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Achievements in emergency medical rescue service, North-West province, 2002 - 2004

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Objective. To analyse the performance of the Emergency Medical Rescue Service (EMRS) in North-West province.

Design. A prospective study of the activity of the EMRS.

Setting. North-West province, 2002 - 2004.

Results. During this period the EMRS response time tended to decrease (reduction of 8 minutes for rural and 6 minutes for urban areas), and the province is now within the national goals. The number of EMRS calls and patients transported increased by a monthly average of 4.8% for the first year and 4.1% for the second year. This means an increase of 357 calls and 487 patients per month. The number of first priority (P-1) (7.4 - 9.0%) and second priority (P-2) (50.2 - 51.4%) cases transported is higher; this represents a more effective service. Mortality during transport remains the same (0.2%), while mortality at the scene has increased from 0.8% to 1% of calls. Medical cases (32.8%), maternity cases (24.1%), assaults (10.6%) and motor vehicle trauma (6.0%) were the main causes of EMRS requests during the 3 years of the study.

Conclusion. Before 2003, the EMRS in North-West was one of the most undeveloped provinces in the country. The achievements (without any increase in resources) during the study period are good, and they result from changes in structure and policies, more effective control of resources, fleet management, and improvement in the medical qualification of staff.

Transport of the ill and injured has a very long history. The earliest evidence of transportation of the ill can be traced back to the biblical period, and since the 18th century all types of vehicles have been used for patient transport.[1] In 1792 the first mobile vehicles were designed for this purpose, and in 1865 the first ambulance system with a hospital base was created. Although patient transport vehicles only began to carry advanced life support staff in the 1960s, it became obvious a decade before that for optimal patient resuscitation and outcome it is necessary to start assessment and management in the pre-hospital setting. Even in intensive care units, the mortality rate is strongly correlated with the quality of the previous medical care given.[1-4]

More recently the development of new techniques, equipment and procedures for resuscitation and management of emergencies have led to the creation of the new specialty of Emergency Medicine. Currently the majority of countries have emergency medical rescue services (EMRS), with some differences in structure and function but with the same objective: to deliver quality medical care in the shortest possible

time to all medical emergencies. The emphasis is on managing life-threatening conditions particularly in the pre-hospital setting, including medical rescue in some countries, and the efficient stabilisation and transport of patients to the appropriate hospital capable of providing more specialised care.[1,2]

In South Africa, before 1977 the ambulance service was delivered on *ad hoc* basis by local authorities. Section 16 of the Health Act (Act 63 of 1977) made ambulance service the responsibility of the provincial government. However, many different models were followed. With the advent of a new political dispensation, the Constitution in Section 5 enshrined ambulance services as a provincial function.

In North-West province this process of provincialisation took place in December 2001, and in the following months the focus was on the re-organisation of concepts, establishment of norms and standards, and training of staff with the goal of improving quality of the service rendered. It is the objective of this study to analyse the performance of the EMRS in the province from 2002 to 2004.

Methods

A prospective study of the activity of the Emergency Medical Rescue Service (EMRS) in North-West province was done for the period March 2002 - June 2004. The 2002 data for March to October were retrospective, and because they were incomplete it was impossible to collect the reports from January and February. The investigation included all emergency medical calls attended by all EMRS stations and all transported patients by the EMRS in the province during the above timeframe.

The primary data were collected from the monthly reports (indicators and statistics) submitted from the EMRS stations to the EMRS district officer and from there to the EMRS head office after review. The source documents were the patient assessment forms filled in for all patients, and the control room call registers and ambulance requisition forms filled in for all EMRS calls. Data related to population were collected from the statistical department of the provincial health department. The remaining information was collected during visits by the authors to all the EMRS stations during the study period. For standardisation of the registers so that the study years could be compared, all monthly data were processed and the results are expressed as monthly averages.

The information gathered included the number of EMRS calls and transported patients, patient code classification, mortality at arrival and during transport, response time (time between the call being received by the station and the ambulance arriving at the scene) and categories of transported patients divided into main medical groups. For management of the information we created a database using Excel (Microsoft Office 2000).

Patient classification was as follows:

- P-1 (First Priority or Red Code) for life-threatening situations that have to be resolved in a short time to prevent death of the patient
- P-2 (Second Priority or Yellow Code) for situations posing less risk to life although potentially affecting vital signs, i.e. the patient needs treatment but not immediately
- P-3 (Third Priority or Green Code) for situations without a real risk to life, i.e. the patient does not need immediate medical attention and can wait until other codes are managed, and
- P-4 (Fourth Priority or Blue Code), representing patient death, was divided into death by the time the transport vehicle arrived (including unsuccessful resuscitation at the scene) and during transport.

Response time is the period between receiving a call and arrival of the ambulance at the scene. In North-West province the EMRS is currently divided into 4 districts (Bophirima, Bojanala, Central and Southern), and consists of 22 EMRS stations.

Results

Between 2002 and 2004, EMRS response time has shown a tendency to decrease in rural as well as urban areas (by 8.2 and 5.9 minutes, respectively), and consequently the provincial average has also decreased (Fig. 1). This applies to all four districts, but Southern district has better results for urban areas (8.5 minutes' reduction) and Bophirima district for rural areas (20 minutes' reduction).
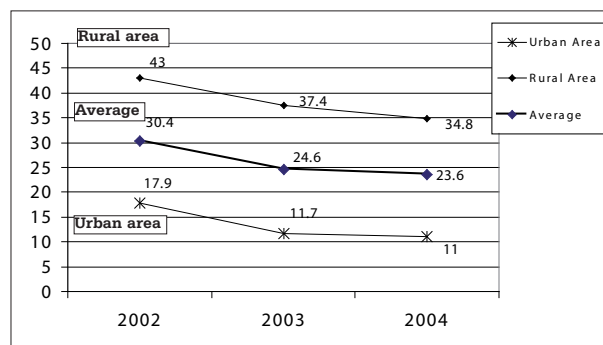

Fig. 1. Average EMRS response time (minutes) in North-West province, 2002-2004.

Calls have increased by a monthly average of 4.8% from 2002 to 2004 (Fig. 2) with a peak in 2003. This applies to all districts except Central district, which decreased by 11.6%. These figures represent 3.6, 3.2, 4.6 and 6.9 calls per 1 000 population per month for Bophirima, Bojanala, Central and Southern districts respectively.
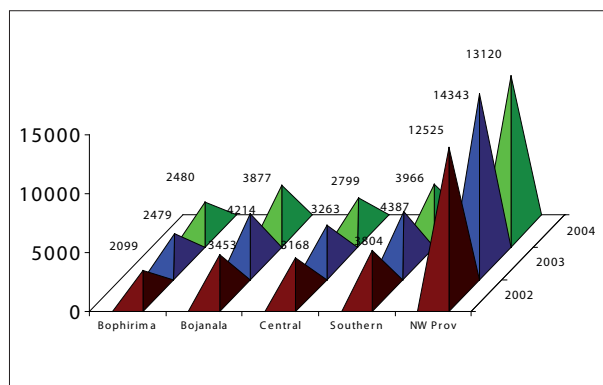

Fig. 2. Monthly average number of EMRS calls, North-West province, 2002 - 2004.

The monthly average number of patients transported also shows an increase (4.1%) when the three years are compared (Fig. 3), with 706 more patients transported per month. Central district is the only one that does not show an increase.

Analysis of patient classification according to life support priorities (Fig. 4) shows a slightly increase in the proportion of cases with P-1 and P-2 classification (232 and 295 more cases respectively per month). At
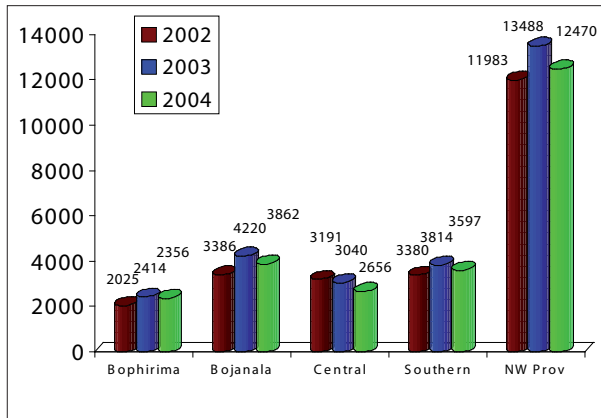
Fig. 3. Monthly average number of patients transported by the EMRS, North-West province, 2002 - 2004.
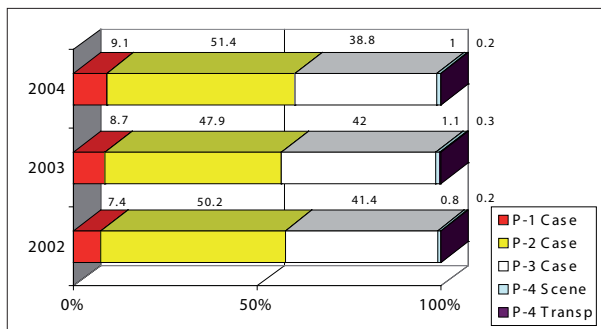

Fig. 4. Classification of patients transported by the EMRS (%) according to life support priorities, North-West province, 2002 - 2004.

present, 60.5% of our transported cases need an urgent and efficient service.

The proportion of patients who died during transport has remained much the same, but the average number of deaths at the scene has increased from 103 per month in 2002 to 123 in 2004.

The main condition necessitating EMRS requests (Fig. 5) remains medical emergencies (32.8%); this figure has fallen even if stroke cases (1.8% in 2004), which were reclassified during the study period, are included. (In 2003 we implemented a new classification, and there are now 5 instead of 8 main groups.) The second, third and fourth most common conditions necessitating transport are still maternity cases (from 23.1% to 24.1%), assault (10.6% in 2004) and motor vehicle accidents (MVAs), the figure for which increased from 4.3% to 6.0%. Cardiac cases, accounting for only 0.97% of calls in 2002, now represent 2.4% of transported cases, with an average of 184 more cases per month.

Comparison between districts shows that the Bojanala EMRS transports more cardiac (2.9%) and MVA cases (8.1%) and Central district more stroke (2.6%), maternity (28.5%) and childhood disease cases (7.1%).

The EMRS response to MVAs varies between districts. While the service is involved in 49.3% of MVA cases
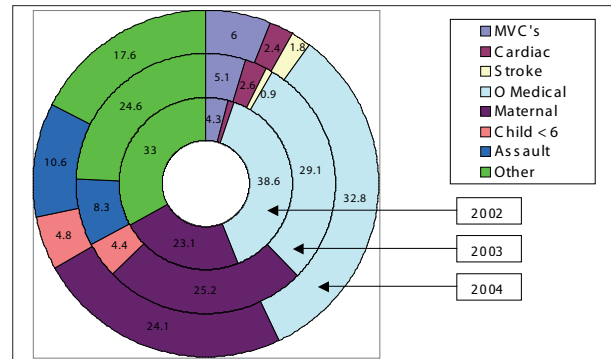

Fig. 5. Patients transported by the EMRS (%) according to their medical condition, North-West Province, 2002 - 2004.

in Central district, the percentage for Bojanala is only 3.2%. The firgure for the province as a whole is 17.1%.

Discussion

The average call time has dropped in both rural and urban settings. In 2002 the province was outside the national norm of 40 minutes for rural areas and 15 minutes for urban areas. At present our response time (RT) is within both targets, and with the planned development of more EMRS satellite points response time in general will improve, especially in the rural areas.

RT is important because, in combination with better staff medical qualification, it lowers mortality rates. It has been recorded that in medical emergencies not only is a good rescue team needed, but the RT is vital; ideally it should be less than 5 minutes, because above this the impact of EMRS in terms of survival is poor.[5-7] The average internationally accepted norm for advanced life support (ALS) is less than 10 minutes.[4]

Research on cardiopulmonary resuscitation (CPR) has shown that if CPR is done in less than 5 minutes 10 - 11% of patients survive; the figure falls to 8% after 8 minutes and to 6% after 15 minutes.[7]

Pell *et al.*[7] determined the association between ambulance RT and survival in the UK and found that decreasing the target for response to 90% of calls from 14 to 8 minutes would increase survival from 6% to 8%, while an RT of 5 minutes would increase it to 10 - 11%. The American Heart Association states that for a good recovery after CPR treatment should be started as soon as possible, and if basic life support is instituted in less then 4 minutes and ALS in less than 8 minutes, 43% of patients survive.[5] Unfortunately data related to CPR and life support procedures in our province were not recorded during the study period.

Arreola-Risa *et al.*,[8] who studied RT and qualification of staff, demonstrated that a reduction in RT from 15.5 to 9.5 minutes correlated with a reduction in mortality during transport from 8.2% to 4.7%.

The demand for EMRS, reflected in the amount of calls,

depends on several factors including population and pre-hospital health staff knowledge about the system, EMRS accessibility, accident and disease rates AU and variables related to cultural and social behaviour. These factors could explain the tendency for the number of calls to increase and the differences between regions in calls and patients transported per population group. Young *et al*.[9] evaluated 11 541 trauma patients transported to an emergency department by ground ambulance or private vehicle and found that patients with major or fatal injuries, older persons, patients with high-velocity injuries and those with hip fractures are more likely to use an ambulance. An EMRS can improve the community's ambulance utilisation by providing public education (e.g. on proper use of EMRS and recognition of injury severity), and by collaborating with dispatch, the local community and health care providers.[5,9]

We await an increase in calls in the future. Not only is the ratio of calls to population increasing, but our plan to extend the service to outlying areas and to improve its professionalism and thus confidence in it will increase demand. The most rural district (Bophirima), for example, now has 381 more calls (18.2%) per month, and the ratio of patients transported per population for Bojanala, the most populated district (comprising one-third of the total North-West population), is half the provincial average.

Despite the general tendency for calls to increase, there was a slight decrease in patients transported in 2004 compared with 2003; furthermore, the increase in calls is not the same as the increase in patients transported, the main reason possibly being a previous lack of vehicles. There were a number of calls that could not be served (4.3% in 2002 and 3.3% in 2004), especially in the Southern region, for which the figure in previous years was 9.3% of calls. To improve this situation, an agreement has been made between the private EMRS and the Provincial Health Department to provide an adequate service, so that even in disaster situations and when there is a shortage of vehicles the community is covered.

According to patient classification, the EMRS transports 60.5% of real emergencies, and the proportions of P-1 and P-2 cases are higher than the norm for other provinces. This could be explained by better response time or better case classification. Better response time can also be correlated with the slight increase in the proportion of cases dead on arrival.

EMRS providers worldwide report that a large percentage of cases transported are not in fact emergiencies.[11-13] Herlitz *et al*.[10] found that of 930 patients transported because they were thought to have coronary disease only 30% in fact did so, and only 14% had a myocardial infarction. Dunne *et al*.[11] found that 59.2% of patients transported by an EMRS did not

need immediate medical care and concluded that the majority of patients triaged as low risk did not require emergency ambulance transport. Other research[12] showed that only 52% of patients transported by an EMRS were admitted to hospitals, and of these only 44% had a life-threatening condition.

Gauteng province reported in 2002[13] that conditions posing an immediate threat to life (P-1) accounted for 7.7% of the total number of cases transported, P-2 cases for 46.8% and non-serious conditions (P-3) for 44.3%; 1.15% of patients were dead on arrival (P-4).

Classification according to priority, as reported in the literature,[11,14,15] is now widely used in North-West province and this helps us to define patients' condition in terms of survival and decide on priority of the call dispatch, staff qualification required for each situation, which patients will receive treatment first, conditions that require priority treatment, more professional service, the appropriate destination for the patient, and other needs such as rescue equipment or a helicopter.

Unfortunately, reporting systems in the hospitals do not inform us about numbers of P-1 and P-2 cases who arrive there without the EMRS. This would give us useful information about the effectiveness of the EMRS.

Our mortality rate during transport is very low, which means that the treatment patients are receiving while in the care of the EMRS staff is efficient. In an attempt to improve this figure, in the last financial year the department concentrated on staff training. The proportion with intermediate medical qualification has increased from 8% to 17%, and 48.2% of personnel have done at least one academic course. These figures will increase further once the EMRS college in the province obtains intermediate life-support training accreditation.

The fact that community knowledge about emergency assessment is extremely limited delays both the institution of basic medical attention and the call for help; an estimated 20 - 40% of trauma-related deaths could be prevented if all citizens had access to a well-organised system of trauma care.[14] Planning for the future will need to take this into account.

The main groups of patients transported in North-West are still medical and maternity cases. This is the opposite of what would be expected, as cardiac and trauma cases are the most frequent findings in the majority of research.[1,3,5,12,14-16] Medical conditions described by others were uncommon in our study, including cardiac arrest, respiratory failure, loss of consciousness and bleeding.[5,12] In Mexico, a third of patients transported have suffered trauma.[1] These differences may be due to specifically South African characteristics, the rural character of the province, or the data collection form. In contrast, in the Gauteng report medical cases accounted for 66% of calls received (with 1.2% for inter-institutional transfer of

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patients), trauma cases for 32.8%, of which MVAs were 28.8%, and interpersonal violence 71.2%.[14] Neither our previous nor our present classifications are satisfactory, because they cover few medical problems and not mechanism of injury or the injury itself. In future we plan to apply the 10th revision of the *International Statistical Classification of Diseases and Related Health Problems (ICD-10).*

The proportion of cardiac cases we transport is very low. This may be due to the low incidence of the disease in the province (although the prevalence of risk factors is high) or other factors. We need to find out the real reason for this and to improve management of these cases. In the Johanson report,[17] patients with acute myocardial infarction (AMI) cases chose ambulance transport only when it was unavoidable. Even in the First-World setting of the USA, with all its resources, only half of patients with AMI were transported to hospital by ambulance.[18] International practice guidelines strongly recommend use of the EMRS by patients with symptoms suggesting cardiac disease, because recovery rates improve with rapid intervention, especially in the first hour after onset of symptoms.[5,18]

The extension of the service and the opening criteria for maternity cases (all classified as at least P-2 cases) is the main reason why more of these cases are being transported. On the other hand, despite the fact that MVAs represent only the 5.6% of our cases, their social impact and the number of lives lost make them a major problem now and for the future.

Not all MVA cases need a medical rescue service, but this is currently one of our indicators of utilisation of a rescue service and the differences between the regions, and therefore an item for review in the future. Our explanation for this is that in the Central and Southern region the EMRS has been used as a primary response, and not every case responded to necessarily equates to a rescue function performed. On the other hand, this difference was not correlated with availability of rescue vehicles.

Conclusion

Before 2003 the EMRS in North-West province was one of the most undeveloped in the country. Recent years have seen many transformations. The programme is now a vertical one, and the results have been achieved mainly by changes and standardisation in policies and structure, allocation of resources equally and in accordance with need, the establishment of a communication system, improved EMRS training and better management of vehicles.

An EMRS forms part of a system and should not be regarded as a stand-alone entity. A patient expects and deserves continuous treatment, and for this reason the principles of emergency medicine must be applied consistently from the time of injury or deterioration of the patient's condition to the most advanced intensive care unit. Many countries apply the proven concept of 'first aid with first witness' and training and teaching of emergency procedures to the population, and implement courses on these concepts in all health centres including hospitals.

Our next main goals will be improvement of EMRS staff qualifications, an increase in our fleet and relocation of ambulances in strategic places, and consolidation of adequate policies, all with the objective of ensuring that an efficient EMRS is accessible to the people who need it most.

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