Tools for 'safety netting' in common paediatric illnesses: a systematic review in emergency care

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ABSTRACT

Context Follow-up strategies after emergency department (ED) discharge, alias safety netting, is often based on the gut feeling of the attending physician.

Objective To systematically identify evaluated safety-netting strategies after ED discharge and to describe determinants of paediatric ED revisits.

Data sources MEDLINE, Embase, CINAHL, Cochrane central, OvidSP, Web of Science, Google Scholar, PubMed.

Study selection Studies of any design reporting on safety netting/follow-up after ED discharge and/or determinants of ED revisits for the total paediatric population or specifically for children with fever, dyspnoea and/or gastroenteritis. Outcomes included complicated course of disease after initial ED visit (eg, revisits, hospitalisation).

Data extraction Two reviewers independently assessed studies for eligibility and study quality. As meta-analysis was not possible due to heterogeneity of studies, we performed a narrative synthesis of study results. A best-evidence synthesis was used to identify the level of evidence.

Results We summarised 58 studies, 36% (21/58) were assessed as having low risk of bias. Limited evidence was observed for different strategies of safety netting, with educational interventions being mostly studied. Young children, a relevant medical history, infectious/respiratory symptoms or seizures and progression/persistence of symptoms were strongly associated with ED revisits. Gender, emergency crowding, physicians' characteristics and diagnostic tests and/or therapeutic interventions at the index visit were not associated with revisits.

Conclusions Within the heterogeneous available evidence, we identified a set of strong determinants of revisits that identify high-risk groups in need for safety netting in paediatric emergency care being related to age and clinical symptoms. Gaps remain on intervention studies concerning specific application of a uniform safety-netting strategy and its included time frame.

What is already known on this topic

- The importance of safety netting after emergency department (ED) discharge to monitor disease course is well recognised and applied.
- Evidence-based approaches on this topic are underexposed in literature, since strategies are often based on the gut feeling of the ED physician.

What this study adds

- It remains difficult to determine high-risk patient groups for whom safety netting is essential.
- Studies concerning follow-up were mostly conflicting or with limited evidence.
- Young children, medical history, infectious/respiratory symptoms, seizures and progression/persistence of symptoms were the strongest associated determinants of revisits.

INTRODUCTION

When patients are discharged from the emergency department (ED) without definite diagnosis, monitoring children's course of disease to rule out serious infections is mandatory.[1] This theme is covered by the term 'safety netting', introduced to general practice in 2004 by Roger Neighbour who considered it a core component of general practice consultation.[2] Safety netting can be described as a set of procedures or guidelines, which should be followed when a patient is discharged from the ED. This strategy is required in situations with increased risk for serious complications, either in the diagnosis itself (eg, dehydration in patients with gastroenteritis) or if individual patient characteristics are associated with a high risk of complications (eg, significant comorbidity or immunosuppressive therapy).[1] Patients who revisit the ED may be regarded as the high-risk population of possible failure of this safety-netting strategy.

The importance of safety netting is increasingly recognised in emergency care and literature.[3] Healthcare physicians lack standardised safety-netting methods since strategies are often based on the gut feeling of the ED physician,[4] and key gaps are described in need of studies on methods and effects of safety netting.[3 5] Therefore, we planned to systematically review the literature on this important topic.

Our first aim was to systematically summarise evaluated safety-netting strategies after ED discharge. Second, we identified children at risk for revisits to improve the identification of children prone to deteriorate after emergency discharge, by studying determinants of ED revisits. Both aims were studied in the total ED population or specifically for children with common illnesses as fever, dyspnoea and gastroenteritis.

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METHODS

Inclusion criteria

We considered all types of studies eligible if they reported about safety netting and/or their strategy after ED discharge and extended our search for determinants of ED revisits as a proxy of failing safety-netting strategies. We included studies on the total ED population or specific for children with fever, dyspnoea and gastroenteritis. Studies reporting data on adult and children together as well as studies in low-income countries, due to differences in healthcare organisation, were excluded. Two reviewers independently assessed inclusion (EdV-K and MW); discrepancies were resolved by a third reviewer (RO).

Outcome measures

Outcomes included complicated course of disease after initial ED visit, mainly dominated by revisits and hospitalisation.

Search strategy

We searched the following electronic databases: MEDLINE OvidSP, Embase (Excerpta Medica dataBASE), CINAHL (Cumulative Index to Nursing and Allied Health Literature), Cochrane central register of controlled trials, Web of Science, Google Scholar and PubMed as publisher (searches updated in January 2014) (see online supplementary information 1). We checked the reference list of these papers for additional articles that were not included in the initial computerised search.

Data extraction

We retrieved the full text copies of all articles identified as potentially relevant by reviewing the abstracts of search results. Two reviewers' extracted data on the following: study design, disease/working diagnosis, study population, number of revisits, follow-up period and type of revisit. The determinants were grouped into: child characteristics, social/demographics, disease characteristics, physician and process characteristics. Finally, data on follow-up after ED discharge, including the follow-up strategy, were extracted.

Risk-of-bias assessment and best-evidence synthesis

Two authors (EdV-K/DHFG) independently assessed the potential risk of bias of the studies included using the *MINORS*, a methodological index for non-randomised studies,[6] together with the presence of revisits as primary outcome measure and the number of events (see online supplementary information 2). Consensus was reached by the two reviewers (EdV-K/DHFG); otherwise, the independent opinion of a third reviewer was decisive (RO).

We performed two separate 'best-evidence' syntheses based on the study of van Tulder *et al*;[7] one according to safety-netting strategies and one according to determinants of revisits as meta-analysis of results was not possible owing to heterogeneity in participants, interventions, outcome measures and methodological quality[7] (see online supplementary information 2).

RESULTS

Identification and selection of the literature

The literature search identified 2604 references (figure 1). Overall, 36 of 83 full text articles screened for eligibility were excluded on the basis of incorrect study aims, data on adult patients, reviews or low-income populations. Data extraction was performed for 58 articles, including 11 articles added from reference lists. Forty two articles described determinants of revisits, and 18 articles *(2 articles duplicate)* reported on follow-up after ED discharge (figure 1).

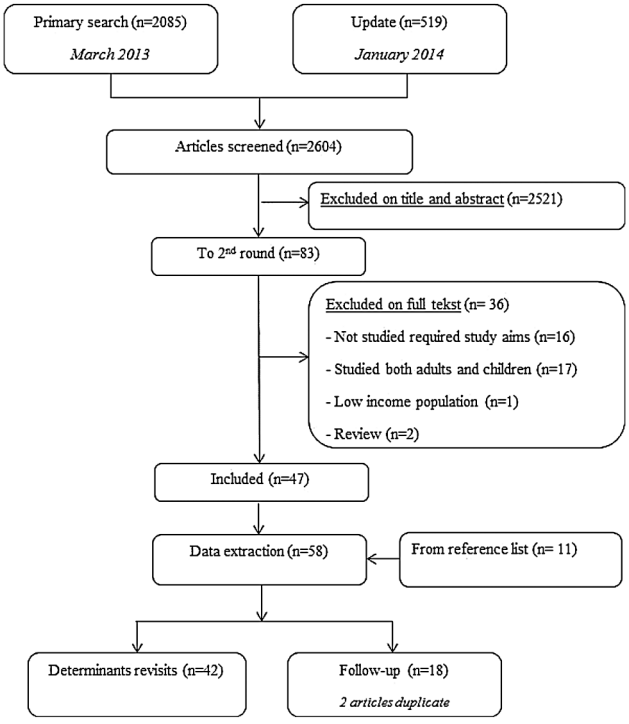

Figure 1 Flowchart of the study selection and exclusion stages during the systematic review process.

Description of included studies

Study characteristics are presented in tables 1 and 2. Included studies were mostly cohort studies (72%, n=42). Fifty two per cent (n=30) of the studies originated from the USA and 19% (n=11) from the UK. Year of publication varied between 1995 and 2013, with 33% (n=19) published in the last 2 years. Most studies (n=34) included all children presented to the ED or the most common paediatric illnesses; 14 studied febrile children and 10 studies reported specific diseases only (eg, gastroenteritis, influenza, respiratory tract infections). Study populations varied between 13 and 568 845 children (median: n=1371) and number of events (revisits or hospitalisation after revisit) varied between 9 and 36 734 (median: n=189). Follow-up period after ED discharge varied between 1 and 656 days (median: 3 days). Most studies (n=29, 50%) described scheduled and unscheduled revisits together; 19 (33%) only measured unscheduled revisits (tables 1 and 2).

Risk-of-bias assessment

Online supplementary information 2 shows the potential risk of bias with 36% (n=21) of the studies having low risk of bias. For all studies, the reviewers achieved uniform bias assessment. Ten studies (17%) were scored as high risk of bias because only abstracts were available (nine Congress abstracts and one Spanish abstract). Initial disagreement on 55 out of 880 assessed items (6%) for opportunity of bias was solved by consensus reached by the two reviewers (EdV-K/DHFG) or by the decision of a third reviewer (RO).

Safety netting after discharge

Figure 2 presents an overview of the different safety-netting strategies evaluated in the included studies (n=18) and the

Table 1 Characteristics of included studies regarding the first study aim: safety-netting strategies after emergency department (ED) discharge

Author Year Country	Study design	Article/ abstract	Disease/ working diagnosis	Primary outcome: revisits	N total, male %	N outcome, male %	Age inclusion Median (IQR)/ mean age (SD)	Follow-up* (days)	Type of revisit	Risk of bias (high/low)
Baker 2009 USA	CP	Article	Fever	Yes	280 NR	105 NR	3–36 months NR	319–656†	suR	Low
Bloch 2013 USA	RCT	Article	All‡	No	436 54%	216 58%	1 month to 18 years NR	2–5	NA	Low
Browne 2001 Australia	BA	Article	GE, asthma, croup	Yes	5534 NR	240 NR	NR	NR	suR	High
Considine 2007 Australia	BA	Article	Fever	No	40 NR	15 NR	<16 years 3.1 years ±2.5 *before* 1.8 years ±1.3 *after*	2	NA	High
Chande 1996 USA	RCT	Article	All	Yes	130 59%	37 NR	All 39 months§ ±36 63 months¶ ±58	30, 90 and 180	suR	High
Fagbuyi 2011 USA	CP	Article	Influenza-like	No	38 646 53%	1091 NR	6 months to 21 years 82.3 months ±84.6	7	uR	High
Horne 1995 USA	CP	Article	All	No	250 NR	171 NR	All NR	3	NA	Low
Ismail 2013 USA	RCT	Abstract	Fever	No	63 16%	NR	NR	14	NR	High
Lawrence 2009 USA	CR	Article	All	Yes	40 418 NR	979 NR	NR 2 years (0.5–7.0)	3	suR	High
Maguire** 2011 UK	CP	Article	Fever	No	220 56%	29/56 NR	<5 years 27% ≤1 years	NS	suR	High
Moineau** 2004 Canada	CR	Abstract	GE	Yes	1862 NR	108 NR	NR 2.6 years ±2.8	7	uR	High
O'Neill-Murphy 2001 USA	BA	Article	Fever	No	87 NR	NR	3 months to 5 years NR	14, 56	suR	High
O'Neill 2001 USA	CR	Article	All	No	NR	NR	NR	NR	NA	High
Patel 2009 USA	nRCT	Article	GE	No	291 NS	NA	3 months to 18 years 60% <1 years	1, 2	NA	High
Porter 2000 USA	CP	Article	Fever	No	92 NR	NA	≤36 months 27,4 years ±9,2	NA	NA	High
Roland 2011 UK	CP	Abstract	Fever	No	457 NR	NR	NR	NR	uR	High
Scarfone 1996 USA	CP	Article	All	No	179 55%	91 NR	NR 31 months††	1	NA	Low
Yang 2012 Taiwan	BA	Article	All	Yes	1285 54%	9 56%	NR 34 months§ (0–207)	3	suR	High

*Time until revisit.
†See online supplementary information 2.
‡Common illnesses, without children with traumatic presenting symptoms.
§In the intervention group.
¶In the control group.
**Studies included for both study aims (Maguire *et al* 2011 and Moineau et al 2004).
††Mean (CI).
All, all ED diagnoses; BA, before after trial; CP, cohort study, prospective; CR, cohort study, retrospective; GE, gastroenteritis; NA, not applicable; NR, not recorded; nRCT, non-randomised controlled trial; NS, not specified; RCT, randomised controlled trial; suR, scheduled and unscheduled revisit; uR, unscheduled revisit.

corresponding level of evidence as identified by the colours of the plus/minus signs, according to the best-evidence synthesis (details in online supplementary information 3a and 3c).

Moderate/limited evidence

There was moderate evidence for the positive influence of a standardised follow-up programme (including, eg, a venue for handling calls after ED visits)[8] on patient care and patient satisfaction.[8 9] Limited evidence was found that clinical pathways at the ED resulted in a reduced admission rate, shortened length of stay and fewer revisits after discharge.[10] We found limited evidence for risk factors associated with non-compliance of scheduled revisits; for example, parents' perception that their child is not severely ill, parents' age (<21 years) and ED physicians uncertainty about patients' return.[11]

Conflicting evidence

We found conflicting evidence for the association between safety-netting advice and the reduction of revisits. According to four studies,[9 12–14] revisits could be reduced by providing consistent verbal and written discharge information regarding the natural history of disease[13] and temperature measurement/

Table 2 Characteristics of included studies regarding the second study aim: determinants of revisits

Author Year Country	Study design	Article/ abstract	Disease/ working diagnosis	Primary outcome: revisits	N total, male % of total population	N outcome (revisits), male %	Age inclusion Median (IQR)/ mean age (SD)	Follow-up* (days)	Type of revisit	Risk of bias† (high/low)
Alessandrini 2004 USA	CR	Article	All	Yes	54 784 NR	1893 NR	All 4.6 years ±4.9‡	2	suR	Low
Ali 2012 USA	CP	Article	All	Yes	8742 NR	124 52%	All 3.0 years (1.1–12)‡	3	suR	High
Angoulvant 2012 France	CP	Article	All§	Yes	501 NR	206 51%	<6 years 18 months (7–39)	7	suR	High
Augustine 2013 USA	CS	Abstract	All	Yes	13 NR	13 NR	All 4.2 years¶	2	uR	High
Berry 2013 USA	CR	Article	All	Yes	568 845 NR	36 734** NR	≤18 years 3 years (0–10)	30	uR	Low
Black 2010 UK	CR	Abstract	All	Yes	2345 NR	91 NR	<17 years 76% <5 years	3	uR	High
Callery 2010 UK	CR	Article	All	Yes	43 372 NR	2433 NR	<15 years NR	7	suR	Low
Chang 2008 Taiwan	CR	Article	All	No	3216 58%	188 NR	<18 years 5 years ±0.1	3	suR	Low
DePiero 2002 USA	CR	Article	All	Yes	51 195 NR	261** NR	All NR	3	suR	Low
Dunlop 2005 Australia	CR	Article	Fever	No	260 52%	35 NR	6 months to 6 years 25.7 months††	1	suR	High
Easter 2012 USA	CR	Article	All	Yes	97 374 NR	1091** 52%	0–21 years 52% <5 years‡	4	suR	Low
Florin 2013 USA	CR	Article	Pneumonia	Yes	100 615 54%	6439 NR	2 months to 18 years 3 years (1–6)	3	suR	Low
Freedman 2013 Canada	CR	Article	GE	Yes	3346 55%	526 57%	<18 years 3.4 years ±3.5	7	uR	Low
Gallagher 2013 USA	CR	Article	All	Yes	119 792 53%	1499** NR	All 7.6 years¶	3	uR	Low
Gaucher 2012 Canada	CR	Article	All	No	49 146 51%	2534 NR	<19 years 62% <5 years	2	uR	Low
Goldman 2006 Canada	CR	Article	All	Yes	37 725 NR	1990 NR	<19 years 18% <1 year	3	uR	Low
Goldman 2011 Canada	CR	Article	All	Yes	2062 55%	353** 59%	<19 years 57 months (0–215)	3	suR	High
Gregor 2009 USA	CP	Article	RTI/GE	No	455 59%	49 NR	6 weeks to 8 years 1.9 years ±1.9	60	suR	High
Hacking 2012 UK	CR	Abstract	All	Yes	2453 NR	130 NR	NR 4 years††	NR	uR	High
Jacobstein 2005 USA	CC	Article	Fever	Yes	15 384 54%	165 54%	All 38 months ±43	3	uR	Low
Jain 2010 USA	CR	Article	All	No	452 868 54%	17 335 NR	<19 years 22% <1 years	3	suR	Low
Klein-Kremer 2011 Canada	CR	Article	Fever	Yes	397 NR	92 67%	3–36 months 17 months ±8‡	3	suR	High
Lal *et al* 1999 UK	CP	Article	All	Yes	7328 NR	65 NR	NR	3	uR	High
LeDuc 2006 USA	CP	Article	All	Yes	932 NR	237 49%	All 4 years¶	2, 90	suR	High
Liberman 2012 USA	CR	Article	RTI	No	467 59%	189 NR	<19 years NR	7, 30	suR	Low
Logue 2013 Canada	CR	Article	All	Yes	1173 NR	261 61%	All 4.4 years¶	3	suR	High
Maguire‡‡ 2011 UK	CP	Article	Fever	No	220 56%	127 NR	<5 years 27% ≤1 years	NS	suR	High
Mansbach 2008 USA	CP	Article	Bronchiolitis	No	1456 58%	837 58%	<2 years 6.9 (4.2–11.3)§§	14	NS	Low
Michelson 2012 USA	CR	Article	All	No	198 778 NR	7281 NR	All 10% <1 years	2	suR	High
Mintegui 2000 Spain	CR	Abstract	All	Yes	3667 NR	495 NR	All NR	7	uR	High
Mistry 2007 USA	CP	Article	Fever	Yes	322 57%	76 NR	28 days to 17 years 31.5 months¶	10	uR	High

Continued

Table 2 Continued

Author Year Country	Study design	Article/ abstract	Disease/ working diagnosis	Primary outcome: revisits	N total, male % of total population	N outcome (revisits), male %	Age inclusion Median (IQR)/ mean age (SD)	Follow-up* (days)	Type of revisit	Risk of bias† (high/low)
Mistry 2009 USA	CP	Article	Fever	No	97 56%	18 NR	2–18 years 58.7 months ±40.1	7–10	uR	High
Moineau‡‡ 2004 Canada	CR	Abstract	GE	Yes	1862 NR	108 NR	NR 2.6 years ±2.8	7	uR	High
O'Loughlin 2012 UK	CR	Article	All	Yes	10 573 NR	532 NR	<16 years 34% <2 years	7	uR	High
Roback 1997 USA	CC	Article	Bronchiolitis	Yes	181 NR	57 NR	<1 year NR	4	NS	High
Roggen 2012 Belgium	CR	Abstract	All§	Yes	46 386 NR	1864 NR	<16 years NR	3	suR	High
Samuels-Kalow 2013 Canada	CR	Abstract	Fever	Yes	202 NR	14 NR	2–24 months NR	3	suR	High
Sartain 2002 UK	RCT	Article	All	No	399	31 NS	All 25.7 months¶	90	suR	High
Seow 2007 Taiwan	CR	Article	Fever	No	345 47%	115 NR	3–36 months NR	3	uR	Low
Simmons 2012 UK	CR	Abstract	All	Yes	NR	51 NR	All 59% <2 years	7	uR	High
Small 2005 UK	CP	Article	GE	No	112 NR	56 NR	1–6 years 1.9 (1.3)**	7, 30	suR	Low
Zimmerman 1996 USA	CR	Article	All	Yes	5228 58%	242 NR	<18 years 13% <1 years	14	suR	Low

*Time until revisit.
†Minimum and maximum.
‡Of the number of children with revisits.
§Common illnesses, without children with traumatic complaints.
¶Mean (CI).
**Revisits requiring admission.
††Median (IQR).
‡‡Studies included for both study aims (Maguire *et al*[12] and Moineau *et al*[13]).
§§Of the number of children sent home.
All, all emergency department diagnoses; CC, case–control study; CP, cohort study, prospective; CR, cohort study, retrospective; CS, cross-sectional study; GE, gastroenteritis; NR, not recorded; RCT, randomised controlled trial; RTI, respiratory tract illnesses; suR, scheduled and unscheduled revisit; uR, unscheduled revisit.

treatment.[14] In contrast, other studies concluded that the provision of safety-net advice did not affect the number of revisits.[15 16] We found conflicting evidence for the association between educational interventions at the ED and parental recall of discharge instructions or revisits.[16–24] One study reported that video home management of fever improved caregiver's knowledge of fever, but did not decrease ED use.[18] There was conflicting evidence about the role of telephone follow-up as safety-netting strategy. One study reported that this was an effective way of providing, for example, health information, managing remaining symptoms and recognising complications.[25] In contrast, another study advocated caution in the implementation of telephone follow-up because of moderate success rate in reaching patients.[26]

Determinants of revisits

Figure 3 presents an overview of all determinants of revisits described in the included studies (n=42), their association with revisits and the corresponding level of evidence, according to the best-evidence synthesis (details in online supplementary information 3b and 3c).

Strong evidence

Child characteristics

We found strong evidence for the association of ED revisits with younger children, ranging from ≤12 months until <6 years.[12 27–40] Moreover, for the association between medical history and revisits, although including heterogeneous definitions, we found strong evidence.[12 28 35 37 41 42] Maquire *et al*[12] concluded that history of illness in febrile children was one of the reasons for parental advice-seeking behaviour. However, for children with bronchiolitis, this association was conflicting.[35 41] With strong evidence, no association was found between gender and revisits to the ED[27 30 43] or revisits to the primary care provider.[33] Gender was neither discriminating in the comparison of admitted children with the discharged ones after revisiting the ED nor a prognostic factor in safe discharge of children with bronchiolitis.[35 41 44]

Social and demographic characteristics

There was conflicting evidence that ED revisits were associated with ED crowding.[27 29 42] Two studies were positively associated with revisits,[39 45] and three other studies were even associated with lower ED crowding during late evening or night shifts.[32 40 46]

Disease characteristics

Strong evidence was found for the association of revisits of children with symptoms of infectious diseases[9 29 31 33 35–37 39 43 45 47–50] or respiratory symptoms[29 30 35 37 41 45 47–49 51] compared with all ED revisits. Strong evidence was found for the association between revisits and seizures or other nervous system diseases.[27 37 39] Lastly, strong association was found between progression/persistence of symptoms and revisits.[9 13 36 38 39 44 48 51–56]

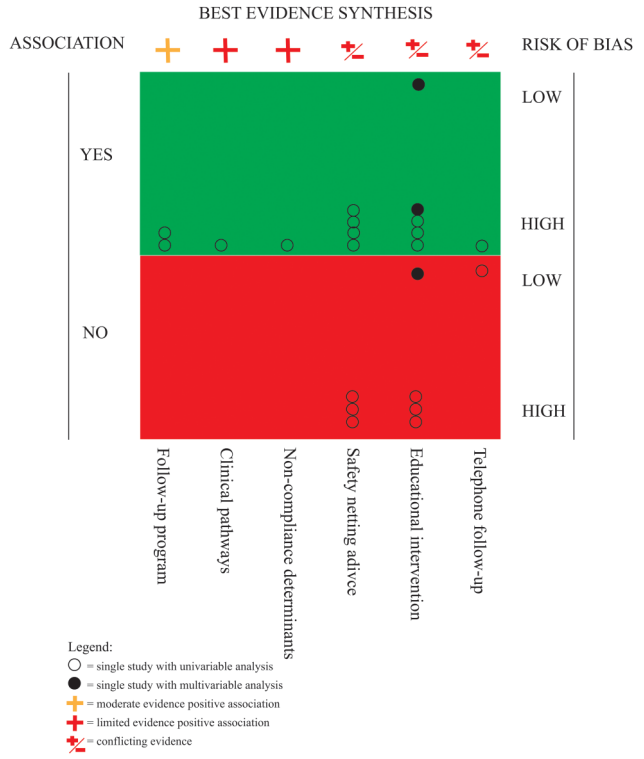

Figure 2 Level of evidence safety-netting strategies according to the best-evidence synthesis.

Physician characteristics

We found no association between physicians' characteristics, such as being paediatrician or resident[42 57] or physicians' years of experience,[41 58] and revisits.[41 42 57 58]

Process characteristics

We observed strong evidence for the absence of the association between revisits and the performance of diagnostic tests or therapeutic interventions at the index visit.[43 48 55 59 60]

Limited/moderate evidence

Child characteristics

Mistry *et al* studied a health-related quality-of-life instrument (PedsQL). There was limited evidence for the association between lower changes in PedsQL scores and ED revisits, which implied less improved quality of life for the revisiting child.[61]

Process characteristics

No association was found between revisits and paediatric hospital at home service compared with conventional hospital care for children suffering from breathing difficulty, diarrhoea and vomiting, or fever.[62] We found no association between revisits and children with acute gastroenteritis admitted to hospital compared with a comparable group of children managed at home.[63]

Conflicting evidence

Child characteristics

There was conflicting evidence for the association between ethnicity and revisits. In disease-specific studies (bronchiolitis and

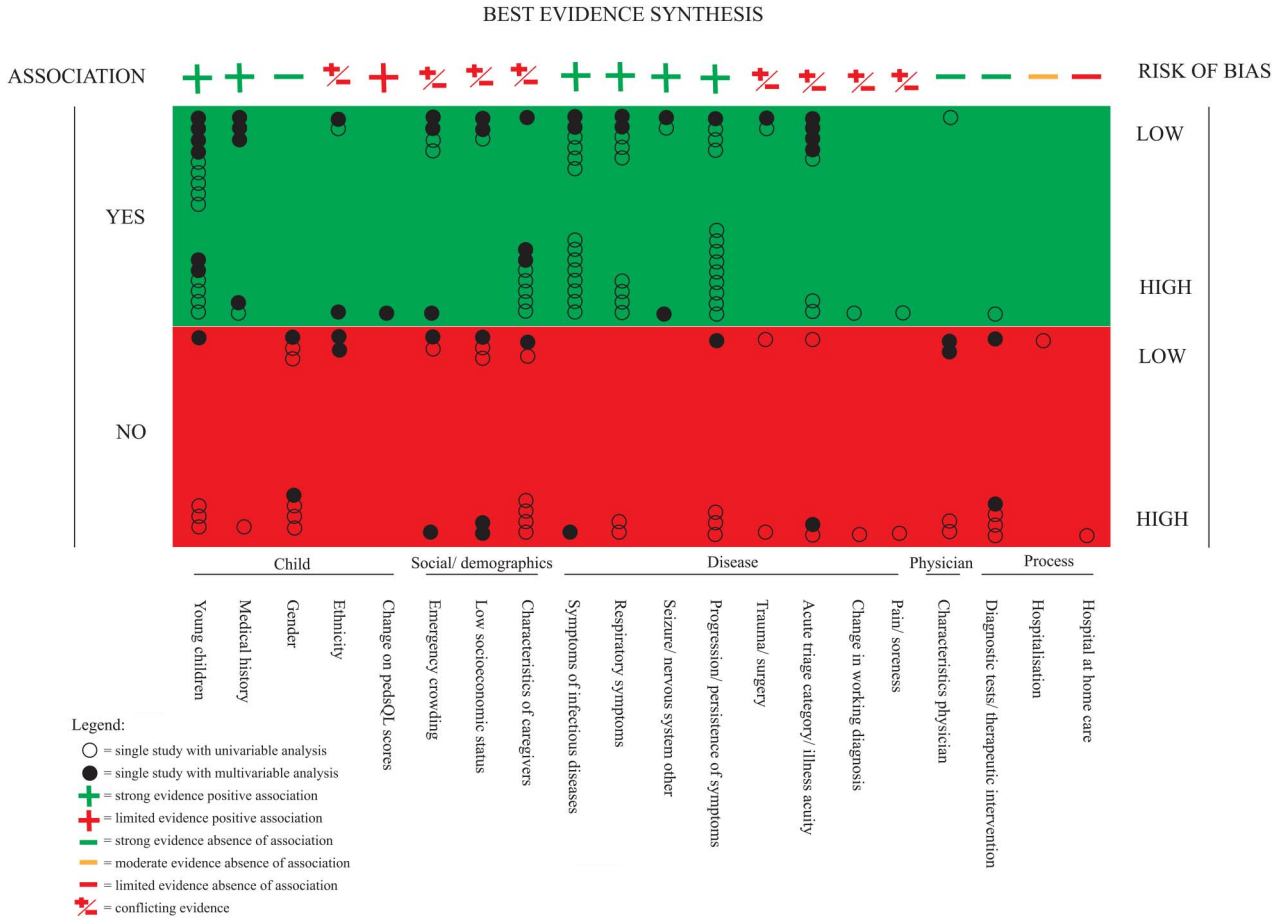

Figure 3 Level of evidence determinants of revisits according to the best-evidence synthesis.

fever), ethnicity was not associated with revisits[42 35] in contrast to studies including the total ED population.[27 30 37]

Social and demographic characteristics

There was conflicting evidence for the association between revisits and characteristics of caregivers. For example, caregiver's age, marital status and presence/age of other children were not associated with revisits in five studies.[33 42–44 55] In contrast, other studies concluded that language spoken at home or single caregivers were associated with revisits.[9 12 28 36 40 50 51 64] Next, we found conflicting evidence for the association between lower socioeconomic status and revisits.[27 28 30 33 37 40 42 45]

Disease characteristics

Associations between trauma, surgical problems or pain[43 48] and revisits were conflicting.[29 30 37 48] Conflicting evidence was found for the association between revisits in change of working diagnosis[44 47] and ED triage acuity.[13 28 29 32 33 36 38 40 42]

DISCUSSION

Follow-up after discharge and determinants of revisits: main outcomes

Limited evidence was observed for different strategies of safety netting, with educational interventions being mostly studied. Identified determinants of children at risk for revisits included young children, relevant medical history, infectious/respiratory symptoms or seizures and progression/persistence of symptoms. No association with revisits was found for gender, emergency crowding, physicians' characteristics and diagnostic tests and/or therapeutic interventions at the index ED. For other described determinants, no statement was possible due to conflicting evidence.

Strengths and weaknesses of this review

The development of evidence-based strategies of safety netting is a challenging new topic. Available studies describing revisits of the ED population and their characteristics vary in populations, study aims and methodology. The main strength of this systematic review is combining all information on determinants of revisits using a best-evidence synthesis. Most studies about safety netting are rather descriptive, and did not study their effectiveness.[1 5] In our review, we summarised the literature that evaluated the clinical consequences of their safety-netting intervention.

This review has some limitations. Because of the heterogeneity of the studies, we could not perform a meta-analysis. This systematic review is limited to the provision of whether there is evidence for a significant association or not. This approach limits the interpretation and clinical relevance of the reported associations, but is a consequence of the large heterogeneity of present studies on this topic. Second, there is no standardised risk-of-bias assessment method for the variation of study designs and outcomes included in this systematic review. To overcome lack of general accepted thresholds determining the study's risk of bias, and to include relevance to the research question on the risk-of-bias criteria,[65] we used the *MINORS* risk-of-bias criteria.[6] We added two important items, which would be the most appropriate for our included studies. With this approach, we aimed to perform best available systematic risk-of-bias analysis. We classified determinants to 'strong evidence' on the presence of low risk-of-bias studies, although high risk-of-bias studies may also have studied the same determinants (see online supplementary information 2).

Furthermore, there are limitations embedded in the study design of the included studies itself. The majority of studies are analysed with univariable statistical approaches, with only 35% (20/58) of the studies using multivariable statistical analysis. It remains unknown to what extent the determinants are independently associated with revisits. Second, although we followed the focus of most studies by defining 'revisits' as proxy for high-risk populations of failed safety-netting strategies, hospitalisation after revisiting the ED is probably the most effective outcome to evaluate this topic. However, study of this outcome is limited due to its low prevalence. Third, some study characteristics increased heterogeneity between our different determinant categories. For example, determinants were not always specified, for example, 'history of illnesses' was not further described in the study of Maguire *et al*. Furthermore, outcome measures were not homogenous and included, for example, revisits or admission after revisit. Finally, study comparisons varied between revisits versus total ED population or subgroups of revisits (discharged vs admitted children).

Implications for clinical practice and future research

A content of safety-net advice, as included in the National Institute for Health and Care Excellence (NICE) guideline,[66] has been published in relation to general practice where consensus was reached among general practitioners and paediatric ED consultants using a modified Delphi approach.[1 4] Safety-netting advice should include: (1) the existence of uncertainty, (2) what exactly to look out for, (3) how exactly to seek further help, (4) what to expect about time course. Our systematic review shows that a variety of safety-netting techniques are used, but the effective components or the best way to perform remains unknown, as has been identified by others.[1 5] Second, we generated answers on what determinants are associated with revisits, and those who are not. Moreover, the conclusions of our review can improve homogeneity in study design on follow-up strategies, and can add to progress in this research area. In essence, the importance of this knowledge should be combined with parent-related factors as their ability to understand and to comply with the designed safety-netting strategy.[11] Lastly, one notable gap in safety-netting literature is its time frame strategy. The NICE fever guideline claims 'to arrange a follow-up appointment at a certain time and place'.[67] In future research, we need to study the (efficacy of) safety-netting strategies in which the aspect of time is taken into account.[5 67]

CONCLUSION

Determination of a high-risk group in need for safety-netting strategies in paediatric emergency care remains difficult. We identified a set of strongly associated determinants of revisits that could be used for this identification; being young children, relevant medical history, infectious/respiratory symptoms or seizures and progression/persistence of symptoms. Gaps remain on intervention studies concerning specific application of a uniform safety-netting strategy and its included time frame.

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Contributors EdV-K substantially contributed to the conception and design of the study. She participated in the literature search and assessed studies for eligibility. She undertook data extraction, risk-of-bias assessment and performed the best-evidence synthesis. She drafted the initial manuscript, and approved the final manuscript as submitted. DHFG substantially contributed to the conception and design of the study, and reviewed and revised the manuscript. She participated in the risk-of-bias assessment, and approved the final manuscript as submitted. MW participated in the literature search, and assessed studies for eligibility. She reviewed and revised the manuscript, and approved the final manuscript as submitted. HAM substantially contributed to the conception and design of the study. She reviewed

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