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A generic performance framework for ambulance services: an Australian health services perspective.

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Dr Peter O'Meara

Associate Professor, School of Public Health, Charles Sturt University

Abstract

This review explores a selection of existing methods that measure ambulance service performance and identifies a performance framework that could be useful in a variety of contextual settings. It drew on a selection of well-known performance frameworks currently in use within emergency, health and ambulance systems. It is recommended that ambulance authorities adopt a health services performance framework in preference to the widely used emergency services framework with its heavy emphasis on time intervals such as response times. This suggested framework should be able to accommodate a wide range of validated clinical and non-clinical performance indicators that better reflect the position of ambulance services as part of the health system.

Introduction

Australian ambulance services, like those elsewhere, have been encouraged to develop performance measures that satisfy the need for improved accountability, and promote more effective and efficient operational management.¹⁻³ They are under pressure to develop performance management and improvement processes that satisfy the needs of consumers, funders and managers.⁴ Unfortunately, there are few validated indicators of effectiveness and quality in ambulance systems or emergency medical systems, and therefore few universally accepted methods of measurement.^{5,6} This situation exists despite the considerable effort that has been made to develop, collect and analyse performance indicators. Some of these are irrelevant to system design, quality or effectiveness, while others that might be useful may not have been readily measurable because these data were un-collectable or inaccurate due to the problems of data linkage between health institutions or non-compliance.^{7,8}

Service providers are being challenged to monitor and report on their clinical outcomes with evidence that prehospital care saves lives or at least provides valuable outcomes.^{6,9,10} Introduction of new clinical interventions before evidence of their effectiveness has been produced is increasingly being questioned. Efforts are being taken to ensure that harm from current interventions is measured and then minimized. However, it remains true that most of the published evidence related to ambulance systems is limited to survival from cardiac arrest and to a lesser extent the impact of the prehospital system on trauma patients.¹¹⁻¹³ Time intervals of one sort or another are widely used to report on the performance. Those out-of-hospital time intervals that have been validated incorporate activation time, call processing, allocation of resources, mobilisation, travel to the scene, time at scene, travel to hospital, and time spent at the hospital.^{5,14,15}

Consumers and funding agencies want to be able to assess performance against their expectations, policy goals and objectives.¹⁶ Ambulance managers, funders and regulators want a performance management system that assures availability, responsiveness, and quality patient care through the effective and efficient use of resources. Some years ago the Australian Convention of Ambulance Authorities established a working group to improve the standardisation of definitions and to develop a common set of core indicators to enable more meaningful comparative analysis of ambulance service performance to be undertaken.³ Areas of interest include those cases in which response times and at scene times may influence patient outcomes, and the effectiveness of the care given in marker conditions where prehospital care has been shown to make a difference. This strategy is consistent

with the approach being undertaken in the North American Emergency Medical Services Outcomes Project (EMSOP).^{15,17} Others have been critical of this “one size fits all” philosophy in its assumption that performance measures designed in developed western settings can be readily applied to developing countries with different needs and priorities.¹⁸

This paper sets out to explore existing and potential performance frameworks for Australian ambulance services. It draws on studies of ambulance outcomes evaluation^{3,7,16,17,19-22} and from the health services research literature.²³⁻²⁶ Of particular relevance was the proposed national performance framework developed by the Australian National Health Performance Committee,²⁷ which has utilised similar developmental work in the United Kingdom and Canada. Performance frameworks that are in place for ambulance services are described and discussed in relation to the future directions that may be taken in response to the need to report on performance. Work undertaken in the South Australian Ambulance Service provides a contemporary clinical perspective on ambulance service performance frameworks in contrast to the emergency service perspective that is common elsewhere.²⁸

To be useful and coherent an effective performance framework needs to capture the structural elements, service delivery processes, and outcomes of the service delivery system.⁷ Adoption of this approach to the measurement of performance in ambulance services would be consistent with a broader interest in measuring performance across the health system. Driving this are concerns about expenditure constraints, demands for the adoption of new technologies and rising consumer expectations.²⁷

Elements of Performance Reporting Systems

Performance measurement can be defined as the process of collecting and collating individual indicators. From a strictly economic perspective, there are two types of health service performance indicators: health resource indicators, such as those measuring labour force and expenditure; and health service use or utilization.²⁹ Healthcare professionals and researchers are likely to also consider other broad indicators such as effectiveness and equity of importance.^{23,26,30} The three main performance criteria of equity, efficiency and effectiveness are well accepted in the health services research literature.²⁴

Performance reporting systems need to be aligned with organizational strategic goals and focus on encouraging action by measuring the things that matter to consumers, service providers, health care organizations and funders. This realist philosophy asks the question in explanatory terms: what works for whom under what circumstances, and why?³¹ For example, in South Africa an attempt has been made to evaluate the operation of rural ambulance services in regard to staff motivation and the allocation of resources because these issues were perceived as problematic.³² Other important process factors worthy of measurement may include the expectations of stakeholders, such as: service availability; speed of response; competence and skills of staff; communication and teamwork with health and emergency services; and professional and ethical behaviour of staff.³³ In North America, the Emergency Medical Services Outcomes Project (EMSOP) is concentrating on the measurement of outcomes such as the alleviation of discomfort. This project is a five-year project with the purpose of developing a foundation and a framework for out-of-hospital outcomes research. Its aims are to develop a methodologically acceptable outcomes model for emergency medical services using the ‘Episode of Care Model’ and its sub-unit the ‘Out-of-Hospital Unit of Service Model’.^{15,17,20-22,34}

In Canada, the Ontario Prehospital Advanced Life Support (OPALS) team is evaluating the incremental benefit of rapid defibrillation and prehospital Advanced Cardiac Life Support measures for cardiac arrest survival and the benefit of Advanced Life Support for patients with traumatic injuries and other critically ill prehospital patients. This study offers valuable preliminary results and methodological information, including clearly defined definitions of key events and outcomes in the prehospital system.³⁵⁻³⁹

Whether looking at structure, process or outcome measures, ambulance services throughout the world make efforts to measure and improve their performance. Depending on their needs and technical capacity, they do this at the strategic, managerial and operational levels. As they position themselves strategically within the community, and in relation to the emergency management and health systems

the reporting of ambulance performance will become increasingly important as a means of providing meaningful data to guide decision makers in policy development and implementation.

Existing Ambulance Service Benchmarks

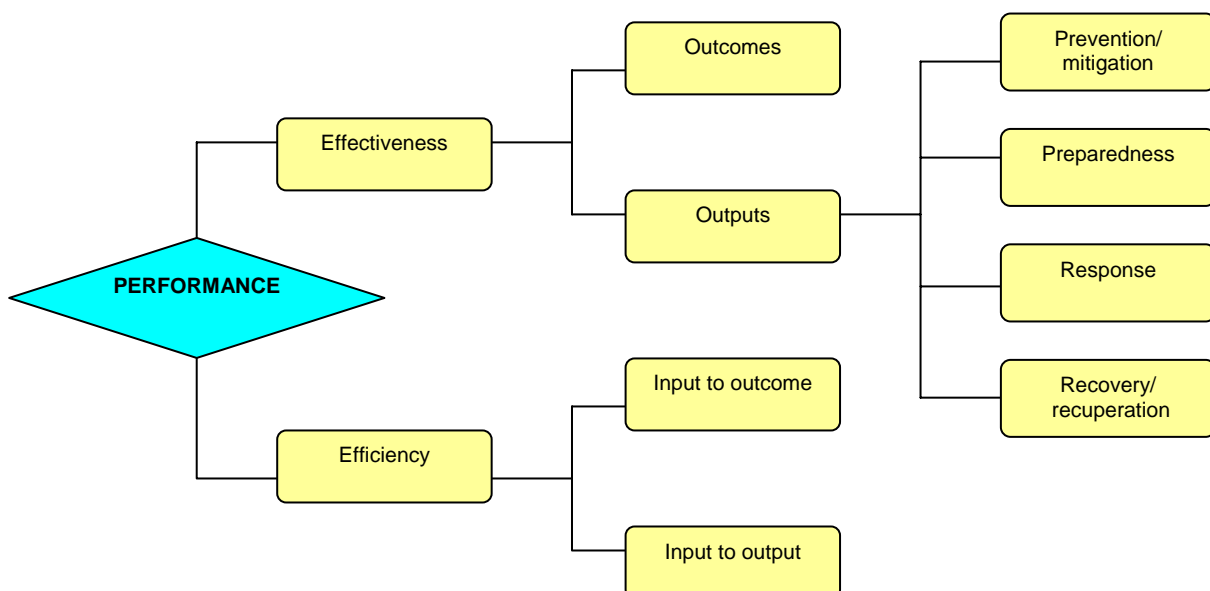
Review of the relevant ambulance, health and emergency services research literature resulted in the identification of existing Australian and international benchmarks for ambulance services. In Australia's two most populous States, Victoria and New South Wales, most of the publicly available information about ambulance service operations and management has come via Auditor General and parliamentary inquiry reports.

At a national level, the performance of state and territory ambulance services in Australia is reported through the processes of the Steering Committee for the Review of Commonwealth/State Service Provision. The framework that they use for the reporting of ambulance performance (Figure 1), reflects the grouping of ambulance with emergency services, to which the framework is conceptually linked.⁴⁰ Australian ambulance services have struggled to develop validated and comparable performance indicators within this frame of reference, particularly in regard to prevention/mitigation and recovery.

The Steering Committee uses eight performance indicators for Australian ambulance services:⁴⁰

- Survival rate from out-of-hospital cardiac arrest.
- Ambulance incidents responses and patients per 100,000 people.
- Proportion of emergency cases which receive a paramedic level of response.
- 50th percentile and 90th percentile response times.
- Level of patient satisfaction.
- Unit cost.
- Expenditure per urgent and non-urgent response.
- Expenditure per person.

Figure 1 Emergency Management Performance Framework⁴⁰



This Commonwealth Performance Framework makes the assumption that ambulance services are the health arm of the emergency services, rather than the emergency arm of the health system. A more appropriate approach may be to use a health services framework for ambulance service performance

indicators, using domains such as outcomes, access and equity, appropriateness, quality, and inputs per output unit as its performance criteria.⁴⁰ Outside the emergency services straight-jacket, researchers and ambulance services are exploring more appropriate performance indicators that better reflect the needs of the community, health service planners, and patients entering the health system through the prehospital system. For example, researchers have carried out studies of utilization characteristics,⁴¹⁻⁴³ time intervals,^{5,44,45} and outcomes.^{7,15,20-22,46,47}

An Australian Convention of Ambulance Authorities working group is emphasizing the development of indicators that will measure clinical performance in key clinical conditions where performance can be improved. In New South Wales, the ambulance service has established a Performance Information Unit to expand upon and improve the analysis and utility of its key performance indicators.³ The South Australia Ambulance Service has worked with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to develop a measurement system that defines the performance of the service and integrates measurement at an organisational level.²⁸ Other state authorities have instigated similar processes to improve data collection and the reporting of performance.

The most widely cited performance framework for ambulance services is the ORCON standards that the Organisational Research Consultancy developed in the United Kingdom. The original ORCON report was first issued in 1974 recommending measures and standards of service for emergency and urgent calls.⁴⁸ These original recommendations specified that:

- 95 per cent of activation times should lie within 3 minutes;
- in Metropolitan Services 50 per cent of calls should receive response times within 7 minutes and 95 percent within 14 minutes;
- in Non-Metropolitan Services 50 per cent of calls should receive response times within 8 minutes and 95 per cent within 20 minutes.

Since that time, these standards have been reviewed and revised taking into account changing expectations, technology, and the challenge of meeting metropolitan standards in rural and sparsely populated areas.⁴⁹ The shortcomings of relying exclusively on response times as a performance measure is well recognised in the United Kingdom with these performance targets now tiered and targeted toward ensuring the fastest response times for those patients with life-threatening conditions. According to a strategic review of ambulance services in the United Kingdom, the newer standards now reflect earlier calls for them to be more patient-focused and clinically meaningful.⁵⁰

Issues of Concern

Despite the recognized importance of effective evaluation processes that can assess and improve the quality of care, efforts to measure the performance of ambulance services have been adhoc. Efforts have often failed the test of being specific, measurable, action-orientated, relevant, and timely.^{16,51} There has been a concentration on easily collectable time intervals of dubious accuracy, while there is little accessible information on clinical matters aside from cardiac incidents.^{11,52-54}

Performance measures or benchmarks need to be reliable, cost effective to collect, and easily understood.²⁷ One of the failings of ambulance performance measurement systems throughout the world is that they generally draw upon a narrow band of performance indicators that are based on availability rather than any coherent framework. It is for example, unlikely that any single indicator such as the commonly used response times will adequately reflect the overall performance of an ambulance service. While response times and other time intervals are valuable in many ways, they fail to describe clinical processes or outcomes. There is also the risk that over reliance on response times as a performance indicator will distort management practices and the deployment of resources.^{55,56} A recent study of a United Kingdom ambulance service using a High Performance Ambulance Service (HPAS) system has reported that " ... the focus on improving response times has been to the detriment of other parts of the service particularly in the development of staff training programmes with potential consequences for the quality of clinical care".⁵⁷

Specific performance indicators and benchmarks need to be examined in the context of their economic, social and cultural environment. Understanding the reasons for variations is an important

part of the improvement process. "Used alone, indicators may be ambiguous, and hide important differentials within populations and population subgroups."²⁹ Another concern expressed is that, some prehospital interventions may be ineffective and in some cases harmful, while current performance indicators and associated research often provide little evidence either way.^{5,6,54,58-59}

At an operational level, the use of narrowly-based performance indicators will sometimes identify variations between individual ambulance stations that cannot be explained without access to a wider range of data and considerable analysis. These anomalies may include variations, in staffing levels, operational time intervals and utilization rates. Some of the variations may be related to the population-age profile of the communities, their size and the availability of resources.

Another factor influencing the validity of current performance indicators in Australia has been the regular banning of documentation as an industrial relations weapon.³ Two possible non-mutually exclusive explanations can be offered as reasons for this behavior. Firstly, paramedics may lack the appropriate education and training to appreciate the importance of these data. Secondly, the indicators may have been imposed without engagement with the 'grass roots' providers.⁷ An associated contributing factor to the poor quality and availability of data may be the lack of evaluation and research activities that regularly use this information.^{54,58,61} In short, there may be a lack of a research and evaluation culture within ambulance services.

Potential Performance Frameworks

In Australia, the most comprehensive work on performance frameworks is that of the National Health Performance Committee, which has developed a comprehensive four-part national performance framework that looks at: health outcomes; determinants of health; health system performance; and health system infrastructure and community capacity.²⁷ Its eight-point health system performance framework, summarized in Table 1, has been largely derived from the Canadian Health Indicators Framework and the work undertaken in the National Health Service in the United Kingdom where a three part strategy to improve performance has been put into place. As part of this process in the United Kingdom, performance targets have been set for ambulance services. This framework is similar to the Joint Commission on Accreditation of Healthcare Organisations (JCAHO) 'dimensions of performance' developed in the United States of America.⁵¹

Table 1 National Health Performance Committee Performance Framework²⁷

Dimensions	Description
<i>Effectiveness</i>	Care/service, intervention or action achieves desired results.
<i>Appropriateness</i>	Care/service provided is relevant to client/patient needs and based on established standards.
<i>Safety</i>	Potential risks of an intervention or the environment are avoided or minimized.
<i>Capability</i>	Individual/s knowledge/skills are appropriate to care/service provided.
<i>Continuity</i>	Ability to provide uninterrupted, coordinated care/service across programs, practitioners, organizations, and levels of care/service, over time.
<i>Accessibility & Equity</i>	Ability of clients/patients to obtain care/service at the right place and time, based on needs and is equitable.
<i>Acceptability</i>	Care/service provided meets expectations of client, community, providers and paying organizations.
<i>Efficiency</i>	Achieving desired results with most cost-effective use of resources.

While ambulance services are not responsible for the broader social and economic factors that impact on peoples' health and access to health services, they need to have performance indicators that fit into a wider performance framework. The community is interested in the extent to which ambulance services are:

- accessible, in the face of financial, geographic, organizational and cultural barriers;
- clinically effective;
- appropriate to need;
- timely;
- in line with agreed standards; and
- delivered by appropriately trained and educated staff.³³

As already indicated, the Emergency Medical Services Outcome Project (EMSOP) in the United States provides a useful framework the measurement of ambulance service performance.^{15,20-22,34} Table 2 provides a summary of the six EMSOP outcome categories.

Table 2 Definition of Outcome Categories from EMSOP¹⁵

Term	Definition
<i>Survival</i>	Mortality directly attributable to the condition.
<i>Impaired physiology</i>	Objectively measurable signs of altered physiology.
<i>Limit disability</i>	A change in the functional status of the patient in terms of ability to live independently and go about their daily lives at home, work, or recreation.
<i>Alleviate discomfort</i>	Uncomfortable symptoms such as pain, nausea, vertigo, or shortness of breath.
<i>Satisfaction</i>	Expectations of patients and families are met by service provided.
<i>Cost-effectiveness</i>	The financial consequences of health care to the patient and society.

The South Australian Ambulance Service has been perhaps the most innovative Australian ambulance service as far as the development of a performance framework is concerned. They commissioned the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Mathematical and Information Sciences section to develop an integrated measurement system that encompassed the need for measures and indicators at the operational, managerial and strategic levels. The study defined eight success measures and then linked them to ten key performance indicators to measure how the ambulance service is performing in these areas.²⁸ Table 3 summarises this framework. Because of this ambulance service's clinical focus, the study was able to capture the key aspects of performance with a small set of measurements drawn from processes linked to their organisational objectives.

When measuring performance, the establishment of the effectiveness of an intervention must be the most important step. There is little point in counting potential beneficiaries for an intervention that is of no benefit. Most challenging of all is the task of apportioning relative priority to different services and recipients. Clinicians must remember that evidence on effectiveness needs to be shared with managers and policy-makers who use these data to allocate resources, and assess and manage performance.⁶²

Table 3 SAAS Success Measurements and Key Performance Indicators

Success Measures	Key Performance Indicators
Patients ready for ongoing treatment	<ul style="list-style-type: none">▪ Patient condition on delivery▪ Accuracy of information to hospital
Timelines	<ul style="list-style-type: none">▪ Time from emergency call to arrival at hospital▪ Delay in meeting Ambulance Transport Services contracted commitments
Communication with patients	<ul style="list-style-type: none">▪ Communication with patients
Cost	<ul style="list-style-type: none">▪ Cost relative to best practice
Revenue	<ul style="list-style-type: none">▪ Revenue
Preparedness for disasters	<ul style="list-style-type: none">▪ Preparedness for disasters
Community awareness	<ul style="list-style-type: none">▪ Community confidence rating
Staff satisfaction	<ul style="list-style-type: none">▪ Employee satisfaction rating

Apart from the inherent characteristics of the out-of-hospital environment, a number of other epidemiological issues need to be considered when adopting a performance framework. Firstly, we need to recognise that the population's ability to benefit from health care equals the aggregate of individuals' ability to benefit. For most health problems this can be deduced more readily from epidemiological data than from individual clinical records. One characteristic of ambulance services' clinical review mechanisms has been their concentration on individual patient care. There has been limited use made of existing databases to establish overall trends in demand for specific clinical conditions or efficacy of particular interventions. Secondly, the ability to benefit does not mean that every outcome will be favourable, but rather that need implies potential benefit, which is on average effective. Thirdly, the benefit of pre-hospital interventions is not just a change in clinical status but can include reassurance, supportive care, and the relief of carers. The list of beneficiaries of care can extend beyond the patient to families and carers.⁶³ In the past ambulance services and state and territory health authorities may have ignored these more holistic performance criteria in favour of the more concrete outcomes such as response times and resuscitation successes.

Drawing from these various performance frameworks, Table 4 is presented here as the basis of a performance framework for ambulance services. It marries the structural dimensions of the National Health Performance Committee's performance framework with the requirement that any framework should be orientated toward the domains of structure, process and outcomes.¹⁶ This framework also incorporates broad outcome categories and the generic expectations of patients and carers, health professionals and service providers, and policy-makers. Performance thresholds can be set at a local level to reflect the different environmental, social and economic settings that ambulance services face. For example, small rural ambulance stations could be benchmarked against similar stations for comparative purposes. Its main strengths are that it is comparable across different ambulance systems and models, and it allows for linkages with other components of the health system.

Table 4 Potential Performance Framework for Ambulance Services

Dimensions	Structures	Processes	Outcomes
<i>Effectiveness</i>	Equipment Staff skills	Response times Resuscitations Interventions	Mortality Survival
<i>Appropriateness</i>	Staff configuration Staff level Evidence base	Research activities Time at scene	New knowledge Adverse events
<i>Safety</i>	Monitoring system	Safety procedures Quality of care	Accreditation Complications
<i>Capability</i>	Appropriate staff Equipment	Clinical practice guidelines and standards Preparedness for disaster	Impaired physiology Alleviation of discomfort
<i>Continuity</i>	Sustainability Teamwork	Coordination Collaboration	Limitation of disability Accurate information
<i>Accessibility & Equity</i>	Time to cases Distance to cases	Resource allocation processes	Utilization rates Availability Demand for services
<i>Acceptability</i>	Public participation Ethical standards	Respect for patient autonomy Accountability	Satisfaction Complaints
<i>Efficiency</i>	Staff to case ratios	Rostering systems	Affordability Cost-effectiveness

Like any other performance framework there remains the challenge of determining appropriate means of measuring these dimensions in the pre-hospital context. However, these challenges are no greater than those faced in other health services and the traditional emergency services that rely on indicators such as clinical standards and disaster preparedness. The major weaknesses of this or any other performance framework remains the poor quality of the available data and the dearth of personnel who have the skills to analyse and act on the information collected.^{7,58} While most Australian ambulance services are implementing technological and educational strategies to overcome these shortcomings, solutions are likely to take some time.

Conclusion

Ambulance services, researchers and many paramedics share the view that the traditional performance indicators used to measure and monitor the operation of ambulance systems could and should be improved. They understand the importance of ambulance providers and paramedics being accountable for their activities.

The adoption of a health services performance framework as the platform for a set of key performance indicators that are specific, measurable and action-orientated would be a positive step.

Drawing away from a now inappropriate emergency services model would broaden the range of performance measures that are available to ambulance system planners and managers. These could include the easily quantified structural factors such as staff numbers and skill sets, process factors that measure what is done and how, and the crucial outcomes measures related to clinical care,

stakeholder satisfaction and financial accountability. Response times would no longer be seen as a sole measure of effective ambulance service performance. Ambulance authorities and researchers are addressing this challenge in Australia and elsewhere through the development of performance indicators and outcome measures.

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