizes, perform analyses of causes of incorrect allocations and even adopt a more qualitative approach looking more closely at the calls and call-takers themselves.

Project Timeline

EMDRC – 2 months

HREC – 2 months

Data collection – 3 months

Analysis – 3 months

Write up – 3 months

Aim for submission: November 2018

Resource Utilisation

The primary resource in this case is time and it needs to be managed appropriately. The research has already received informal approval to make use of the resource of the EMS database and this will be done in collaboration with EMS.

Budget

Item	Description	Unit Cost	No. of Units	Total Cost
Internet and email services	Wifi, airtime	R400	3	R1 200
Office stationary	Paper, pens, highlighters			R60

Office services	Printing, binding	R400	1	R400
Specialized services	Bio statistical services	R450/hr	5	R2250

Total direct cost	R2 560
Total indirect costs (12%)	R307.20
Total	R2867.20

The lead investigator (DM) will fund all expenses.

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2) HREC Acceptance Letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

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Groote Schuur Hospital
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Website: www.health.uct.ac.za/fhs/research/humanethics/forms

07 December 2017

HREC REF: 849/2017

Dr P Hodkinson
Emergency Medicine
F-51, OMB

Dear Dr Hodkinson

PROJECT TITLE: A DESCRIPTIVE STUDY OF RATES OF OVER-TRIAGE BY EMS CALL CENTRE PERSONNEL AND THEIR CORRELATION WITH AMBULANCE CREW ASSESSMENT IN A CAPE TOWN PRE-HOSPITAL SETTING (MMeD candidate- Dr D McAlpine) sub-study linked to R014/2017

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 December 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: Dr D McAlpine will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

Signature Removed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

3) Instructions for Submission to Journal

Instructions to authors for submission to the International Journal of Emergency Medicine can be found at the following site:

https://intjem.biomedcentral.com/submission-guidelines/preparing-your-manuscript/original-research-articles