

ORIGINAL ARTICLE

Safety of telephone triage in out-of-hours care: A systematic review

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Abstract

Objective. Telephone triage in patients requesting help may compromise patient safety, particularly if urgency is underestimated and the patient is not seen by a physician. The aim was to assess the research evidence on safety of telephone triage in out-of-hours primary care. **Methods.** A systematic review was performed of published research on telephone triage in out-of-hours care, searching in PubMed and EMBASE up to March 2010. Studies were included if they concerned out-of-hours medical care and focused on telephone triage in patients with a first request for help. Study inclusion and data extraction were performed by two researchers independently. Post-hoc two types of studies were distinguished: observational studies in contacts with real patients (unselected and highly urgent contacts), and prospective observational studies using high-risk simulated patients (with a highly urgent health problem). **Results.** Thirteen observational studies showed that on average triage was safe in 97% (95% CI 96.5–97.4%) of all patients contacting out-of-hours care and in 89% (95% CI 86.7–90.2%) of patients with high urgency. Ten studies that used high-risk simulated patients showed that on average 46% (95% CI 42.7–49.8%) were safe. Adverse events described in the studies included mortality (n = 6 studies), hospitalisations (n = 5), attendance at emergency department (n = 1), and medical errors (n = 6). **Conclusions.** There is room for improvement in safety of telephone triage in patients who present symptoms that are high risk. As these have a low incidence, recognition of these calls poses a challenge to health care providers in daily practice.

Key Words: *After-hours care, emergency medical services, primary health care, safety, telephone, triage*

Introduction

The organisation of out-of-hours primary care has changed in many developed countries during the last decade. In an increasing number of developed countries it is now provided by physicians who work in large-scale organisations [1–4], with an important role for telephone triage in the initial contact with the patient. Triage is the process of determining the level of urgency and type of health care required in requests for help. Different choices have been made regarding the utilisation of telephone triage across countries. In some countries telephone triage is performed by physicians [3,5], in other countries by nurses or other non-clinicians [2]. In addition, triage may be supported by computerised decision support systems [2].

Telephone triage may compromise patient safety, particularly if urgency is underestimated and the patient is not seen by a physician or with a delay in time. Identification of medical urgency

during telephone contacts with out-of-hours primary care settings has proven to be suboptimal [6,7]. This may result in delayed treatment and thus suboptimal outcomes [8–10], but evidence on this is not consistent [11,12].

An older review of studies concluded that patient safety of telephone triage in out-of-hours care may be compromised [13], but a more recent Cochrane review [14] did not examine patient safety in detail [11,15,16]. Furthermore, the organisation and delivery of out-of-hours care has changed substantially in recent years, which may have influenced telephone triage [17,18]. In recent years a number of studies on telephone triage have been conducted, which is why we decided to perform a review of published research on telephone triage in out-of-hours care. The aim of this review was to assess the research evidence on patient safety of telephone triage in out-of-hours care.

How safe is telephone triage in out-of-hours care?

- Concerns have been expressed regarding the safety of telephone triage in out-of-hours care.
- We found that safety may be suboptimal in patients who present highly urgent symptoms. Improving safety poses a challenge given the low incidence of these patients.

Material and methods

Search strategy

We performed systematic searches in PubMed and EMBASE databases up to March 2010. The search strategy was designed to retrieve studies on telephone triage in out-of-hours care in relation to patient safety. As “telephone triage” is a relatively new term, we also used “telephone consultation” and “telephone hotline”, as suggested in previous reviews on telephone triage [14]. To identify research on clinical performance and patient safety, we searched for outcome measures concerning urgency estimation, advice, referral, and health outcomes. Our search included the following text words and MeSH/EMTREE terms: *(telephone AND (triage OR consult* OR hotlines)) AND (harm* OR safe* OR mortality OR hospitalisation OR accuracy OR appropriateness OR sensitivity OR specificity OR (patient simulation) OR incident OR (adverse outcome) OR (adverse event) OR error)*.

Furthermore, we checked the reviews of Bunn and Crouch [13,14,19]. Finally, we made a list of known relevant studies and we checked that our search strategy included all these studies.

Study selection

Inclusion criteria were formulated in relation to the research aim (Table I). First, papers were included only if they referred to settings open out-of-hours and focused on telephone triage in patients with a first presentation of a medical complaint. Telephone triage was defined as a telephone contact in which the caregiver asked questions to estimate urgency and necessary care level, in order to give advice or refer the patient. Second, studies were included only if outcomes were related to safe performance or subsequent adverse events. We excluded studies that were not written in English, did not have an abstract or a full text article available, as well as letters to the editor or comments. Also, we excluded studies that focused on telephone consultation for one medical complaint (e.g. poison centre) and studies on helplines (e.g.

tobacco cessation). All search results were independently checked by two of the three researchers (LH, VR, MS), using the criteria mentioned in Table I. In case of disagreement on inclusion, the researchers discussed the abstract and, if necessary, retrieved the full-text article for detailed information. If the two researchers could not gain consensus on inclusion, a third researcher was consulted.

Data extraction and analysis

Two researchers (LH, VR) independently extracted study characteristics and safety outcomes from the studies included, using an extraction form. The researchers compared all extracted data and discussed cases of disagreement until consensus was reached or consulted a third researcher (MS). All information presented in the final tables was checked by a third researcher (MS).

We considered unsafe performance as triage which could harm patients because of under-triage, under-estimation of urgency, or under-referral. These triage outcomes could lead to delay in treatment and thus pose risks to patients. For each included study we calculated the percentage of safe performance with a 95% confidence interval, using the Wilson Binomial Proportion Confidence Interval [20]. If the percentage of safe performance was not reported explicitly by the authors, it was deduced from other reported figures. Sometimes only a subset of contacts was relevant for our research aim. Summary estimates of safety were calculated using weighted averages, corrected for the size of the study. Post hoc we distinguished two types of studies: observational studies of real contacts, which included both urgent and less urgent health problems, and prospective observational studies, which used high-risk simulated patients. For real contacts we presented figures on safe performance (including over-triage and over-referral) for studies presenting unselected patients and for studies defining highly urgent patients. High-risk simulated patients (i.e. highly urgent patients) were patients with urgent health problems who needed direct referral, and we calculated the actual safe performance. So, three figures of safe performance were presented. Finally, we described outcomes related to adverse events, such as deaths, hospitalisations, and errors.

Results

Study selection

The searches in PubMed and EMBASE resulted in 790 and 690 hits, respectively. Many studies were excluded because they were not related to actual

Table I. Criteria for inclusion of abstracts.

Theme	Definition	Inclusion	Exclusion
Setting/population:			
Out-of-hours care	Care (partly) after office hours	At least partly out-of-hours care	Only during office hours
Primary care	Care for patients with a first presentation of a medical complaint	Primary care centres, paediatrics, ambulance care, and emergency departments	Disease specific telephone lines, secondary medical care
Telephone triage	Telephone contact in which the caregiver asked questions to estimate urgency and necessary care level, in order to give advice or refer the patient	Computerised decision support systems, triage professionals, telephone triage advice, and referral services	Advice only services, computerised triage systems or websites (without a triage professional)
Outcome:			
Safe performance	Triage resulting in an appropriate outcome (i.e. no under-triage, under-estimation, or under-referral)	Appropriateness, adequacy, under-triage	Appropriateness only related to efficiency
Adverse events	Triage resulting in potential harm due to inappropriate performance and/or delay	Errors/mistakes, near accidents, harm, mortality, unplanned attendance at ED, unplanned admissions within 24 hours	
Other criteria:			
Study design	All levels of evidence were accepted	Empirical quantitative studies, that is controlled and observational studies in clinical practice	Descriptive studies, editorials, reviews, interviews, letters, or comments
Other			Non-English, no abstract, no full text article available

telephone triage or did not report outcomes related to patient safety. We included an additional four studies from the reviews of Bunn and Crouch, which were not identified by our search in databases. We included 34 studies on the safety of telephone triage (Supplementary Table I to be found online at <http://www.informahealthcare.com/pri/abs/10.3109/02813432.2011.629150>). Of these, 23 reported on safe triage, 11 on adverse events, and two on both. The year of publication varied from 1989 to 2009. Most of the studies were performed in the United States ($n = 12$) or the United Kingdom ($n = 8$).

Observational studies

Thirteen observational studies with real patients were identified, presenting figures on safe performance of both unselected and high-risk patients (Table II) [21–33]. For one study it was not possible to report an exact figure of performance, because it presented a graph rather than figures [30]. Ten studies presented safe performance in unselected patients ($n = 4934$), with a weighted mean of 97% (95% CI 96.5–97.4%). One study examined calls that were not forwarded to a physician for confirmation and found this was unsafe in 50% of the cases [27]. Exclusion of this outlier resulted in a weighted mean of 98% (95% CI 97.7–98.4%). Also, five studies ($n = 1266$) presented

safe performance in a high-risk population (weighted mean of 89%; 95% CI 86.7–90.2%). One study of Fourny et al. (2009) found that 70% of contacts were unsafe ($n = 245$); exclusion resulted in a weighted mean of 93% (95% CI 91.4–94.5%) [26]. Two studies reported specifically on performance in patients with a proven acute coronary syndrome (respectively 87% and 79%) [22,26].

Simulated patients

Eleven studies that used simulated patients were identified, but one was excluded because of unclear results (Table III) [6–8,10,34–39]. The estimated proportion of safe triage contacts varied from 9% to 100%, for a subset of high-risk cases. The weighted mean was 46% (95% CI 42.7–49.8%). The setting and telephone triage process varied for these studies. Six studies were performed at emergency department (ED) and urgent care settings [10,34–38]. The three most recent studies were performed in out-of-hours primary care settings [6–8].

Adverse events

Adverse events described in the studies included mortality ($n = 6$ studies) [11,16,26,40–42], unplanned hospitalisations ($n = 5$) [40,41,43–45], unplanned attendance at ED ($n = 1$) [42], and medical errors

Table II. Safe performance in telephone triage in observational studies (n = 13 studies).

First author	Year	Design	Setting	Number (unselected/high risk)	Triage	% Safe performance (95% confidence interval)*	
						Unselected patients	High-risk patients
Egleston	1994	Retrospective follow-up study	Emergency care ED	104	Appropriate advice in 102 of 104 cases at review; 2 calls inappropriate (= unnecessary referral to ED)	100 (96.4–100)	
Srinivas	1996	Retrospective observational study	Telephone helpline and ED	300	97% of callers received appropriate advice as per protocol, while in 3% the advice given was considered to be either insufficient or inappropriate	97 (94.4–98.4)	
Fatovich	1998	Prospective observational study	ED	1,682	Inappropriate advice in 1.4% of calls (= 23 calls); of which 11 (48%) were assessed as potentially life-threatening and 4 (17%) as a possible risk of serious sequelae	99 (97.9–99.1)	
Sramek	1994	Prospective follow-up study	Ambulance care Ambulance dispatch centres	398/136	132 of 136 true urgent calls were detected	99 (97.5–99.6)	97 (92.6–98.8)
Farand	1995	Retrospective observational study	Emergency Medical Services	1,006/444	18 contacts were under-triaged; 426 of 444 urgent calls were triaged accordingly	98 (97.2–98.9)	96 (93.6–97.4)
Dale	2004	Retrospective follow-up study	Ambulance services	239	For 231 calls (96.7%) the majority of the panel agreed with the non-ambulance triage decision; in 35 calls at least one member of the panel thought an ambulance was needed; secondary review showed that only 2 calls needed an emergency ambulance (0.8%) and appropriateness was 99.2%	99 (97.1–99.8)	
Deakin	2006	Retrospective observational cohort study	Ambulance service call centre	263	87% of patients with a confirmed acute coronary syndrome were classified as requiring a category A response (urgent)		87 (82.4–90.5)

(Continued)

Table II. (Continued).

First author	Year	Design	Setting	Number (unselected/high risk)	Triage	% Safe performance (95% confidence interval)*	
						Unselected patients	High-risk patients
Fourny	2009	Prospective observational cohort study	University hospital-affiliated Emergency Medical Service call centre	245	Initial EMS dispatcher's decision was appropriate for 171 (70%) patients with ST-elevation myocardial infarction		70 (64.0–75.4)
Jackson	1997	Retrospective observational study	Primary care Primary Care Clinic and Pediatric Health Information Line	19 vs. 50	Evaluators concurred that advice was appropriate in 95% of resident calls and 98% of nurse calls	Residents: 95 (75.3–99.1) Nurses: 98 (89.5–99.6)	
Hildebrandt ¹	2003	Retrospective follow-up study	Primary care physicians and answering services	119	50% (range 22–77%) of calls not forwarded to the on-call physician represented an emergency needing immediate contact with the physician	50 (41.2–58.8)	
Scarfone	2004	Retrospective observational cohort study	Out-of-hours call centre of a tertiary care hospital	927/178	Compared with children referred immediately to the ED, the proportion instructed to go to the ED within 4 hours of the telephone call received significantly lower ED triage classifications (93% vs. 77%); 91.6% of non-urgent referrals were correct	98 (97.4–99.0)	92 (86.6–94.8)
St George ³	2005	Retrospective observational cohort study	Healthline	90	For 82.2% there were no safety concerns	82 (73.0–88.7)	
Sprivilis ²	2004	Comparative study with concurrent controls	Health Direct and ED	842	Triage distribution at the ED of patients who complied with urgent telephone triage disposition was very similar to the triage distribution of patients triaged to non-urgent care who presented to the ED despite a non-urgent disposition (by telephone); same for hospital admissions	Not applicable	
Total weighted mean				4,934/1,266		97 (96.5–97.4)	89 (86.7–90.2)

Notes: *Wilson Binominal proportion confidence interval; ¹Hildebrandt: self-triage of patients who have to decide whether or not their problem is an emergency; ²Exact figures were not available in the article; ³St George: stratified selection of contacts.

Table III. Safe performance in telephone triage in simulated patient studies (high-risk patients; n = 10 studies).

First author	Year	Setting	Number (high-risk cases)	Triage	% Safe performance (95% confidence interval)*
Verdile	1989	Emergency care ED	46 (1 case)	In 9% appropriate advice to go to ED by ambulance; 61% gave advice to visit ED	70 (55.6–81.3)
O'Brien	1990	Urgent care centres	100 (1 case)	In 17 of 100 calls adequate advice to consult urgent care centre or ED	17 (10.9–25.5)
Isaacman	1992	ED	61 (1 case)	60.4% advised same-day evaluation (= implicit "gold standard"); 71.7% advised to see a physician; no statistical differences between the advice of physicians vs. nurses	60 (47.9–71.7)
Evans	1993	ED	30 calls (none of 3 cases)	Correct telephone advice was given to 74% of all calls	Not applicable
Kunkler	1994	ED	72 (1 case)	In 75% appropriate advice (n = 54) to go to ED by ambulance/car/taxi	75 (63.9–83.6)
Aitken	1995	ED and private ED clinics	36 (1 case)	In 20 of 36 institutions that gave telephone advice, the advice was adequate (56%)	56 (40.0–70.8)
Yanovski	1992	Primary care Pediatric and family medicine (private practices and hospital)	117 (1 of 3 cases)	Appropriate advice for scenario on diarrhoea and dehydration: first-year residents 52%, third-year residents 59%, private practitioners 44%, and faculty physicians 100%. More than one third of all residents and private practitioners reached inappropriate management decisions	60 (50.9–68.4)
Moriarty	2003	Primary care telephone triage system	85 (all 4 cases)	51% of calls were under-triaged (not referred)	49 (38.6–59.4)
Giesen	2007	Primary care physician cooperatives	83 (5 of 20 cases)	Correct urgency estimation by triage nurses in 69%; overestimation in 12.5%; underestimation in 19% of contacts	76 (65.8–83.9)
Derkx	2008	Primary care physician cooperatives	153 (3 of 7 cases)	Triagists achieved the appropriate triage outcome in 58% of all calls; advice was underestimated in 41% of all calls and overestimated in 1% of calls	9 (5.0–14.0)
Total weighted mean			753		46 (42.7–49.8)

Note: *Wilson Binominal proportion confidence interval.

(n = 6; Table IV) [26,33,43,46–48]. Eleven studies reported solely on adverse events, but St George et al. (2005) and Fourny et al. also reported on appropriate performance.

Mortality. Six studies reported on mortality. Labarere et al. reported one death after a call with a non-urgent disposition [42]. Kempe et al. found no deaths in two studies [40,41]. Lattimer et al. found a significant difference in mortality between triaged patients (0.9%) and control patients (0.8%) [11], whereas Thompson et al. did not find

differences between these groups [16]. Fourny et al. stated that in-hospital mortality did not differ according to the appropriateness of the initial dispatcher's decision [26].

Unplanned hospitalisations. Five studies reported on hospitalisations related to under-referral. Stewart et al. found that 21% of patients who were not referred by the telephone triage centre NHS Direct were admitted to hospital compared with 12% of referred patients [45]. The under-referral rate with subsequent hospitalisation ranged from 0.2% to 5.2% [40,41,43,44].

Table IV. Overview of adverse events in telephone triage (n = 13).

First author	Year	Setting	Design	Mortality (after call)	Adverse events		
					Hospitalisations (after non-urgent disposition)	ED attendance (after non-urgent disposition)	Errors
Sher	1994	Telephone helpline	Follow-up study (n = 317)	-	-	-	Patient status at follow-up: 3.8% worse, but no medical emergencies
Lattimer	1998	Primary care physician cooperatives	Randomised controlled trial (nurse telephone consultation vs. normal primary care physician cooperative practice) (n = 7308 vs. 7184)	Within 7 days: 0.9% in control and 0.8% in nurse triage	-	-	-
Thompson	1999	Primary care physician cooperatives	Randomised controlled trial (n = 100 vs. 123)	Within 7 days: no significant differences found (control vs. nurse triage)	-	-	-
Kempe (outcomes)	2003	After-hours call centre of children's hospital	Retrospective study (n = 1561)	No reported deaths	4.6% urgently referred children vs. 0.45% non-urgent referred children; Weighted rate of under-referral with hospitalisation was 0.3%	-	-
Labarere	2003	After-hours primary care call centre	Follow-up study (n = 409)	Death after call with non-urgent disposition: (0.2%)	-	Of patients advised to visit primary care physician during office hours, 9.6% were referred to ED subsequently	-
						Of patients with self-care advice, 32.8% went to primary care physician and 10.1% were subsequently referred to ED	

(Continued)

Table IV. (Continued).

First author	Year	Setting	Design	Mortality (after call)	Adverse events		
					Hospitalisations (after non-urgent disposition)	ED attendance (after non-urgent disposition)	Errors
St George	2005	Healthline	Retrospective observational cohort study (n = 90)				In only 1.1% did the three reviewers consider that the lower endpoint posed some risk to the patient
Hildebrandt ¹	2006	Private family medicine call handling	Retrospective observational study (N = 119)	-	Within 2 weeks: 2% related to call	-	2% suffered clinical harm; 1% were at risk of future harm; 26% experienced discomfort
Kempe (safe)	2006	Pediatric after-hours call centre	Retrospective follow-up study (n = 32,968)	No deaths within 1 week;	Potential under-referral with subsequent hospitalisation: 0.2% (calls with a non-urgent disposition)	-	-
Stewart	2006	NHS Direct and ED	Follow-up study (n = 3,312)	-	21% of non-referred patients vs. 12% of NHS referred patients	-	-
Hirsh	2007	Tertiary care paediatric hospital with call centre for paediatricians	Retrospective follow-up study (n = 83)	-	24-hour under-referral rate: 5.2% (hospital admission after non-urgent disposition of CC)	-	-
Killip	2007	After-hours telephone service for family medicine clinic	Retrospective observational study (n = 63)	-	-	-	In total 22% of calls involved any errors that could have threatened patient safety: 14% of calls had medical errors, 11% had patient errors; 3% of calls involved errors with potentially serious consequences for the patient

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Table IV. (Continued).

First author	Year	Setting	Design	Mortality (after call)	Adverse events		
					Hospitalisations (after non-urgent disposition)	ED attendance (after non-urgent disposition)	Errors
Fourny	2009	University hospital-affiliated Emergency Medical Service call centre	Prospective observational cohort study (n = 245)	In-hospital mortality did not differ according to the appropriateness of the initial dispatcher's decision	-	-	Inappropriate initial decision resulted in median times to reperfusion increasing by 42 minutes (patients receiving fibrinolysis) and 63 minutes (patients undergoing primary PC)
St George	2009	Nurse-on-call: telephone triage line	Retrospective observational study (N = 173 189)	-	-	-	0.023% risk incidents, but no critical outcomes

Note: 'Hildebrandt: self-triage of patients who have to decide whether or not their problem is an emergency (calls not forwarded).

Unplanned ED attendance. One study reported on ED attendance after an underestimation of urgency during telephone triage. Of patients that were advised to visit a primary care physician during office hours, 9.6% were subsequently referred to the ED by the primary care physician. Moreover, 32.8% of patients with self-care advice visited the primary care physician and 10.1% were subsequently referred to the ED [42].

Errors. A study of St George et al. reported that 0.023% of all calls to a nurse telephone line involved risk incidents, although none had critical outcomes [48]. Killip et al. reported that 22% of calls to an out-of-hours telephone service could have threatened patient safety; 3% involved errors with potentially serious consequences to patient safety [46]. Hildebrandt et al. found 2% clinical harm for patient calls that had not been forwarded, whereas 1% were at risk of future harm [43]. Sher et al. performed a follow-up study of a telephone helpline and found that 3.8% of patient status were worse at 24 hours follow-up, although this did not result in medical emergencies [47]. St George et al. reported that in 1.1% of cases the lower endpoint for triage advice posed some risk to the patient [33]. Finally, Fourny et al. stated that the time to actual medical treatment (reperfusion for ACS patients) increased due to an inappropriate decision by ambulance dispatchers [26].

Discussion

Main findings and interpretation

Research in real patients presenting at out-of-hours care showed that on average about 10% of the telephone triage contacts were unsafe. Studies that used simulated high-risk patients showed that on average about 50% were unsafe. The types of adverse events reported included mortality, unplanned hospitalisations, unplanned ED attendance, and medical errors. We conclude that there is room for improvement of patient safety in telephone triage in out-of-hours care.

Studies using simulated patients reported higher rates of unsafe contacts than studies using real patients. As simulated patients present a limited number of – potentially complex – cases, we suggest that studies in real patients are most valid. But reports by simulated patients may be more valid than data extraction from medical records of real patients, because of the objectivity of the measurements. As both designs have advantages as well as disadvantages, making a choice is also a matter of feasibility.

Furthermore, simulated patient studies had lower scores on safe performance compared with real patient studies. This most likely is partly due to the focus on high-risk cases in the simulated patient studies. These cases were carefully designed to allow a straightforward interpretation of the decisions taken. Also, appropriate decisions have been predefined, so that deviations from optimal decisions are more easily detected. Real patient studies often use expert review to assess appropriateness after the actual contact. These contacts may include many aspects that make a range of decisions legitimate. As a medical condition can change over time, decisions could be influenced by the timing of expert review. Even an estimated highly urgent contact is often less urgent afterwards, particularly in primary care. So, there could be hindsight bias in expert review studies.

Since out-of-hours care involves large numbers of contacts, the accumulated effects of unsafe telephone triage are substantial at population level and in patients with many contacts over time. Many developed countries have examined the rate of adverse events in hospital care. A systematic review reported that one or more adverse events occurred in 9.2% of all patients admitted to hospital [49]. Relatively little is known about patient safety in primary care settings, and even less in out-of-hours primary care. A retrospective patient record review study in Dutch out-of-hours primary care physician cooperatives in 2009 found patient safety incidents in 2.4% of all contacts; a third of these were related to telephone triage [50]. This study was based on medical records, so these figures are best compared with studies in real patients. The lower figure may show the benefits of recent reforms in out-of-hours care in the Netherlands, such as the introduction of a primary care physician who approves all telephone triage decisions.

Unsafe telephone triage does not always result in harm to patients. A considerable number of patients who visited an out-of-hours service will have a return or follow-up consultation. Patients may act upon feelings of non-safety and therefore receive appropriate care within a reasonable timeframe and without serious consequences, even when they were initially inappropriately managed [26,41]. Moreover, in most cases patients' conditions will not deteriorate quickly, so there is often time to correct the initial health care decision [40].

Strengths and limitations

This review of observational research in telephone triage provided robust estimates of the safety of telephone triage at out-of-hours care. Nevertheless, some limitations have to be mentioned. Despite our systematic searches we may have missed relevant

studies, because of inconsistent use of key words or a differential presentation of studies. For instance, we missed four studies from the reviews of Bunn and Crouch. Second, it is important to stress that our post-hoc distinction between research in real patients and research in simulated patients is associated with a number of differences, including clinical cases presented, measures of safety, and denominator for the calculations. The calculation of percentages for actual performance was made partly after interpretation of the study results and depended on the information available in the articles. Moreover, we focused on under-triage, under-estimation, and under-referral as triage outcomes that might compromise patient safety. However, over-triage could also compromise patient safety, if it results in an overload with insufficient resources and delay in treatment. Furthermore, it could result in other problems, such as overtreatment and medicalisation. Moreover, the articles included represent a range of settings, cases, and triage professionals, which limits the generalisability. We were not able to analyse differences concerning settings and triage professionals, because the number of included studies was limited. Finally, not all included studies reported figures on adverse events, and the studies on adverse events often did not have enough power to detect differences in clinical outcomes, given their relatively small sample sizes [16,26]. Also, these adverse events were probably not all preventable/avoidable by improving the quality of telephone triage.

Implications for clinical practice

In many countries telephone triage has a crucial role in the organisation and delivery of out-of-hours care [5,14,51]. It is expected to control workload and costs, while maintaining high safety of patient care [14,51]. An obvious question is how telephone triage can be improved. Computerised decision support systems have been tested, but it seems important to improve their clinical relevance substantially concerning safety and efficiency. Another approach is better training of nurses who are responsible for telephone triage. The quality of history-taking is essential for an appropriate triage decision [6,52]. The use of triage protocols can prompt nursing staff to ask appropriate questions [36] and identify accurately the patients at highest medical risk [41]. Education of triage nurses and physicians might contribute, as well as supervision and counselling by physicians [6,7,21]. Because of the low incidence of patients with urgent medical complaints [53], education should focus on the recognition of urgent calls and an adequate response to them.

Implications for future research

Studies on safety of triage are relatively old, especially when taking into account recent reforms of out-of-hours care. New studies on safety of telephone triage are needed to inform health policy. As different models for organising and providing telephone triage exist, comparative studies on effectiveness are recommended, considering different triage professionals and models [41]. Furthermore, evaluation of the cost-effectiveness of the involvement of primary care physicians for supervision of telephone triage is recommended.

Declaration of interest

The author report no conflicts of interest. The author alone is responsible for the content and writing of the paper.

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Supplementary material available online

Supplementary Table I to be found online at <http://www.informahealthcare.com/pri/abs/10.3109/02813432.2011.629150>.