

Secondary ambulance triage service models and outcomes

A review of the evidence

2012

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Suggested citation

Vecellio E, Raban MZ, Westbrook JI. Secondary ambulance triage service models and outcomes: A review of the evidence. Australian Institute of Health Innovation, University of New South Wales. Sydney, November 2012.

This report was commissioned by the National Health Call Centre Network.



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Abstract

Secondary ambulance triage is designed to reduce inefficient use of ambulance and emergency services when another health care response is more appropriate. This review provides an overview of existing secondary ambulance triage service models, their characteristics, key service elements related to performance and evidence of service utilisation and outcomes. A summary of recommendations developed from previous evaluations as well as enquiries conducted when serious incidents have occurred in telephone triage, is provided as a basis to inform the development of 'best practice' models in secondary ambulance triage.

There was limited literature describing secondary ambulance triage practices. This is a likely reflection of its relatively limited application to date. Available evidence suggests secondary ambulance triage is in operation in only a limited number of jurisdictions internationally.

Data derived primarily from the UK and Australia show that secondary ambulance triage services are referred only a small proportion (6-9%) of all emergency ambulance calls. Of these calls, between 17 and 67% are passed back to the ambulance service for ambulance dispatch. However, utilisation of secondary ambulance triage services appears to translate into substantial cost savings to ambulance and emergency services.

Few serious adverse events have been reported as arising from secondary ambulance triage. However, a number of preventable patient deaths have been attributed to failings in telephone triage systems in general and the lessons learnt are also relevant to secondary ambulance triage.

Introduction

Ambulance services around the world are facing increasing demand for their services coupled with funding constraints. It has been estimated that unnecessary emergency ambulance dispatch occurs in 11% to 52% of all emergency calls.¹⁻¹³ This utilisation of emergency medical resources is inefficient and may delay the provision of emergency medical care in cases where it is necessary.¹⁴ Various strategies have been implemented in order to reduce this burden on emergency services and provide patients with the most appropriate care. One such strategy has been secondary ambulance triage.

Ambulance services implement secondary ambulance triage in order to reduce pressure on ambulance and other emergency services by offering alternative health care options to low acuity callers. Low acuity callers to emergency medical hotlines are identified with the aid of call-prioritisation software, and then transferred for secondary ambulance triage conducted by a trained health professional, such as a nurse. Secondary ambulance triage involves a clinical assessment of the reason for the call, usually with the use of decision support software. Recommendations made may include self-care, referral to primary health services such as a general practitioner (GP), emergency department (ED) attendance via own transport, or an ambulance dispatch.¹⁵ Secondary ambulance triage has potential positive impacts for ambulance services and callers. The pressure on ambulance services may be reduced as low acuity callers are referred onto more appropriate and less urgent care. From a caller's perspective, the clinical assessment provided by secondary ambulance triage for low acuity calls may result in detection of a 'high acuity' symptom that would otherwise have remained hidden, and consequently a more timely ambulance attendance and treatment is possible. However, the utilisation of secondary ambulance triage, as an alternative to ambulance dispatch, also has potential limitations. For example, the call-taker does not have the use of visual and non-verbal cues when making a triage decision, cues which would be available to an ambulance paramedic in a face-to-face encounter.^{16, 17}

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“...unnecessary
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Review purpose

The aim of this report is to provide an overview of secondary ambulance triage services which have been adopted in different jurisdictions around the world, and the operating characteristics of these services. These accounts are reviewed in terms of the extent to which secondary ambulance triage services have been successful in their goal of reducing unnecessary utilisation of ambulance and other medical resources without having compromised patient safety. This report also describes serious adverse incidents and errors that have been recorded by secondary ambulance triage services. Lastly, this report synthesises recommendations abstracted from analyses of adverse patient incidents, and

summarises additional relevant recommendations from the telephone triage literature. These recommendations provide a basis to inform the development of 'best practice' models for secondary ambulance triage.

Methods

Definitions

The relationships presented in Figure 1 reflect the definitions used in this report. Telephone triage is an umbrella term which includes all telephone services which provide health advice to callers. This category is further divided into two categories depending on whether the caller has self-assessed the situation as requiring an urgent response and telephoned an emergency medical hotline (emergency telephone triage) or they feel that an emergency response is unnecessary and they have telephoned a health advice service to receive treatment and referral advice (non-emergency telephone triage). Within the emergency telephone triage category, this report distinguishes between primary and secondary ambulance triage. Primary ambulance triage refers to the initial prioritisation of calls received by the emergency hotline. Secondary ambulance triage refers to the transfer of low acuity calls from the emergency hotline for further clinical assessment and treatment referral.

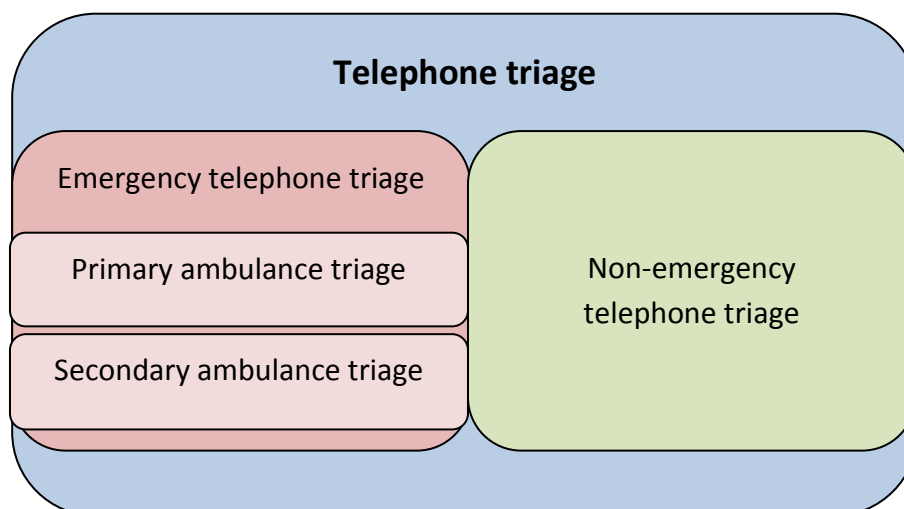


Figure 1. Graphical representation of the relationships between the variants of telephone triage that are considered in this report.

Literature searches

Two researchers (EV and MZR) independently searched the academic and grey literature using PubMed, Medline, Google Scholar, and the Google search engine. The aim was to identify available literature on ambulance services using secondary ambulance triage, as well as to identify specific incidents resulting in patient harm related to secondary ambulance triage. Search terms are shown in Table 1. Websites of ambulance services and

government departments of health were also searched for relevant publications. References in identified papers and reports were hand searched to find articles and reports not revealed by database searches.

Table 1. Keywords used for database and grey literature searches

<ul style="list-style-type: none"> • ambulance triage • ambulance dispatch • triage dispatch • triage incident 	<ul style="list-style-type: none"> • secondary telephone triage • ambulance secondary triage • emergency medical services • telephone triage incident • telephone triage error • telephone triage risk 	<ul style="list-style-type: none"> • telephone triage risk emergency • telephone triage error inquest • telephone triage incident inquest • health advisor telephone ambulance • telephone triage patient safety • telephone triage incident coroner inquest
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Secondary ambulance triage is a sub-category of the umbrella category of telephone triage. A sizeable proportion of recent telephone triage research has focussed on non-emergency telephone triage (i.e. telephone health advice services), that are also a sub-category of telephone triage (see Figure 1). Additionally, secondary ambulance triage and non-emergency telephone triage have common characteristics including that they are generally performed by a call-taker with a clinical background. Therefore, for completeness, the literature search presented here did not automatically exclude studies of, and recommendations made for, telephone triage, primary ambulance triage, or non-emergency telephone triage. Such articles were included in this report when relevance to secondary ambulance triage was demonstrated. Similarly, some recommendations presented in the ‘best practice’ secondary ambulance triage model were originally made with reference to telephone triage in general, or one of its sub-categories, but are equally relevant to the secondary ambulance triage context.

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Approximately 6-9% of all emergency calls qualify for secondary ambulance triage.

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Results

The search of the literature revealed that secondary ambulance triage is used by National Health Service (NHS) ambulance services in England and Wales in the United Kingdom (UK), and metropolitan Victoria (VIC), Western Australia (WA), Queensland (QLD) and New South Wales (NSW) in Australia.¹⁸⁻²³ Secondary ambulance triage is also being piloted in

Wellington, New Zealand, by the Wellington Free Ambulance Service and by some ambulance services in the USA.^{24, 25}

Effectiveness of secondary ambulance triage

Table 2 summarises the available ambulance service and study data on emergency calls transferred to secondary ambulance triage and their outcomes. Only a small proportion (6-9%) of telephone calls received by emergency medical hotlines were categorised as low acuity and referred to secondary ambulance triage. The proportion of these calls that are eventually assigned a non-ambulance response is between 32% and 83% (approximately 3-6% of all emergency calls).

There is wide variation in the proportion of calls returned to the ambulance service following secondary ambulance triage. This proportion was estimated at less than 10% for English ambulance services using NHS Direct for secondary ambulance triage,²⁶ and ranged from 25% to 54% for the Welsh Ambulance Services and Ambulance Victoria, respectively (Table 2). Table 2 also shows that study data confirm the wide variation in the proportion of calls where the outcome of secondary ambulance triage was ambulance dispatch, ranging between 17% and 67%. A study of NHS Direct nurses conducting simulated secondary ambulance triage found that between one-fifth and one-third of cases were eventually triaged back to the ambulance service for ambulance dispatch.²⁷ The calls returned to the ambulance service following secondary ambulance triage are returned for a variety of reasons and not necessarily for an emergency ambulance response. A randomised controlled trial in the UK showed that of the secondary ambulance triage calls transferred back for an ambulance response, 44% were for an emergency ambulance response, while the remainder were for ambulance dispatch for other reasons (e.g. urgent transport, falls).²⁸ But for those calls that do eventually receive an emergency ambulance dispatch, it is valuable to assess just how much delay is introduced by the secondary ambulance triage process. A trial in the USA of secondary ambulance triage estimated that, for calls referred to a secondary ambulance triage service that were eventually passed back for ambulance dispatch, the average time between the initial call and the call being passed back for ambulance dispatch was approximately 12 minutes.²⁹

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Secondary ambulance triage in England saved the National Health Service approximately £40-80 million annually.

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Though the volume of calls that result in a non-ambulance response due to secondary ambulance triage is small, this has been estimated as translating to substantial savings to ambulance services. An assessment of England's ambulance services estimated secondary ambulance triage saved the NHS £40-80 million annually.²⁶ The Queensland Ambulance Service, which received 828,406 calls in 2011-12, has estimated that if 49,500 calls (6%)

annually were assigned a non-ambulance response through secondary ambulance triage, savings could amount up to AU\$21million.³⁰ Ambulance Victoria has estimated that its secondary ambulance triage service resulted in a 9% decrease in demand for emergency ambulances in the metropolitan region.²⁰ A randomised controlled trial in the UK found that costs of running a nurse-led secondary ambulance triage service were outweighed by the savings to ambulance and emergency services in general through shorter job cycle times and fewer ED visits.²⁸

Table 2. Emergency calls referred for secondary ambulance triage and triage outcome from ambulance service and study data

Ambulance service / Year(s)	Total no. emergency calls	No. calls referred for secondary triage (% of all emergency calls)	No. secondary triage calls referred back for ambulance response (% of secondary triage calls)	No. secondary triage calls assigned a non-ambulance response (% of secondary triage calls)
Ambulance service data				
<i>Welsh Ambulance Service</i> ¹⁸				
2010-11	435,806	39,382 (9%)	21,266 (54%)	18,116 (46%)
<i>English Ambulance Services</i> ²⁶				
2009-10	7,848,000	-	-	230,500
<i>Ambulance Victoria (metropolitan region)</i> ²⁰				
2011-12	601,306	48,090 (8%)	11,820 (25%)	36,270 (75%)
2007-08	525,977	30,249 (6%)	9,441 (31%)	20,808 (69%)
<i>Queensland Ambulance Service (Brisbane & South East region)</i> ²²				
2011-12	-	-	-	2,652*
Study data				
<i>Carmarthen command-and-control centre, Wales, UK</i> ³¹				
2007-08	-	3,041	1,642 (54%)	1,399 (46%)
<i>Greater Manchester, Two Shires & Welsh Ambulance Services, UK</i> ²⁸				
2003-04	-	1,766	1,182 (67%)	568 (32%)†
<i>London & West Midlands Ambulance Services, UK</i> ¹⁵				
1998-1999	-	635	305 (48%)	330 (52%)‡
<i>King County, Washington, USA</i> ²⁹				
Prior to 2000	-	133	22 (17%)	111 (83%)

*Reported as 51 calls per week in 2011-12.

†There were 14 calls (1% of calls referred for secondary ambulance triage) where the ambulance arrived during the secondary ambulance triage process.

‡330 calls were triaged to a non-ambulance response; however the alternative care option was accepted in only 62 of these cases.

Secondary ambulance triage system features and issues

Methods of assessing caller suitability for secondary ambulance triage

Low acuity cases, as identified by a call prioritisation system, are referred for secondary ambulance triage. The most commonly used call prioritisation systems in the ambulance services with secondary ambulance triage identified in this review are the Medical Priority Dispatch System and Advanced Medical Priority Dispatch System. Newer versions of these systems include an additional lower-level categorisation for the least severe low acuity cases, which identifies callers who are suitable for an alternative non-ambulance response.^{28, 32} This categorisation has been tested as safe for this purpose, with over 15 years of implementation experience in overseas jurisdictions.^{28, 32} In England and Wales, additional low acuity codes are also used to identify callers suitable for secondary ambulance triage.³² The important difference is that these additional codes require further clinical assessment through secondary ambulance triage before referral onto alternative care.³²

Clearly, the process for the initial primary triage assessment of ambulance calls will impact the volume of callers eligible for secondary ambulance triage. In the UK, ambulance services are now switching to a new locally developed call prioritisation system, called NHS Pathways.^{26, 33} NHS Pathways has narrowed the threshold for immediate ambulance dispatch resulting in a smaller percentage of calls receiving the most urgent response. At the North East Ambulance Service, NHS Pathways classified 24.6% of all calls as requiring an urgent ambulance response, as compared with 28.8% of ambulance calls to services where the NHS Pathways system was not used.²⁶ The exact impact on the number of calls referred for secondary ambulance triage, however, is unclear. No data regarding whether this change has resulted in a greater proportion of secondary triage calls being referred back to the ambulance service were available.

In-house vs. external provider of secondary ambulance triage service

Secondary ambulance triage services can be run by the ambulance service itself or by an external provider. Examples of both systems exist, however there is little research into the benefits and limitations of either approach. External providers of secondary ambulance triage are usually already existing telephone triage health advice services, which mainly take calls directly from the public. One such telephone triage health advice service in the UK, NHS Direct, provides secondary ambulance triage to some ambulance services in England and Wales.^{19, 26} In Australia, *healthdirect Australia* is the telephone triage service which provides secondary ambulance triage in WA, and NSW after hours.^{21, 34} Ambulance Victoria run their own secondary ambulance triage, as do Ambulance NSW during normal working hours.^{20, 23}

Prioritisation of secondary ambulance triage calls

It is important that calls transferred for secondary ambulance triage are answered in a timely manner. This means that if secondary ambulance triage is managed by a telephone triage health advice service that also accepts direct calls from the public, the calls transferred from the ambulance service should be given priority over incoming calls direct from the public. In Ambulance Victoria's metropolitan jurisdiction, which has an internally run secondary ambulance triage service, calls that cannot be connected to the service within a short period of time have an ambulance dispatch organised.³⁰

Additionally, protocols should be in place to deal with calls initially made by the public to non-emergency telephone triage health advice services that are subsequently transferred to the ambulance service. Ambulance Victoria, for example, has a policy that calls transferred to them from a telephone triage health advice service are assigned an ambulance response and do not qualify for secondary ambulance triage.³⁰

Health professionals conducting secondary ambulance triage

Secondary ambulance triage services are most commonly staffed by nurses and paramedics. Ambulance Victoria's and Ambulance NSW's internally run secondary ambulance triage services employ both nurses and paramedics.^{23, 30, 35} NHS Direct, the telephone triage health advice service which also provides secondary ambulance triage to ambulance services in England and Wales, employs nurse call-takers.^{19, 27} There is little literature comparing the performance of nurses and paramedics undertaking secondary ambulance triage. One study in the UK found that nurses were approximately 28% more likely than paramedics to recommend a non-ambulance response at the conclusion of secondary ambulance triage.¹⁵ However, it was suggested that this could be due to the more extensive experience the nurses had in telephone triage prior to the study. The same study, upon analysing secondary ambulance triage safety, found no difference in the safety performance between the two health professionals.¹⁵

Selection of computer systems to support secondary ambulance triage

Compatibility between call prioritisation systems and the decision support software used for secondary ambulance triage is critical for smoothly operating services. A 2007 review of ambulance services identified this as an issue at Ambulance Victoria, where the call prioritisation system was not compatible with the McKesson software used for secondary ambulance triage.³⁰ As a result, the data collected by the call prioritisation software was not able to be automatically transferred to the software used by secondary ambulance triage, necessitating that the call-taker take the patient history again.³⁰ However, some experts have suggested that triaging decisions may in fact be improved when the secondary ambulance triage call-taker takes a thorough history from the caller and is not influenced by call-notes written by the previous call-taker.³⁶

The decision support software used at secondary ambulance triage is also likely to influence the recommendations made for patient treatment. One study looked at the effect of software on care recommendations made by NHS Direct nurses for simulated secondary ambulance triage calls. That study concluded there was little consistency in recommendations made by four nurses presented with the same standardised scenario when each nurse used different decision support software.²⁷ However, the study authors concluded that it is difficult to determine whether this variation is primarily due to the software or to the nurses' clinical judgements. If it is the latter, there are implications for the level of experience and training of nurses assessing these calls.

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“...there was often little agreement between the triaging decisions of different nurses diagnosing patients with the same symptoms.”
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Referral of callers to other health services

Ideally, during secondary ambulance triage, if the caller is assessed as not requiring an ambulance and is deemed suitable for alternative care options, the call-taker should be able to refer the caller to a specific service offered by a specific health care provider. Ambulance Victoria has agreements with health providers that specify minimum response times for referred calls.³⁰ In fact, the Nurse-on-Call non-emergency telephone triage line in Victoria, Australia, is not used for secondary ambulance triage precisely because it is not able to provide formal referrals or appointments for health services.³⁰ In England and Wales, NHS Direct, which provides secondary ambulance triage to some ambulance services, has a linked directory of local health services so that a caller can be referred to a specific provider.¹⁹

Incidents and errors associated with telephone triage

This literature review identified three studies that reported the rates of adverse incidents in telephone triage. One four-month trial in Washington state in the USA, using an experienced nurse who was also trained in telephone triage protocols in a secondary ambulance triage capacity, assessed the quality of service provided in 133 low acuity calls transferred from the 911 emergency medical hotline. Although 22 callers (17%) were transferred back to 911 for ambulance dispatch, there were no calls received during the trial period for which an adverse event was recorded and self-reported caller satisfaction was very high.²⁹ A trial using three NHS Direct sites in a secondary ambulance triage capacity in the UK, for a 6-month period between October 2002 and April 2003 found that, although almost half the calls serviced by secondary ambulance triage were eventually scheduled for an ambulance dispatch, no serious adverse events were reported.²⁸ In one of these UK sites, out of 3,975 calls received, two adverse patient outcomes were recorded, a rate of 0.05% (no adverse patient outcomes were recorded in the other two sites).²⁸ A follow-up

questionnaire study found that, out of 340 returned questionnaires, there were 14 cases (4.11%) where secondary ambulance triage was clearly of no clinical benefit and it resulted in longer-than-necessary patient suffering.²⁸ A study of the rates of incident reports at six Swedish Health Care Direct sites, acting in a non-emergency triage capacity in 2007, found the average incident report rate to be 1 in each 792 received telephone calls (0.13%).³⁷

The most serious adverse events occur extremely infrequently and, while they are very informative, brief trials such as those reported above, do not necessarily capture such rare events. Therefore, this report also searched the grey literature in order to identify and report on some of the most severe adverse patient outcomes (often patient death) that have been reported and some contextual information surrounding these serious adverse events. Table 3 contains summary descriptions of the serious adverse events in telephone triage. The majority of these serious adverse events were registered for non-emergency telephone triage telephone calls – where a call was made directly to a telephone health advice service (e.g. NHS Direct or *healthdirect Australia*) – and primary ambulance triage calls. Thus far, very few serious adverse events have been registered for calls taken by secondary ambulance triage services. An analysis of the primary ambulance triage and non-emergency telephone triage incidents revealed, however, that many of the errors made – most often failure to recognise serious patient symptoms – were also relevant in the secondary ambulance triage context.

Table 3. Telephone triage incidents that have significantly impacted on patient safety.

Year	Incident Location	Patient			Summary/Outcome/Recommendations/Comments
		Name	Sex	Age	
Primary ambulance triage incidents					
2011	Warrnambool, VIC, Australia	Walter Martelloni	M	79	Patient initially had symptoms of illness. But then symptoms faded. Patient's wife called on behalf of patient. Patient did not want an ambulance, patient's wife did. Call-taker decided that patient did not have symptoms of heart attack, so an ambulance was not dispatched. They decided to attend hospital the next morning, but patient died during the night. ³⁸
2011	Warrnambool, VIC, Australia	Ron Ziegeler	M	80	Palliative care and cardiac patient. Three frantic phone calls from wife. 143 minute delay in ambulance attendance. Patient had been incorrectly classified as low urgency. Died in hospital two days after the delayed ambulance attendance. ³⁹
2009	Parmelia, WA, Australia	Robert Hart	M	48	Patient was vomiting blood, his wife called 000 for an ambulance but none came. She called 000 again and was told all the ambulances were busy. The call had been classified as priority 4 – non-urgent and a patient transport vehicle was dispatched and arrived 40 minutes later (and even then was not properly equipped for such a health issue). Call-taker had not asked appropriate questions to designate priority correctly. The patient transport personnel called for another ambulance but it only came as priority 2 and arrived 30 minutes later. In the meantime, the patient had died. ^{40, 41}
2007	WA, Australia	Dwayn Arnold	M	27	Patient's friend (not physically with patient) called 000 for an ambulance because patient had shortness of breath and other symptoms, but the call-taker categorised the call as non-urgent and the ambulance took 1-hour to arrive and were not able to enter building (despite being given specific instructions for how to do so) so they left without seeing patient. Another friend went to the house and found the patient white and cold, he called 000 again and another ambulance was sent (which arrived almost 2 ½ hours after the first call), but it was too late. The patient had died from complications from an infection. ⁴⁰

Year	Incident Location	Patient			Summary/Outcome/Recommendations/Comments
		Name	Sex	Age	
2007	WA, Australia	Tina Oddo	F	n/a (adult)	The patient, a previous stroke survivor, was disorientated and unresponsive. The patient's granddaughter called 000 for an ambulance. Twenty minutes passed and the ambulance had not arrived. The patient's granddaughter called 000 again to discover that first ambulance request was 'lost' in the system (had been inadvertently deleted). Another ambulance was dispatched but only with priority 4 (non-urgent). Only at the third 000 call did the call-taker prioritise the ambulance request as priority 1; 90 minutes after the first call. The patient died. This and other incidents resulted in a large 12-week inquiry into St John's Ambulance Service in WA which found "major inadequacies" in the service. ^{40, 42}
2010	London, UK	David Fisher	M	76	Patient's partner called 999 and described both struggling to breathe and history of heart problems; but the call-taker marked the "struggling to breathe" option in the protocol, which had recently been downgraded so an ambulance would not be sent (call-taker was unaware of this change). An ambulance would have been sent, however, had the call-taker marked "history of heart problems" in the system. The call was diverted to secondary ambulance triage and the delay in dispatching paramedics contributed to patient death. ⁴³
2009	Suffolk, UK	Bonnie Mason	F	58	Patient fell down a long set of stairs, but because it was a "long" fall, she was categorised as lower urgency. The ambulance allocated to her was diverted to a different incident before eventually attending to her 38 minutes later. Patient died from catastrophic skull fractures. East Anglian ambulance chiefs changed the way incidents are categorised. Now the most important issue in urgency decisions is whether the patient is conscious and breathing normally after the incident. ⁴⁴⁻⁴⁷

Year	Incident Location	Patient			Summary/Outcome/Recommendations/Comments
		Name	Sex	Age	
Secondary ambulance triage incidents					
2009	Manchester, UK	Louis Austin	M	8	Patient's parent's original call to 999 incorrectly categorised as low-priority. Secondary ambulance triage failed to upgrade it to urgent. Missed diagnosis of diabetes, incorrectly thought to be swine flu, and ambulance was refused. Patient died from untreated diabetes. North West Ambulance Service changed its policies: children under 16 not triaged over phone (high risk group); improvements to hand-over system to GPs. Paramedic at secondary ambulance triage received a 3 year caution for failing to upgrade the call to urgent. ⁴⁸⁻⁵⁰
2008	Wolverhampton, West Midlands, UK	Wellesley Lewis	M	76	Patient's wife twice called 999 for an ambulance. First call received advice only; second call was forwarded to NHS Direct for secondary ambulance triage. Call-taker over-rode the protocol algorithm downgrading the call from "urgent GP" to "routine GP". Patient saw the GP, who referred him to a local ED. Soon after arrival to the ED, the patient died. Ruptured abdominal aortic aneurysm mistaken for disc prolapse in lower back. ⁵¹
Non-emergency triage incidents					
2007	Port Fairy, VIC, Australia	Janice Sharp	F	60	Patient and husband both called local hospital. Patient failed to indicate sufficient urgency, was told to attend Port Fairy Medical Clinic later in the morning. She attended the clinic, was very ill and died. Small bowel obstruction was missed. No evidence of system failure, patient and her husband were not assertive enough. ⁵²
2006	QLD, Australia	Alexander Coggins	M	1	Patient's mother called 13HEALTH (telephone health advice service), she was told to bring child to GP the next day, but the child was dead within 5-hours. Streptococcus pneumoniae was missed. ^{17, 53, 54}
2006	Keilor, VIC, Australia	Annie van Prooyen	F	n/a (adult)	Patient made two calls to the Nurse-on-Call help line. First she was told to take Panadol and sleep, and then she was told to take a bath with bicarbonate soda. Patient was incorrectly diagnosed with the flu, when in fact she had Meningococcal. Patient had a five day stay in infectious disease ward, then discharged to home. ⁵⁵

Year	Incident Location	Patient			Summary/Outcome/Recommendations/Comments
		Name	Sex	Age	
2012	Dundee, Scotland, UK	Craig Davidson	M	20	Patient sent home after a hospital visit where he was diagnosed with muscle injuries and put on pain killers. Patient's mother called NHS24 service, two doctors arrived 3 hours later because call had been given a low urgency rating. Doctors thought patient had anxiety and gave him tranquiliser injection. Within hours the patient died from ruptured spleen. ⁵⁶⁻⁵⁸
2010	Cornwall, UK	Ethan Kerrigan	M	6	Patient's father initially took patient to out-of-hours clinic at hospital but no doctors on duty, so the father was told to call out-of-hours medical service. He called them from the hospital car park. He was told over the phone to examine his child's abdomen. Eventually, the child was prescribed Ibuprofen, a hot water bottle, and told to make an appointment to see a GP the next day. Patient died from missed diagnosis of appendicitis. In the wake of this death, Serco (the company running the out-of-hours telephone medical service) worked with the local NHS to develop enhanced protocols for handling illness in young children. ^{58, 59}
2010	Lincolnshire, UK	Dean Beresford	M	44	Patient called NHS Direct and told call-taker he was suffering chest pains, but the call-taker entered 'no' to the chest-pain item on the computer. Call was passed to a nurse call-taker who asked a series of questions but then over-rode the urgent flag generated by the computer. A GP telephoned the patient, but failed to call an ambulance and referred him to an out-of-hours service at a hospital. Patient drove himself to hospital but was misdiagnosed with productive cough, prescribed antibiotics and sent home. Patient eventually died from ruptured heart as a result of heart attack. ^{58, 60}
2010	Southampton, UK	Gary Lovett	M	20	Patient suffering from vomiting, fever, and chest pain. Patient's parents called NHS Direct and out-of-hours GP multiple times and were told to take over-the-counter medication. Patient died from bronchopneumonia. ⁵⁸
2006	Romford, UK	Jeffery Wingrove	M	48	Call made to out-of-hours GP service (Primecare), which refused a home visit because patient was not elderly. Paramedics eventually called but they misdiagnosed patient with severe vertigo and prescribed paracetamol. Died from missed diagnosis of stroke. General Medical Council inquiry concluded that doctor failed to take adequate history, to consider all symptoms and other reported information, and refused to organise home visit even when warranted. Six-figure (£) out-of-court settlement with family. ^{58, 61-64}

Recommendations to inform 'best practice' models for secondary ambulance triage

Recommendations derived from past incidents and errors

The following recommendations for the implementation of telephone triage have been abstracted from investigations of the telephone triage incidents described in Table 3. These recommendations were also frequently corroborated by recommendations found in the telephone triage literature.

- Telephone triage computer systems should allow for multiple symptom codes (and other information codes, e.g. patient demographics, and history of prior illness), and the triage decision (i.e. whether to send an ambulance) should be based on either the most serious of those codes, or some computed sum of codes.^{39, 43, 58, 61-65}
- Triage computer systems should include an over-ride function so that call-takers can exercise their own clinical judgement. Call-takers should be trained and encouraged to over-ride automated triage decision if their clinical judgement suggests that it is appropriate to do so.^{39, 44-47, 65}
- While call-takers should be able to easily use the over-ride to increase the urgency category of a call, it should not be possible, or only possible with stringent checking procedures and/or consultation with a supervisor, for them to use the over-ride to decrease the urgency category of a call.^{51, 58, 60, 65}
- Callers from high-risk demographics (e.g. children and elderly) should not be triaged over the phone; automatic face-to-face consultation and/or ambulance attendance should be provided.^{17, 39, 48-50, 53, 54, 58, 59, 66}
- Call-takers should take a complete medical history and follow the entire protocol in-use in their centre. All criteria for urgency need to be eliminated before a patient can be categorised as non-urgent.^{39, 40, 48-50, 55, 58, 61-65, 67, 68}

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Call-takers should be encouraged to use their clinical judgement to upgrade automated triage decisions.
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Recommendations derived from literature

The additional following recommendations have been made by developers, managers, researchers, and reviewers of telephone triage systems:

- Triage protocols should be used to prompt nursing staff to ask appropriate questions⁶⁹ and identify accurately patients at highest medical risk.^{70, 71} Written protocols should outline the questions to ask the caller, the recommended responses for minor problems, and which calls should be referred immediately to a doctor or scheduled for an office appointment.⁷² If possible, triage protocols should be nationally recognised and written and reviewed by physicians.⁶⁵
- Call-takers should quickly recognise top priority calls and transfer the call to, or instruct the patient to call, the emergency medical hotline. These top priority calls include emergency situations that involve, but are not limited to high-risk symptoms such as allergic reactions, chest pain, eye injuries, burns, or shortness of breath/wheezing⁷¹⁻⁷³ or if the caller indicates comorbidities such as diabetes, recent surgery, or immunosuppression,⁶⁶ or if symptoms include those most frequently implicated in malpractice claims: abdominal pain or chest pain.^{36, 65} If the patient is unable to call the emergency medical hotline, the patient should be kept on the line while another staff member calls the emergency medical hotline on another line.⁷⁴
- Training programs for telephone triage should focus on optimising telephone communication, including recognising and compensating for the inherent limitations of remote triage with limited visual cues. A Swedish study covering the period between 2003 and 2010, concluded that the most common reasons for telephone triage malpractice claims, were failure to listen to the caller, communication failure, and the call-taker asking too few questions regarding patient symptoms. All these issues are forms of communication failure.³⁶
- Only physicians or qualified staff such as Registered Nurses (RN), Nurse Practitioners (NP), and Physician Assistants (PA) should provide telephone triage.⁷² RNs can also complement Emergency Operators (EO) in emergency medical hotline centres; RNs and EOs have skillsets that complement one another. RNs deal best with more complicated somewhat diffuse cases (which are more difficult for EOs) and EOs deal well with more urgent acute calls (which are more difficult for RNs).¹⁶

- Call-takers should be aware of markers for high-risk calls. For example, male callers are usually considered “reluctant callers”, nurses should keep this in mind when speaking to them as males may misrepresent the severity or duration of their symptoms³⁶; and repeat calls for the same problems may indicate that the caller is not understanding instructions that they are being given or that the patient's symptoms are worsening, and the caller does not understand how to communicate this.^{36, 65, 66}
- Call-takers should evaluate patient needs based on information in that call, and not ‘inherit’ their colleagues previous evaluations (from the computer call-notes).³⁶
- Call-takers should use open-ended questions to get a more comprehensive view of patient needs. Closed-ended questions are associated with greater risk to patient safety.³⁶
- Call-takers should confirm that the patient has understood what they have been told, e.g. ask the caller to repeat back the advice that they have been given.^{36, 65}
- When the caller is only a messenger who has not seen the patient, or a witness who has seen the patient but does not know their medical history, the “safety first” policy, namely ambulance dispatch in all instances, should be adopted. Only when dispatchers are able to obtain medical information (calls placed by the patient themselves, or a friend/relative) is there scope for not dispatching an ambulance.⁷⁵ Call-takers should always attempt to speak to the patient directly, if possible, to minimise missing non-verbal cues.³⁶
- Because of the relatively low incidence of patients with high-risk medical complaints,⁶⁵ call-taker training should focus on the recognition of such high-risk calls and an adequate response to them. Training in the use of national telephone triage guidelines has been shown to be useful,⁷⁶ as has training in active listening, active advising, and call-structuring.⁷⁷

Limitations

This review revealed there is very limited academic or grey literature related to secondary ambulance triage. However, the general telephone triage literature is abundant, possibly reflecting the fact that telephone triage services have been used more frequently and for a longer time than secondary ambulance triage. The literature suggests secondary ambulance triage only been actively employed in the last decade; and even then has only been implemented in a few jurisdictions worldwide. Ideally a set of 'best practice' recommendations for a secondary ambulance triage would be derived from evaluations and reviews of previous systems. However, since secondary ambulance triage is still in its infancy, such a literature does not yet exist. Therefore, this report has referred to the relevant general telephone triage literature to generate a set of 'best practice' recommendations. These recommendations should be used with caution pending the results from directly relevant evaluations of implementations of secondary ambulance triage.

Conclusion

This review of the literature regarding secondary ambulance triage services revealed that there is limited academic or grey literature describing implementations of these services. Secondary ambulance triage services are in operation in only a limited number of jurisdictions; mostly in the UK and some Australian states (NSW, VIC, QLD, and WA), although there have also been limited trials in the USA and New Zealand. Different jurisdictions have opted for either in-house or external solutions for secondary ambulance triage. There have not been any evaluations to determine superiority of one over the other.

Secondary ambulance triage services in operation are referred only a small proportion of total ambulance calls (approximately 6-9%) and in the region of 17-67% of these (2-5% of all emergency calls) are eventually passed back to have an ambulance dispatched. One study estimated that an average of 12 minutes is lost when this unnecessary call transfer occurs. Despite these results, secondary ambulance triage has been reported as resulting in substantial cost savings and improved overall ambulance efficiency in both Australia and the UK. The cost of running secondary ambulance triage appears to be outweighed by the savings obtained through reduced ambulance and emergency service utilisation.

New computer triage software systems are being developed which have appropriate protocols to allow them to be used in contexts where secondary ambulance triage has been implemented. These changes should allow for safer and more efficient guidelines for the use of secondary ambulance triage. Secondary ambulance triage call-takers are usually trained nurses and paramedics but given the constraints of telephone triage (where it is not possible to see the patient or their symptoms) there are advantages to having call-takers receive telephone triage training.

A number of different computerised decision support systems have been developed and there is little consistency between the protocols in each system. Because the protocols in each system differ, and because call-takers may interpret the protocols in idiosyncratic ways, there is often little agreement between the triaging decisions of different nurses diagnosing patients with the same symptoms. This area of telephone triage has room for improvement with an aspiration towards triage decisions being both consistent and 'best practice'. Ambulance and emergency services, and the general public, have this expectation of these services.²¹

Secondary ambulance triage needs to be both effective (making the correct decisions for patient treatment) and timely (making those decisions rapidly so that patient risk and suffering are minimised). While very few serious adverse events have been recorded in secondary ambulance triage, a number of patient deaths, in both Australia and the UK, have been attributed to failings in telephone triage systems. These incidents are also relevant to the secondary ambulance triage context and it is important for such systems to consider the evidence from the academic literature and learn the lessons from previous adverse incidents.

While secondary ambulance triage is a recent phenomenon and there have been few direct evaluations, this report has utilised the broader telephone triage literature and compiled recommendations which may inform the development of 'best practice' models for secondary ambulance triage.

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