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A systematic review and 'best-fit' framework synthesis of contributory factors to telephone triage safety☆

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ABSTRACT

Telephone triage is a popular service globally but is under-represented in healthcare safety research and the definition of its safety is not well understood. Moreover, human factors frameworks for organisational learning are often designed for use in face-to-face healthcare and may be less reliable for detecting contributing factors in telemedicine. A systematic review of peer-reviewed literature in Scopus and PubMed databases to identify patient safety indicators and contributing factors to primary care telephone triage safety was conducted. Both qualitative and quantitative studies were included. No studies were excluded due to quality but Critical Appraisal Skills Programme tools supported commentary on quality considerations. 96 peer-reviewed articles met the requirements for inclusion, and definitions of, and contributing factors to safety were synthesised using the Systems Engineering Initiative for Patient Safety (SEIPS) as a 'best-fit' framework. Few studies defined safety. Most included studies measured 'appropriateness' of care/advice. Few research articles used data from actual incidents and/or near-misses. To reflect the various safety indicators "actionable, appropriate, and timely care, avoiding unavoidable deterioration or harm" is proposed as a working definition for telephone triage safety. Regarding contributing factors to telephone triage safety, most studies focused on individual worker and patient factors. Physical environment and organizational factors were under-researched, which is particularly pertinent since both are likely to differ from face-to-face care, unveiling noteworthy directions for future research. The review culminated in a list of contributory factors to patient safety in telephone triage with potential to use these to support incident investigation and system redesign.

1. Introduction

A recent editorial highlighted that evaluative research into telehealth quality and safety (including triage) has not matched the pace of adoption, especially given the increased usage since the COVID-19 pandemic (Guetterman and Buis, 2024). One specific example is telephone triage: the assessment of patients' symptoms via telephone and signposting to further care. Telephone triage is well utilised (e.g., in the UK between 2023 and 2024, the NHS 111 telephone triage service received over 21 million calls (The Kings Fund, 2024), and is the 'front door' to accessing healthcare in many health systems (Pope et al., 2017). Despite this, a recent bibliometric analysis of telephone triage research undertaken prior to this systematic review, and as part of a wider research programme to understand telephone triage safety, yielded fewer than 800 articles over a 40-year period (Poots et al., 2024). Moreover, findings suggested studies were concentrated in emergency and ambulatory care, with knowledge gaps in primary and integrated care, and systems deploying non-clinical staff.

Previous research has suggested telephone triage can improve patient flow and efficiency (Grol et al., 2006), is convenient for patients (Lopriore et al., 2017), and that systems are potentially too *risk averse* as opposed to *risky* (MacLellan et al., 2023). However, serious concerns have been raised about patient safety. Services like NHS 111 and Swedish Health Direct have been implicated in cases resulting in serious harm to patients (Rees et al., 2017) and malpractice claims (Björkman et al., 2021). A previous systematic review suggested the percentage of

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calls which were safe for callers varied from 46 % to 97 %, decreasing as symptom urgency increases and for high-risk simulated patients. (Huibers et al., 2011). This is concerning since millions of callers access telephone triage services, even a 1 % risk of harm could equate to harm for thousands of patients (Wheeler et al., 2015). Others note a clear definition of telephone triage safety is lacking (Lake et al., 2017) which could make it difficult to measure patient safety in the first instance and leading to mixed.

Telephone triage systems are complex, yet existing research often focuses on singular factors contributing to cases of harm such as lack of situation awareness (Rees et al., 2017) or call-handler qualifications (Wheeler et al., 2015). However, more recent studies, in line with contemporary approaches to safety, have suggested multiple interacting factors contribute to the safety of telephone triage like human-technology interaction, which can affect communication between callers and triage professionals, resulting in incomplete or inaccurate information exchange, which can contribute to patient harm (Morgan and Muskett, 2020). Additionally, suboptimal technology design and wider system factors like infrastructure or physical space can create the need for workarounds in the system (Poots et al., 2024). Since no specific contributory factors framework exists for telephone triage (or telemedicine more generally), the application of investigative tools designed for face-to-face care may miss latent systemic factors contributing to telephone triage safety (Morgan and Muskett, 2020). In response to these challenges, the current systematic review aims to a) identify potential indicators of patient safety, and b) system factors contributing to patient safety outcomes, in telephone triage, to move towards the development of a contributory factors framework which can be used to investigate and pre-empt adverse events in telephone triage systems.

The systematic review questions are as follows:

1) What safety indicators have previously been used in primary care telephone triage safety research?
2) What systemic factors contribute to safety outcomes of primary care telephone triage systems?

2. Methods

2.1. Protocol, registration and reporting system

The protocol for this systematic review was registered in PROSPERO (CRD 42022320933), available at: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022320933.With its focus on safety, the systematic review was designed and reported according to PRISMA-Harms (Zorzela et al., 2016) guidelines as much as possible. Given the exploratory design of the present study, the ECLIPSE model for performing health management searches (Wildridge and Bell, 2002) guided development of literature searches and eligibility criteria (see Fig. 1).

2.2. Eligibility criteria

The research team collaborated with a provider of Integrated Urgent Care (IUC) telephone triage in the UK (i.e., NHS 111) on a wider programme of research. Therefore, only primary care studies were included as these more closely resembled the IUC system. The main outcomes of interest were patient safety indicators and contributory work system factors, based on the Systems Engineering Initiative for Patient Safety (Holden et al., 2013). Since the entire work system was of interest, studies could include a focus on the patient or the call handler.

Temporal validity issues were raised in a previous systematic review (Huibers et al., 2011), therefore only peer-reviewed journal articles from the 20 years up to the date of searching (April 2022) were included. Whilst quality was assessed, given the paucity of literature pertaining to telephone triage safety (Poots et al., 2024; Lake et al., 2017) no exclusions were made based on quality, instead quality comments are available for interested readers (Supplementary Material A). Inclusion and exclusion criteria are presented in Fig. 2.

2.3. Information sources and search strategy

PubMed and Scopus databases were used for searches. Searches were completed in April 2022. Keywords searched included ‘telephone triage’, its variants (e.g., ‘teletriage’ and ‘remote triage’). Since the primary aim of the review was to understand contributory factors (both positive and negative) to safety, safety and related outcomes words were

ECLIPSE model (Wildridge & Bell, 2002) to define the search strategy

Expectation of the search requester – *The researcher is looking to understand how safety of telephone triage is measured, and the contributing factors to safety performance and incidents*

Client Group - *patients availing of primary care telephone triage services*

Location – *remote care, world-wide*

Impact – *By understanding how patient safety could be appropriately measured, investigated, and consequently improved; could result in a useful tool for investigating incidents and planning for system change in telephone triage organisations*

Professionals – *all professionals performing telephone triage in primary care, both non-clinical and clinical are of interest*

Service – *Primary care telephone triage services*

Fig. 1. ECLIPSE model (adapted from Wildridge & Bell, 2002) guiding the current review.

Inclusion Criteria

- Studies including 'telephone triage' or related terms, e.g., 'teletriage', 'remote triage'
- Studies undertaken in the Primary Care setting, e.g., GP Surgeries, Out-of-Hours
- Primary empirical research using qualitative methods (e.g., focus groups/interviews) and/or quantitative methods (e.g., timeliness); secondary data relevant to safety (e.g., adverse event analyses)
- Peer-reviewed journal articles published in English
- Studies published in the 20 years up to April 2022
- Studies including terms relating to safety of telephone triage, e.g., 'adverse events', 'harm', 'risk', 'appropriateness' or 'timeliness'

Exclusion Criteria

- Grey literature e.g., conference proceedings, editorials, commentaries
- Studies in settings using video conferencing software
- Studies in emergency ambulance settings or pre-planned telephone triage calls, e.g., pre-assessment

Fig. 2. Criteria used in the present systematic review to include or exclude yielded articles.

included in the search strategy such as 'appropriateness', 'time', 'malpractice', and 'adverse event', guided by criteria used by Huibers et al. (2011) in their systematic review of telephone triage safety. An example is outlined in Fig. 3.

2.4. Study selection

Fig. 4 outlines the study selection process. Bibliometric details and study abstracts were downloaded from the databases and loaded into Endnote for collation and removal of duplicate articles. Title and abstract screening were carried out by two reviewers (JP, JM) using Rayyan.ai. JP reviewed all abstracts and JM reviewed 10 %, to assess inter-rater reliability (Cohen's Kappa). Where there were conflicts regarding inclusion, this was solved through discussion with the review team. Full texts for inclusion were retrieved using Google Scholar, the university library, and ResearchGate and reviewed by JP.

2.5. Data extraction

Guided by Carroll et al. (2011; 2013), data was extracted predominantly from the results section (either reported findings, or summary statements supported by data) and input to a data extraction form in Excel for extraction by JP. Definitions of safety, where present, were taken from the introductions of studies. The findings relating to contributory factors were synthesised using Best Fit Framework Synthesis (BFFS; Booth & Carroll, 2015; Carroll et al., 2011; 2013) with SEIPS 2.0 (Holden et al., 2013) serving as the a priori framework. These were then grouped thematically using reflexive thematic analysis principles (Braun and Clarke, 2019).

2.6. Risk of bias in and across studies

Carroll et al.'s (2013) guidance for assessing the quality of reporting in qualitative studies was used (i.e., the presence of the study question and design; sampling and selection details; and methods of data

Below is an example of one search strategy used in SCOPUS (the ellipsis (…) indicates the inclusion of other outcome-related keywords discussed previously and curly brackets were used to search for precise terms):

TITLE-ABS-KEY ({telephone triage} OR {telephone-triage} OR {teletriage} OR {tele-triage} OR {tele triage} OR {hotline} OR {telephone consultation} OR {remote triage}) AND (outcomes OR appropriate* OR time* OR morbidity…)

Fig. 3. Examples of search strategy used in Scopus. A similar search strategy was used in PubMed.

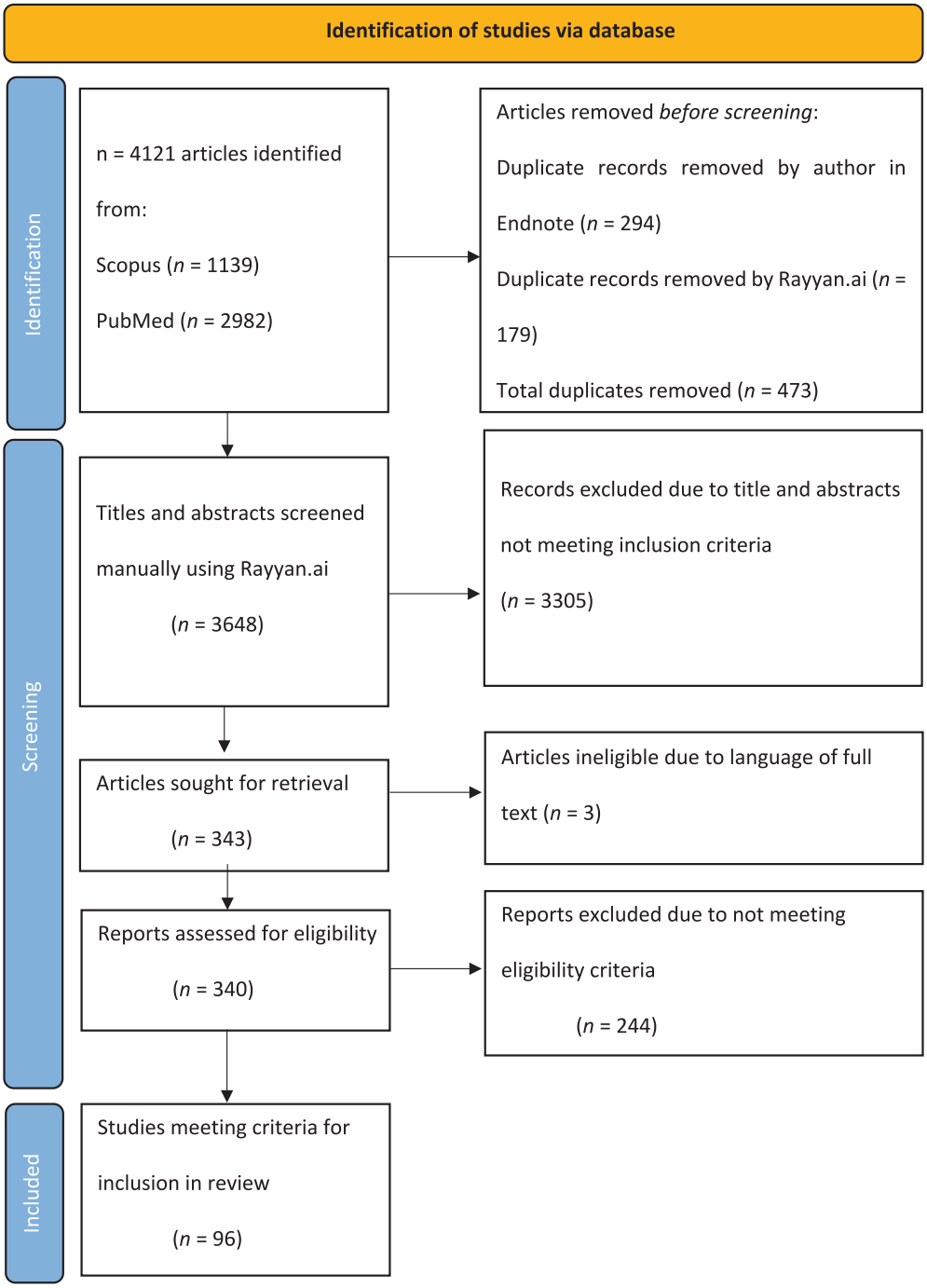

Fig. 4. PRISMA flow diagram outlining excluded and included article numbers, adapted from (Page et al., 2021).

collection and analysis). For other study designs, relevant Critical Appraisal Skills Programme (n.d.). Available at: www.casp-uk.net (CASP, n.d.) tools were used to assess risk of bias. Notes on study quality can be found in Supplementary Material A. Following (Carroll et al., 2013)'s example, as a final test of risk of bias, the conceptual model was compared with the a priori framework to ascertain whether any anticipated themes were missing, justify their absence, and explain new themes and their evidence base. A Delphi study was also undertaken (to be reported elsewhere) to investigate the validity of findings for NHS 111.

3. Results

3.1. Study selection

As depicted in Fig. 4, the titles and abstracts of 3648 articles were screened and 340 full texts retrieved. 96 articles were included in the final analysis. Inter-rater reliability was calculated for 10 % of papers using Cohen's Kappa, and was moderate to substantial (κ = 0.64) (McHugh, 2012). There were 25 conflicts between reviewers which were excluded through discussion with the whole review team for reasons such as duplicate articles; not being safety related; using video consultations. Included studies are listed in Table 1. Many included studies were published in 2020 (n = 13), likely due to increased interest in

Table 1
Studies included in the review, details of system settings including triage professionals, definitions of safety, and measurements used.

Included study	Setting	Triage professional	Definitions of safety provided	Measurement(s) of safety used
Al-Abdullah et al. (Al-Abdullah et al., 2009)	TTAS	Nurses – general	No definition provided	Appropriateness using checklist and physician judgement
Allan et al. (Allan et al., 2014)	TTAS	Nurses – general	"Safety and quality of care… is contingent upon nurses' ability to maintain concentration… take in and process information… to use the information to make appropriate decisions… cognitive failures…" (pp. 202).	Choice reaction time to detect cognitive failures
Allen-Davis et al. (Allen-Davis et al., 2002)	TTAS	Nurses – general	No definition provided	Accuracy of telephone assessment compared to microscopic cell culture
Bogdan et al. (Bogdan et al., 2004)	TTAS	Nurses – general	"patients receive the right care, in the right place, at the right time… patient compliance with recommendations" (pp. 539)	Questionnaire on caller compliance and satisfaction
Boutin et al. (Boutin et al., 2006)	TTAS	Nurses – specialist	No definition of safety provided	Effect of the quality of an intervention for asthma triage on quality of interactions, appropriateness of referral by 'observer', evaluation of callers' understanding of advice
Brasseur et al. (Brasseur et al., 2021)	OOH	Nurses – specialist	"appropriate referrals of the patients at the right time, right place, and with the right person" (pp. 640);	Redirection because of inappropriate triage e.g., undertriage; error rate (percentage of over- and under-triage) of the SALOMON tool (algorithm)
Campbell et al. (Campbell et al., 2014)	GPO	Comparison of professionals	"Patient safety (ie, deaths, the occurrence and duration of any emergency hospital admissions within 7 days of the index request, and the number of patients with any attendances to accident and emergency departments within 28 days" (pp. 1861)	Case note review and practice records used to identify: deaths and emergency hospital admissions within 7 days of index request; A&E attendance in 28 days; log sheet of identified adverse events returned monthly
Cook et al. (Cook et al., 2010)	TTAS	Nurses – general	Comparison of "appropriateness of consultants in emergency medicine and general practitioners on the appropriateness of NHS 24 [telephone triage] referrals to the Emergency Department" (pp. 213)	Questionnaire on the most appropriate outcome judged by ED consultants and GPs.
Dale et al. (Dale et al., 2003)	EMS*	Nurses – general	Overuse of ambulances "contributes to inefficient, clinically inappropriate healthcare, and may delay the provision of emergency care to those with life threatening needs" (pp. 178)	Inpatient admissions within 7 days of receiving a classification of non-urgent
Dale et al. (Dale et al., 2004)	EMS*	Nurses – general	"Clinical safety of the triage decision process" (pp. 364); "Would the patient have come to harm (due to his/her clinical condition) if he/she did not receive an emergency ambulance within 14 min?" (pp. 366)	Nominal group technique used to determine the reliability of the initial assessment; case studies using audiotaped transcripts which were judged that an emergency ambulance should have been dispatched within 14 min to confirm mis-triage.
Derkx et al. (Derkx et al., 2008)	OOH	Not specified	no definition of safety but: safety as quality of the care process "this includes assessment of the clinical quality of questions asked as well as evaluation of the answers and the care advice given. (pp. 1); under- and over-estimation of urgency	Percentages of clinical obligatory questions asked and items within home management and safety net advice based on comparison with pre-agreed standards and of care advice given in relation to the required care advice
Derkx et al. (Derkx et al., 2010)	OOH	Not specified	No definition or description	Use of novel rating scale to judge quality of reports and conversations for incognito standardised patients
Eastwood et al. (Eastwood et al., 2020)	TTAS	Multiple professionals	Appropriateness of upgrades of urgency by secondary dispatchers	Measured as receiving treatment by attending paramedics or transportation to the Emergency Department
Erkelens et al. (Erkelens et al., 2020)	OOH	Multiple professionals	Safety as serious adverse events (SAE): "An SAE is defined by the Dutch Healthcare Quality, Complaints and Disputes Act as;an unintended or unexpected event related to the quality of care and resulting in death or a severe harmful event for the patient" (pp. 40)	Expert assessment of safety (yes/no rating) and quality (Guetterman and Buis, 2024; The Kings Fund, 2024; Pope et al., 2017; Poots et al., 2024; Grol et al., 2006; Lopriore et al., 2017; MacLellan et al., 2023; Rees et al., 2017; Björkman et al., 2021; Huibers et al., 2011) of call recordings which contained a sample of cardiovascular SAEs
Erkelens et al. (Erkelens et al., 2020)	OOH	Not specified	No specific definition	Risk ratio of TIA or stroke among people calling with stroke-like symptoms
Erkelens et al. (Erkelens et al., 2020)	OOH	Multiple professionals	Serious Adverse Event is "an unintended or unexpected event related to the quality of care and resulting in death or severe harmful event for the patient" (pp. 117)	Expert judgement of appropriateness of calls relating to missed acute cardiac symptoms
Erkelens et al. (Erkelens et al., 2020)	OOH	Multiple professionals	No specific definition	Appropriateness of dichotomised (i.e., high/low) urgency estimation compared to final clinical outcome
Erkelens et al. (Erkelens et al., 2021)	OOH	Nurses – general	No specific definition	Qualitative study investigating interactional difficulties including question design
Ernesäter et al. (Ernesäter et al., 2016)	TTAS	Nurses – general	No specific definition but implicates telephone nurses questioning and caller understanding as "a potential threat to patient safety" (pp. 116)	Content analysis of a sample of call Roter Interaction Analysis System (RIAS)[1] to assess utterances of callers and responses of nurses
Ernesater 2010	TTAS	Nurses – general	No specific definition but describes under- and over-triage	Retrospective content analysis of incident (n = 426) reports and contributory factors
Ernesäter et al. (Ernesäter et al., 2010)	TTAS	Nurses – general	"Safety risks in telephone advice nursing might be related to gathering partial information from callers, communicating with callers with language problems, or callers behaving in a way that hinders communication (such as being very angry); but the greatest risk seemed to	Case-control design using sample of all reported medical errors (n = 33) within malpractice claims. Corresponding calls identified and collected as sound files from the manager in charge at the respective call centres. RIAS scale used to analyse quality of

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Table 1 (*continued*)

Included study	Setting	Triage professional	Definitions of safety provided	Measurement(s) of safety used
			be uncertainty due to inability to see the caller in person. Another safety risk within telephone advice nursing is not talking directly with the patient in need of care" (pp. 2)	communication including question design and back-channel responses
Gamst-Jensen et al. (Gamst-Jensen et al., 2017)	OOH	Multiple professionals	Safety as accuracy and under-triage: "the accuracy of telephone triage has been shown to vary from 49 to 98 %, suggesting that the issue might affect patient safety" (pp. 2) "Under-triage was defined as Potentially Under-Triaged Calls (PUTC) by specific criteria to an OOH Hotline, and identification by integration of three databases: Medical Hotline database, Emergency number database, including the Ambulance database, and electronic patient records." (pp. 1)	Thematic analysis of features of n = 327 voice logs of Potentially Under-triaged Calls (PUTC) were identified using a linked dataset, representing 0.04 % of all calls (n = 937.056) to the OOH; 31 calls were analysed qualitatively regarding 19 patients
Gamst-Jensen et al. (Gamst-Jensen et al., 2020)	OOH	Multiple professionals	Hospitalisation for more than 24 h within 48 h of the call	Prospective cohort study investigating relationship between degree of worry of those admitted to hospital (n = 581)
Gamst-Jensen et al. (Gamst-Jensen et al., 2021)	TTAS	Nurse –general	No specific definition provided	Hospitalisation or 30-day mortality using national register
Giesen et al. (Giesen et al., 2007)	GPOOH	Nurse – general	No safety definition but refers to underestimations of urgency	Cross-sectional, observational study using simulated patients (n = 5)in 4 GP coops using 20 vignettes based on practice cases; assessment of appropriateness of urgency level given based on GP as 'gold standard'
Grant et al. (Grant et al., 2002)	TTAS	Compares professionals' performance	Safety as symptom management	Scores on consensus-derived checklists of essential management of clinical scenarios presented by standardised patients compared to walk-in clinics
Graversen et al. (Graversen et al., 2020)	OOH	Comparison of professionals	"Securing a safe and efficient telephone triage is a challenge as it must balance a minimum of undertriage securing high patient safety, while keeping overtriage at an acceptably low level." (pp. 2)	Assessment of Quality in Telephone Triage (AQTT) tool used by 24 physicians to assess 1294 audio-recorded telephone triage calls from two OOH services
Graversen et al. (Graversen et al., 2019)	OOH	Multiple professionals	Degree of under- or over-triage	Delphi study to assess validity of a translated version of the Dutch KERNset tool for assessing quality, safety, communication and efficiency of triage on a sample of 48 OOH patient contacts.
Gren et al. (Gren et al., 2022)	TTAS	Multiple professionals	Hospitalisation of more than 24 h following call	Relationship between degree of worry and patient outcome (i.e. hospitalisation, illness severity) and content analysis of calls resulting in hospitalisation (n = 54)
Haimi et al. (Haimi et al., 2020)	TTAS	GP	"In some cases tele-triage may compromise patient safety, particularly if time urgency is underestimated by the service provider, rendering the patient without the necessary treatment and within the necessary timeframe" (pp. 2–3)	Two physicians retrospectively reviewed 339 parent-physician calls and analysed for factors that may have affected appropriateness and reasonableness of decisions made and adherence with advice
Hayward et al. (Hayward et al., 2017)	OOH	Not specified	Safety as "delayed escalation" using hospitalisation within 3 days	Retrospective service evaluation using medical records to assess instances of hospitalisation "delayed escalation" following triage calls. 4465 individuals required secondary care
Hildebrandt et al. (Hildebrandt et al., 2006)	GPOOH	Not specified	Describe six types of clinical harm ranging from minimal (physiologic change) to severe (including hospitalisation and death) for patients have declared their concern is not an emergency and their calls were not forwarded to health professional	Linked data study reviewing (n = 288) calls not forwarded to the on-call physician coded by category of harm and intervention required
Hogenbirk et al. (Hogenbirk and Pong, 2004)	TTAS	Nurse – general	"Regardless of their nature, assessing the appropriateness of the information provided is necessary to ensure that telephone health services meet acceptable standards." (pp. 53)	Audit of 73 tape recorded calls and print out of computerized call record by a multi-disciplinary team of 6 auditors for appropriateness of advice given
Holmström et al. (Holmström et al., 2019)	TTAS	Nurse specialist	Safety as failures and deviations from decision-support systems "Communication failure is the most common reason for patient safety risks and the most common cause of adverse events … Adverse events are related to medical errors or failures… (pp. 502).	Observations and interviews of 6 telenurses from 6 centres analysed using content analysis to ascertain factors that affect deviation from system
Holmström et al. (Holmström et al., 2016)	TTAS	Nurse – specialist	No definition	Descriptive, qualitative interviews with 10 older people about experiences of healthcare
Huibers et al. (Huibers et al., 2012)	OOH	Multiple professionals	Safety as timeliness: "Underestimated contacts… pose a risk to safety of telephone triage" (pp. 311)	Cross-sectional, observational study of responses to simulated patients presenting 20 vignettes; 304 audio-taped contacts analysed percentage of, and types of questions asked
Huibers et al. (Huibers et al., 2012)	OOH	Nurse – general	Safety as appropriateness: "telephone triage has an important role to guarantee accessible, efficient and safe care. Triage is the process of determining the medical urgency and ap- propriate type of health care required for patient telephone contacts." (pp. 547)	Secondary analysis of telephone triage consultations by nurses using a validated instrument to assess urgency, appropriateness of decisions
Inokuchi et al. (Inokuchi et al., 2021)	OOH	Nurse – general	No definition	Assessed appropriateness of urgency by determining undertriage (n = 263, 1.3 %) using doctor opinion and medical records

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Table 1 (*continued*)

Included study	Setting	Triage professional	Definitions of safety provided	Measurement(s) of safety used
Jácome et al. (Jácome et al., 2019)	TTAS	Nurse – general	No definition	Cross-sectional descriptive analysis of differences between level of concordance between users' intentions and nurse disposition
Kaminsky et al. (Kaminsky et al., 2014)	TTAS	Nurse – general	Equity as safety: "Embedded in patient safety is the law requirement of treating everyone fairly and equitably." (pp. 4)	Qualitative, exploratory study interviewing 23 managers using deductive directed content analysis;
Kempe et al. (Kempe et al., 2006)	OOH	Nurse – general	"Under-referral of a patient who is not recognized to be seriously ill and subsequently is hospitalized or experiences a poor outcome is the most serious possible consequence of signing out patients to a call center. (pp. 462)	Linked data study analysing paediatric patients, determined as under-referral using hospitalisation (under 24 h), compliance, and death within 1 month (n = 1); 56 patients were under-referred
Kempe et al. (Kempe et al., 2003)	OOH	Comparison of professionals	No definition, measures appropriateness	Appropriateness of disposition rated by 'expert panel' reviewing audio recordings of calls given a non-urgent disposition and then hospitalised within 24 h, as well as a survey of parents using service. 3 under-referrals identified by expert panel.
Knight et al. (Knight et al., 2015)	TTAS	Nurse – general	No definition provided	Qualitative study using nurse interviews, policy review and interviews with nursing directors to ascertain trade
Krumperman et al. (Krumperman et al., 2015)	EMS	Multiple professionals	No definition of safety, but alludes to adherence with instructions in two separate triage systems	Comparison of caller compliance and satisfaction with two types of assessment service; data and telephone survey
Lararère et al. (Labarère et al., 2003)	TTAS	Multiple professionals	Compliance and adverse events, "Adverse events were investigated by gathering deaths and attendance at EDs within 72 h of a contact." (pp. 289)	Cross-sectional telephone survey using a 16-item questionnaire including self-reported compliance
Leclerc et al. (Leclerc et al., 2003)	TTAS	Nurse – general	No definition, but investigating patient adherence	Comparison of self-reported advice from survey interviews and nurse data to identify false positives and false negatives
Lewis et al. (Lewis et al., 2021)	TTAS	Multiple professionals	Patient adherence with, and appropriateness of advice	Linked data study analysing routine dataset and subsequent ED attendance to assess appropriateness of, and compliance with advice
Mahmood et al. (Mahmood et al., 2017)	GPO	GP	No definition, but assesses timeliness	Retrospectives study assessing difference in wait times from first contact to clinic for cancer patients using normal triage or telephone triage
Marklund et al. (Marklund et al., 2007)	TTAS	Nurse – general	No definition provided	Appropriateness of advice and adherence measured by GP and nurse rating of quality of documentation; patient survey of intentions before and after the call
McDonald et al. (McDonald et al., 2021)	TTAS	Nurse – general	No definition provided	Retrospective, descriptive study using electronic health records to assess adherence to advice
McKenzie et al. (McKenzie and Williamson, 2016)	OOH	GP	No definition provided	Phenomenological approach to assess the 'essence' of being a telephone doctor
Mckinstry et al. (McKinstry et al., 2010)	GPO	GP	Refers to "important safety issues such as collecting sufficient information for diagnosis and making an appropriate management plan, although agreement on what constituted adequate "safety netting" was weaker." (pp. 301)	Analysis of 106 call recordings by 19 GPs against published criteria
McKinstry et al. (McKinstry et al., 2009)	GPO	Multiple professionals	Alludes to timeliness: "There is increasing international policy emphasis on timely patient access to health care … may be time inefficient in managing continuing illness… furthermore the safety of telephone consultations remains a major concern." (pp. e209)	15 focus groups held with multidisciplinary professionals and triangulated by a national questionnaire to understand safety, content and quality differences to face to face care
Meer et al. (Meer et al., 2012)	ED**	Comparison of professionals	AppropriatenessSafety as cases which could potentially have resulted in avoidable hazardous situation (AHS).	Prospective surveillance study comparing appropriateness of urgency assessments of 3 types of personnel by an expert panel
Montalto et al. (Montalto et al., 2010)	OOH	Multiple professionals	Safety as over- and under-triage "undertriage, other things being equal, may result in neglect of important or dangerous situations through either delay or non-attendance. Similarly, overtriage may result in increases in anxiety, costs and service utilisation, usually in the times when the health service is unable to respond fully." (pp. 8)	7 actors simulated 7 different patient scenarios over 60 calls validated by clinical experts to determine appropriateness
Morgan & Muskett (Morgan and Muskett, 2020)	TTAS	Multiple professionals	"A serious incident, or an incident requiring investigation, is defined as an incident that occurred in relation to NHS-funded services and care resulting in unexpected or avoidable death, harm or injury to patient, carer, staff or visitor (NHS England)." (pp. 4)	Conversation analysis of a corpus of routinely-recorded NHS 111 telephone conversations including all serious incidents from 2 years prior to data collection and a sample of other calls to assess interactional misalignment
Morreel et al. (Morreel et al., 2022)	TTAS	Non-clinical call handler	Accuracy of telephone triage measured by sensitivity and specificity	Real-time simulation whereby patients were directed to telephone triage followed by questionnaire on appropriateness of advice by GPs against contact centre data
Morreel et al. (Morreel et al., 2020)	TTAS	Not specified	Appropriateness of urgency level	Single centre prospective study using simulated patients using vignettes (Huibers et al., 2011) presented to 12 call handlers (120 phone calls total) compared to GP as gold standard
Murdoch et al. (Murdoch et al., 2015)	GPO	Nurse – general	No safety definition	Conversation analysis of 47 audio-recordings while nurses use a CDSS to study effect of CDSS on nurse-patient interactions

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Table 1 (*continued*)

Included study	Setting	Triage professional	Definitions of safety provided	Measurement(s) of safety used
Mudoch et al. (Murdoch et al., 2014)	GPO	Comparison of professionals	No definition of safety provided	Qualitative comparative study of content and form of questions in 51 telephone triage encounters between GPs, nurses and patients seeking a same-day appointment
Niemann et al. (Niemann et al., 2004)	TTAS	Patients?	Adherence	Interviews with (x) patients about their compliance with advice from telephone triage calls
North & Varkey (North and Varkey, 2010)	TTAS	Nurse – general	"Adverse events such as deaths following telephone triage calls are rare, suggesting that the process is basically safe. However, if calls tend to concern mostly minor illnesses, then adverse events following calls would be uncommon even if the triage process itself was flawed." (pp. 383)	Investigates rate of hospitalisation up to 72 h following triage calls compared to ED and doctor office visits using a linked data set.
O'Cathain et al. (O'Cathain et al., 2003)	TTAS	Nurses – general	Refers to quality, rather than safety and consistency of decisions by nurses	Sensitivity and specificity of CDSSs involved in triage measured by 119 scenarios constructed based on low priority calls
O'Connell et al. (O'Connell et al., 2002)	TTAS	Nurses – general	Adherence with recommendations	Adherence with advice given by telephone triage nurses using claims data of (n = 22998) patients and their linked call records
Pasini et al. (Pasini et al., 2015)	OOH	GP	No definition of safety provided	Proportion of compulsory questions the call handler asked compared to the questions on a standard reference lists, proportion of correct decision made by the call handler and length of call for four simulated clinical cases used in Incognito Standardized Patient method
Philips et al. (Philips et al., 2015)	GPOOH	Comparison of professionals	No safety definition provided but alludes to appropriateness	Observational, explorative study investigating untrained secretaries urgency levels as compared to GPs as the "silver standard" and calculations of percentage over- and under-triage
Richards et al. (Richards et al., 2004)	GPO	Multiple professionals	"quality indicators, such as accuracy of problem identification and impact on patient discomfort of decisions taken by nurses during telephone triage…, no studies have investigated the accuracy of such a system in identifying inadequate information-gathering or decision-making and the likelihood that such a system would reliably identify issues for training, supervision and clinical governance." (pp. 552–553)	Observational study of 218 calls where GPs and nurse practitioners rated quality on a scale of 1–5 including appropriateness of outcome from 1 = potentially dangerous to 3 = safe and appropriate.
Röing et al. (Röing et al., 2013)	TTAS	Nurses – general	"Patient safety is defined as 'protection from care injury' and patient safety work as 'work aiming at enhancing patient safety by analysing, determining and obviating causes of risks, adverse events and negative events' (Poots et al., 2024)" (pp. 969)	Descriptive, qualitative study of 12 nurses, 6 were interviewed using stimulated recall and 6 in a reference group to ascertain the core aspect of the call and how it was done with reference to patient safety.
Röing & Holmström (Röing and Holmström, 2015)	TTAS	Multiple professionals	"malpractice claims within Swedish Healthcare Direct, the national telephone helpline in Sweden. At least 33 claims of malpractice have been filed since the service was created in 2003. Although a low number, consequences have been tragic. Research in Swedish telenursing on contributing systemic and organizational factors and consequences of malpractice claims is sparse." (pp. 35)	Interviews with triage professionals involved in malpractice claims to explore the thoughts, feelings, and experiences of the telenurses and managers.
Roivainen et al. (Roivainen et al., 2020)	TTAS	Nurses – general	No definition provided	Prospective observational study using hospital records, database and nurse survey to analyse call back times and the influence on adverse events
Sakurai et al. (Sakurai et al., 2014)	TTAS	Nurses – general	"Refusal was defined as a patient's refusal to comply with a recommendation from a nurse indicated by the protocol." (pp. 236)	Exploratory study where physicians reviewed problems with triage of 1205 classified non-urgent patients, of which 86 had an outcome of hospitalisation, referral or transfer. There were 11 cases in which patients refused to comply with triage recommendation.
Sax et al. (Sax et al., 2018)	TTAS	Comparison of professionals	No definition of safety	Retrospective population-based cohort study of a natural experiment where extended wait times were routed to nurse. Compared suggested outcomes for nurses and doctors, and 7-day and 30-day all cause mortality rates
Schoenmakers et al. (Schoenmakers et al., 2021)	TTAS	Multiple professionals	Defines a triage protocol as "safe when the rate of under-triage is less than 15 %" (pp.2)	Cross-sectional design involving patients, GP cooperatives and telephone operators. A random sample of calls and referrals were assessed for efficiency and safety using a standard template
Siddiqui et al. (Siddiqui et al., 2020)	TTAS	Multiple professionals	No definition	Data linkage study of compliance with advice given by telephone triage, which could be a "clinical risk".
Smith (Smith, 2010)	TTAS	Nurses – General	Assessed safety of a specific algorithm for crying babies	Focus group with professionals about the safety of the algorithm
Smits et al. (Smits et al., 2016)	GPO	Other	Safety as unsafe triage decisions: "To be able to evaluate the safety of triage (i.e. potential unsafe triage decisions), we deliberately included more highly urgent case scenarios than actually occur." (pp. 30)	Cross-sectional observational study using a web-based survey including scenarios with various health problems and levels of urgency and comparison with standard developed by professional expert panel. Measured safety as over-estimation (specificity) and under-estimation (sensitivity) of urgency.

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Table 1 (*continued*)

Included study	Setting	Triage professional	Definitions of safety provided	Measurement(s) of safety used
Smits et al. (Smits et al., 2017)	GPO	Multiple professionals	Safety is ""identifying patients in need of immediate care" (pp. 2)	Tested the validity of an instrument developed by Delphi panel to assess quality of telephone triage, including safety
Snooks et al. (Snooks et al., 2009)	TTAS	Multiple professionals	No definition	Questionnaire study to patients and a panel of experts using rule-based guidance and assessment of transcripts
Søvsø et al. (Søvsø et al., 2019)	OOH	Multiple professionals	No definition provided	Population-based observational cohort study assessing mortality 1-day and 1–30 days after a hospital contact, probability of ICU stay during hospital stay, and length of hospital stay associated with OOH contact for 6826 patients with illnesses of interest (e.g., stroke, sepsis) and making first contact.
Søvsø et al. (Søvsø et al., 2020)	OOH	Multiple professionals	No definition provided	Population-based observational cohort study of patients with contact to EMS or OOH-PC, and short (<24 h) hospital contacts or admissions (>24 h) on the date of the OOH service contact
Sprivulis et al. (99 I.)	TTAS	Nurses – general	No definition provided – investigates compliance	Compliance rates, triage distributions and admission rates were determined using linked data
St George et al. (St George et al., 2009)	TTAS	Nurses – general	No definition but refers to clinical safety, risk incidents and accuracy of triage	Retrospective review of existing clinical and other data to compare nurses working from home and call centre using mystery callers presenting vignettes
St George et al. (St George et al., 2005)	TTAS	Comparison of professionals	No definition provided	Retrospective analysis of 90 symptomatic calls to a telephone triage line by three GPs as gold standard, blinded to advice given; used median to assess variation among doctors. One review deemed a risk to callers due to nurse error.
Staub et al. (Staub et al., 2013)	TTAS	Other	No definition but alludes to appropriateness and quality	Retrospective comparison of point-of-care and time-to-treat recommendations of a protocol with actual recommendations of trained physicians using record review of 96 cases
Tariq et al. (Tariq et al., 2016)	GPOOH	GP	No definition provided	Detailed descriptive statistical analysis of medication-related queries received by the after-hours GP helpline and the caller's intentions and adherence to advice
Thilsted et al. (Thilsted et al., 2018)	TTAS	Not specified	No definition but suggests degree of worry "as an additional tool… could aid determination of urgency and type of healthcare needed, potentially increasing patient safety" (pp. 1)	Convergent parallel mixed methods design deploying a rating scale to record degree of worry and qualitative data using the common-sense model of regulation
Thylén et al. (Thylén et al., 2015)	TTAS	Nurses – general	No definition but alludes to timeliness	Multicentre descriptive, cross-sectional design of self-reported data of 445 patients hospitalised with Segment Elevated Myocardial Infarction (heart attack) including timeliness and mode of transport
Tran et al. (Tran et al., 2017)	TTAS	Multiple professionals	"Non-compliance with advice to attend ED care has the potential for serious adverse health outcomes for patients." (pp. 11)	Observational follow-up study using data linkage from records of calls, ED presentations, hospital admissions and medical consultation claims, and association with caller and call characteristics
Turnbull et al. (Turnbull et al., 2012)	TTAS	Non-clinical call handler	No definition but describes the role of CDSS in safe care: "Call-handlers are often portrayed by policy-makers and service providers as trained 'users' of technology whose role is to capture the information needed for the CDSS to reach safe and effective decisions. However, these staff are now making decisions, supported by CDSS, about how quickly" (pp. 234)"	Comparative case analysis of non-clinical call-handlers' use of a CDSS to triage calls using survey and ethnographic methods in three settings.
Valanis et al. (Valanis et al., 2003)	TTAS	Nurses – general	No definition	Exploration of factors likely to influence call outcomes using call description information and interpersonal communication features from a sample of 1 to 2 h of calls, in addition to manager checklists and focus groups.
Valanis et al. (Valanis et al., 2003)	TTAS	Nurses – general	No definition	Four-phase study examining the relationships of caller, nurse and system characteristics to telephone nursing advice outcomes to build a framework
Vilstrup et al. (Vilstrup et al., 2019)	OOH	Comparison of professionals	"According to the WHO, patient safety can be defined as the absence of preventable harm to a patient during the process of healthcare and reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum" (pp. 1)	Observational study of 200 audio-recorded telephone triage conversations randomly selected to assess call duration and affect e.g. empathic response
Wahlberg et al. (Wahlberg et al., 2003)	TTAS	Nurses – general	No definition provided	3-round Delphi Study to identify biggest problems for telephone triage
Wouters et al. (Wouters., 2020)	OOH	Not specified	No definition but alludes to timeliness and incident rate i. e., "The Dutch triage system is overall safe with only 0.006 % calamities a year, but this incidence is higher with around 0.03 % in the do- main of chest discomfort." (pp.474)	Cross-sectional study of 1655 recordings of telephone conversations of patients who called an out-of-hours service with symptoms of acute coronary syndrome for call time, patient characteristics, symptoms, medical history and urgency and final diagnosis of each call from GP.
Wouters et al. (Wouters et al., 2020)	OOH	Nurses – general	No definition, but refers to "safety culture" (pp. 1183)	Qualitative study using audio-stimulated recall interviews with 24 telephone triage nurses and analysis using grounded theory.

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Table 1 (*continued*)

Included study	Setting	Triage professional	Definitions of safety provided	Measurement(s) of safety used
Xu et al. (Xu et al., 2004)	GPO	GP	No definition provided	Comparison of patient reported symptoms (n = 22) over the telephone with doctor reported symptoms and a clinical test.

telemedicine because of the COVID-19 pandemic.

3.2. Study characteristics

Full details of triage settings, and qualifications of triage staff can be found in Supplementary Material A. Most productive research countries were the UK (n = 19), Netherlands (n = 14), and USA (n = 13). Study settings were most often telephone triage and advice services (TTAS; n = 52), followed by Out-of-Hours services (OOH; n = 25). Nurse-led triage was the most common model (n = 42). Only two studies (Turnbull et al., 2012; Morreel et al., 2020) focused on non-clinical staff. Eight articles did not state the qualifications of triage professionals.

3.3. Definitions and measurements of safety

The first aim of this review was to identify definitions and indicators of safety used previously. Details were extracted from introductions and methods sections, coded, and grouped thematically. Although identified as measuring safety related outcomes, twenty-nine articles did not explicitly state a definition of safety.

3.4. Explicit references to safety

Those articles referring to safety often referred to adverse events (n = 10), using generic definitions of safety as the 'absence of harm', including the World Health Organization or national health system definitions (n = 3; (Morgan and Muskett, 2020; Erkelens, 2020; Vilstrup et al., 2019). Three papers referred to human error (Allan et al., 2014; Ernesäter et al., 2010; Röing and Holmström, 2015) and two referred to the presence/absence of safe decisions (Smits et al., 2016; Turnbull et al., 2012). Very few articles utilised actual adverse event data to measure or learn about safety (n = 5). Some relied on call recordings to investigate the effects of communication or technology on safety (e.g., (Morgan and Muskett, 2020; Ernesäter et al., 2014). One study analysed incident reports to identify contributory factors (Ernesäter et al., 2010). Two studies tailored a specific definition of safety for telephone triage, which was coded as "right care, right place, right time" (Bogdan et al., 2004; Brasseur et al., 2021), suggesting timeliness and appropriateness are also important for safety.

Two studies measured safety as hospitalisation, and this ranged from within 48 h of a call (Gamst-Jensen et al., 2020) to within 72 h of a call (North and Varkey, 2010). Mortality was also used as an indicator, ranging from within 72 h of a call (Labarère et al., 2003) up to 30 days after the initial call (Sax et al., 2018). Given the focus of the review is non-emergency care, many calls included in the studies refer to minor symptoms and therefore this measurement may lack sensitivity to less safe care or caller deterioration. North and Varkey (North and Varkey, 2009) describe this problem:

> *"adverse events such as deaths following telephone triage calls are rare, suggesting that the process is basically safe. However, if calls tend to concern mostly minor illnesses, then adverse events following calls would be uncommon even if the triage process itself was flawed" (2009, p. 383).*

3.5. Alternative definitions and indicators

Table 2 lists the themes relating to other definitions of safety. Most often (n = 15), studies referred to 'appropriateness' (of advice, diagnosis, or referral option offered). Similarly, eight articles referred explicitly to 'under-' or 'over-triage' where the advice was deemed inappropriate for the patient's needs (either wasteful, or unsafe). Appropriateness was often measured using a 'gold' or 'silver standard' (i.e., judged by a doctor or nurse, e.g., (Al-Abdullah et al., 2009). Designs using such standards varied in terms of the number of experts, whether evaluations were subjective or based on checklists (and how those checklists were developed), and whether evaluations took place retrospectively or in-situ by using standardised vignettes or patients (e.g., (Huibers et al., 2012; Morreel et al., 2020; St George et al., 2009). Two studies compared triage decisions with clinical tests (Allen-Davis et al., 2002; Xu et al., 2004). The variation in measurement of these outcomes highlight potential biases in studying triage appropriateness, accuracy, and difficulties in comparing findings across studies.

Table 2
Themes relating to definitions of safety identified and number of articles.

Themes relating to definitions of patient safety in telephone triage	Number of articles reporting
No definition provided	29
Appropriateness (of disposition, diagnosis, or referral)	15
Patient compliance/adherence with advice	12
Adverse events	10
Timeliness of triage decision	9
Under and over-triage	8
Death of patients	7
Harm to patients	3
Underestimation of urgency	3
Accuracy of diagnosis/referral	3
Human error	3
"Right place, right time"	2
Hospitalizations following triage	2
Safe decision-making	2
Identification of needs	2
Consistency between triage professionals	2
Appropriateness of upgrade	1
Sensitivity and specificity of an algorithm	1

Patient compliance (n = 12) in which researchers measured whether callers actioned suggested advice was the third most common theme. This has been measured using interviews/surveys with patients (Niemann et al., 2004; O'Connell et al., 2002; O'Connell et al., 2002), expert opinion (Hogenbirk and Pong, 2004; Sakurai et al., 2014), or linked data from calls, medical, or insurance data (Inokuchi et al., 2021; Jácome et al., 2019; Kempe et al., 2006; McDonald et al., 2021; Sprivulis et al., 2004), or a combination (Krumperman et al., 2015; Tran et al., 2017).

A full list of definitions themes and measures are outlined in Tables 2 and 3, respectively.

3.6. Contributory factors

The second review aim was to identify potential contributory factors to safety from the included studies, to develop a preliminary framework to enhance incident investigation. Table 4 details the number of articles referring to themes grouped by using SEIPS 2.0 (Holden et al., 2013). Table 5 identifies the contributory factors categories and themes derived from each paper.

Most articles focused on individual factors, which were divided into call-handler and caller, to reflect the difference in respective tasks and work system components (e.g., environment). Caller factors were most frequent (n = 21 themes), for example, demographics, high acuity

Table 3
Themes relating to methods used to measure safety.

Methods used to measure safety	Number of articles reporting
Linked data	28
Expert judgement	14
Checklists (e.g., of diagnostic questions)	10
Standardized patients e.g., vignettes	8
Patient survey/interview	7
Content analysis of incidents or calls	5
Call data	5
Adverse event rate	5
Stimulated recall of specific events	2
Focus group	2
Delphi study	2
Conversation analysis of recorded calls	2
Clinical test	2
Observations	1
Interviews with staff	1
Experiments	1

Table 4
Number of articles referring to contributory factors by SEIPS work system categories.

SEIPS 2.0 work system contributory factors	Number of articles	Number of final subthemes (i.e. contributory factors)
Call-handler	39	17
Caller	47	21
Tools and technology	35	17
Physical environment	6	5
Organisational conditions	30	9
Task conditions	28	11
External Environment	30	11

Table 5 shows the contributory work system factors categories synthesized from individual journal articles.

symptoms. Call-handler factors included 'seeking a second opinion if in doubt', 'differences in perception of safety'. Tools and technology factors included themes relating to technology training, availability of Supporting Information, malfunctioning technology. Task conditions themes related to task complexity (e.g. increasing complexity with symptoms and communication difficulties) and using paralanguage. The external environment factors included demand for the service and organisation of the health system. Very few articles considered the role of the physical environment on safety (e.g., noise levels). Whilst 30 articles referred to organizational conditions, few themes were generated, suggesting heterogeneity (e.g., Staffing, job demands). Supplementary Material B provides a list of the subthemes identified.

4. Discussion

Summary of evidence

This evidence synthesis addresses previous review concerns regarding telephone triage safety, particularly the lack of a definition (Huibers et al., 2011; Lake et al., 2017) and challenges with using metrics like hospitalisation (North and Varkey, 2010) for non-emergency telephone triage. Given the myriad indicators identified in this review, it seems reductionist to define and measure safety using only one indicator. Whilst two articles proposed definitions of "right care, right place, right time" (Bogdan et al., 2004; Brasseur et al., 2021), this still neglects to recognise the role of the patient in their care. We propose "*actionable, appropriate, and timely care, avoiding unavoidable deterioration or harm*" as a working definition for telephone triage safety, given the increased patient-professional collaboration required and to acknowledge that minor symptoms may not lead directly to serious harm, but to deterioration. The many indicators of safety and quality identified can be used by researchers and primary/integrated care practitioners to evaluate services, depending on the resources available. Future research should seek to investigate how these can best by 'optimised' using systems-oriented research methods (Dul et al., 2012). Research which analysed experienced adverse events was limited and could be a starting point for future research (Ernesäter et al., 2010). This likely requires collaboration between organisations providing and investigating telephone triage and Human Factors and Ergonomics researchers. This can be challenging due to the practicalities of data sharing between organisations, which requires much preparation (Healthcare Safety Investigation Branch, 2022).

Following previous research which suggested incident investigation frameworks designed for face-to-face care may not adequately uncover contributory factors in remote healthcare systems (Morgan et al., 2016), the contributory factors synthesised here provides a basis for designing an expert-validated contributory factors framework to support system investigation and improvement (Poots et al., manuscript in progress). Moreover, it is hoped the themes generated provide a catalyst for future human factors research in telephone triage and other telemedicine innovations as healthcare gets increasingly closer to home (NHS, 2015). This is particularly important as new technologies are introduced into triage systems, for example, machine learning (Inokuchi et al., 2021). Clear starting points based on the quantity of literature available, and themes generated in this review, are the effect of the physical environment and organisational conditions on call handler performance and resulting safety outcomes. Randomised controlled trials in call centres altering physical or organisational conditions could be conducted to analyse effects on performance, measured as cognitive readiness, or cognitive load. A similar methodological approach has been used to investigate the effectiveness of a social support intervention on staff resignations and burnout (Linos et al., 2022).

There are limitations to the present review. Firstly, given the limited telephone triage research literature available (Poots et al., 2024), the exploratory nature of the review, and since a planned Delphi study with experts assessed the generalisability of the findings, no studies were excluded based on quality or research design. Whilst this is useful to increase discoverability of relevant articles, since the research corpus has increased since the COVID-19 pandemic (Poots et al., 2024), future evidence syntheses may wish to narrow inclusion criteria, to compare findings and draw inferences about the safety of telephone triage systems using specific indicators or definitions, e.g. through *meta*-analytic methods. Given the increase in research outputs since the pandemic, the present review covering research from 2002 to 2022 may omit relevant studies. Therefore, searches were run again in Scopus in May 2025. Over 400 papers were identified which had been published since 2022 however, when the search was limited to primary and urgent care, only 58 articles remained, suggesting telephone triage research in primary and urgent care settings is still limited. Secondly, since most of the research is from western countries, and the lead authors are European, it is important to consider whether the findings might transfer to developing countries, given the stark contrast in healthcare delivery, availability of telehealth, size, relative wealth and rurality of population. Future collaborations with experts in developing countries could explore the key differences and broaden the themes synthesised here.

There is a clear gap in the evidence base of articles which reviewed actual adverse events and near misses which ought to be addressed. Many healthcare systems routinely, and mandatorily, review incidents, near misses, and patient feedback. This means there may be a "file drawer" effect, whereby, there is useful safety evidence inside organisations which is not shared for the purposes of generating generalisable knowledge through research. Using actual safety incidents can enable other organisations to change systems and processes before an incident happens. Examples of methodologies from the yielded studies included stimulated recall using recordings (Röing and Holmström, 2015), and systems analyses of incidents (Gamst-Jensen et al., 2017). These types of studies require collaboration between academics and practitioners and leaders in telehealth organisations.

Table 5
Contributory factors to safety identified using Best-Fit Framework Synthesis. SEIPS 2.0 (Holden et al., 2013) was the framework used.

Included study	Work system components						
	Person – Caller	Person – Call handler	Tools/ Technology	Organisational Conditions	Task conditions	Physical Environment	External Environment
Al-Abdullah et al. (Al-Abdullah et al., 2009)		x					
Allan et al. (Allan et al., 2014)				x			
Allen-Davis et al. (Allen-Davis et al., 2002)		x	x		x		
Bogdan et al. (Bogdan et al., 2004)	x				x		x
Boutin et al. (Boutin et al., 2006)		x			x		x
Brasseur et al. (Brasseur et al., 2021)	x	x	x				
Campbell et al. (Campbell et al., 2014)		x		x			
Cook et al. (Cook et al., 2010)		x		x			x
Dale et al. (Dale et al., 2003)	x	x					
Dale et al. (Dale et al., 2004)	x	x	x				x
Derkx et al. (Derkx et al., 2008)		x	x				
Derkx et al. (Derkx et al., 2010)		x			x		
Eastwood et al. (Eastwood et al., 2020)	x						x
Erkelens et al. (Erkelens et al., 2020)	x			x	x		
Erkelens et al. (Erkelens et al., 2020)		x					x
Erkelens et al. (Erkelens et al., 2020)		x					
Erkelens et al. (Erkelens et al., 2020)	x		x		x		
Erkelens et al. (Erkelens et al., 2021)			x		x		
Ernesäter et al. (Ernesäter et al., 2016)	x		x				
(Ernesäter et al., 2010)			x	x	x		x
Ernesäter et al. (Ernesäter et al., 2010)					X		
Gamst-Jensen et al. (Gamst-Jensen et al., 2017)	X	X			X	X	
Gamst-Jensen et al. (Gamst-Jensen et al., 2020)	X		X				
Gamst-Jensen et al. (Gamst-Jensen et al., 2021)	x						
Giesen et al. (Giesen et al., 2007)		x	x				
Grant et al. (Grant et al., 2002)							X
Graversen et al. (Graversen et al., 2020)		X					
Graversen et al. (Graversen et al., 2019)		X	X		X	X	
Gren et al. (Gren et al., 2022)	X						
Haimi et al. (Haimi et al., 2020)	X	x	X	X	X		X
Hayward et al. (Hayward et al., 2017)				X			x
Hildebrandt et al. (Hildebrandt et al., 2006)	X		X				
Hogenbirk et al. (Hogenbirk and Pong, 2004)		X					
Holmström et al. (Holmström et al., 2019)	X	X	x	X	X		
Holmström et al. (Holmström et al., 2016)						x	
Huibers et al. (Huibers et al., 2012)			X		X		
Huibers et al. (Huibers et al., 2012)	X				X		
Inokuchi et al. (Inokuchi et al., 2021)	X						
Jácome et al. (Jácome et al., 2019)	X						x
Kaminsky et al. (Kaminsky et al., 2014)				x			x
Kempe et al. (Kempe et al., 2006)	x						
Kempe et al. (Kempe et al., 2003)	X	x		x	x		
Knight et al. (Knight et al., 2015)	x	x	x	x			
Krumperman et al. (Krumperman et al., 2015)	X	x		x			
Lararère et al. (Labarère et al., 2003)							
Leclerc et al. (Leclerc et al., 2003)	x						
Lewis et al. (Lewis et al., 2021)	X	x					x
Mahmood et al. (Mahmood et al., 2017)							
Marklund et al. (Marklund et al., 2007)	x						
McDonald et al. (McDonald et al., 2021)	x						X

(continued on next page)

Table 5 (*continued*)

Included study	Work system components						
	Person – Caller	Person – Call handler	Tools/ Technology	Organisational Conditions	Task conditions	Physical Environment	External Environment
McKenzie et al. (McKenzie and Williamson, 2016)			X	X		X	X
Mckinstry et al. (McKinstry et al., 2010)							
McKinstry et al. (McKinstry et al., 2009)	X	x	X		X	X	X
Meer et al. (Meer et al., 2012)	X	X					
Montalto et al. (Montalto et al., 2010)	X		X	X	X		x
Morgan & Muskett (Morgan and Muskett, 2020)	X	X	x		X		
Morreel et al. (Morreel et al., 2022)					x		
Morreel et al. (Morreel et al., 2020)	x						
Murdoch et al. (Murdoch et al., 2015)			X		x		
Mudoch et al. (Murdoch et al., 2014)		X	x		X		
Niemann et al. (Niemann et al., 2004)	X						
North & Varkey (North and Varkey, 2010)	X						
O'Cathain et al. (O'Cathain et al., 2003)			X				
O'Connell et al. (O'Connell et al., 2002)	X						
Pasini et al. (Pasini et al., 2015)				X	x		
Philips et al. (Philips et al., 2015)	X	X			x		x
Richards et al. (Richards et al., 2004)		X	x		X		
Röing et al. (Röing et al., 2013)	X	x	x	x	X		x
Röing & Holmström (Röing and Holmström, 2015)	X	X		X	X	X	x
Roivainen et al. (Roivainen et al., 2020)							
Sakurai et al. (Sakurai et al., 2014)	x		x				x
Sax et al. (Sax et al., 2018)		x					x
Schoenmakers et al. (Schoenmakers et al., 2021)		x	x	x			x
Siddiqui et al. (Siddiqui et al., 2020)							
Smith (Smith, 2010)	X	x	x	x			
Smits et al. (Smits et al., 2016)		X	X	X	X		
Smits et al. (Smits et al., 2017)		x	X	x	X		
Snooks et al. (Snooks et al., 2009)							
Søvsø et al. (Søvsø et al., 2019)	x						X
Søvsø et al. (Søvsø et al., 2020)	X						
Sprivulis et al. (99 I.)							
St George et al. (St George et al., 2009)						X	
St George et al. (St George et al., 2005)		X	x				
Staub et al. (Staub et al., 2013)	x		X				X
Tariq et al. (Tariq et al., 2016)							
Thilsted et al. (Thilsted et al., 2018)	x		x				x
Thylén et al. (Thylén et al., 2015)	x						x
Tran et al. (Tran et al., 2017)	x						x
Turnbull et al. (Turnbull et al., 2012)		x	X	x	X		
Valanis et al. (Valanis et al., 2003)				x		x	x
Valanis et al. (Valanis et al., 2003)	x	x	x	x		x	
Vilstrup et al. (Vilstrup et al., 2019)		x	x		x		
Wahlberg et al. (Wahlberg et al., 2003)	x			x	x		x
Wouters et al. (Erkelens., 2020)	x						
Wouters et al. (Wouters et al., 2020)	X	X	X	X	x		x
Xu et al. (Xu et al., 2004)			x				

*indicates these articles did not identify any work system factors but were included in systematic review. They may have identified processes which are outside the scope of this review.

5. Conclusion

There is a need to advance telephone triage safety research further using a systems approach, and learning from actual adverse events and incidents. This review provides academics, clinicians, manager and policymakers with indicators to measure safety, and contributory factors to consider, to enhance organisational learning and improve safety outcomes.

CRediT authorship contribution statement

Jill Poots: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Jim Morgan: Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Conceptualization. **Matteo Curcuruto:** Writing – review & editing, Supervision, Methodology, Formal analysis. **Stephen Elliott:** Writing – review & editing, Supervision, Methodology. **Andrew Catto:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssci.2025.106967.

Data availability

I have attached relevant supplementary materials which provide details of the secondary data used for this study. Additional information can be made available on request to authors.

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