

Educational interventions for the prevention and management of adverse events following immunisation: a systematic review

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ARTICLE REVIEW

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Abstract *This study investigated educational interventions for the prevention and management of adverse events following immunisation. This a systematic review was conducted by examining observational studies, with no restriction as to language or year, registered in PROSPERO with the identifier CRD42022313144 and by searching the MEDLINE, LILACS, Embase, CINAHL and Scopus databases. Two researchers selected the studies, extracted the data and assessed the risk of study bias; disagreements were resolved by a third researcher. A total of six articles met the inclusion criteria of the systematic review and the studies reported significant post-intervention improvements in staff conduct in relation to immunisation. It was concluded that educational strategies that lead to continued professional development in relation to vaccination in primary care were effective in reducing and/or eradicating immunisation errors and adverse events following immunisation.*

Key words *Continuing education, Nursing, Drug-related side effects and adverse reactions, Vaccination, Systematic review*

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Introduction

Adverse events following immunisation (AEFIs) are defined by the World Health Organisation (WHO) as “any untoward medical occurrence which follows immunisation and which does not necessarily have a causal relationship with the usage of the vaccine”¹.

Factors involved in such events include vaccine composition, the organism of the vaccinated individual and the vaccination application process. Staff conduct in non-compliance with standards and techniques may or may not cause harm to the client, leading to what are termed immunisation errors (IEs)².

A 2020 survey in 5 English-speaking countries found prevalence of IEs of 1.15 per 10,000 vaccine doses³. In several countries then, IEs are responsible for AEFIs and are therefore the first to be examined in an investigation². Several authors state that vaccine hesitancy may be associated with the occurrence of IEs⁴.

Nursing plays a fundamental role in the immunisation process, at the stages of reception, vaccination screening, the correct preparation, handling and administration of immunobiologicals, clarifying doubts and giving guidance on vaccines administered and possible AEFIs. Faced with a AEFI, nurses will report and investigate the event, thus contributing to improved quality and patient safety at the stages of the vaccination process⁵.

Nurses face difficulties in their work process, such as poor physical structure, organisational problems, as well as poor quality training. Most prominent among these difficulties are those relating to knowledge and attitudes to the day’s work⁶.

Accordingly, knowledge and safety in nursing staffs’ conduct and guidance are indispensable at all stages of vaccination in Primary Health Care (PHC), with a view to optimising health services in accordance with Brazil’s National Immunisation Programme (*Programa Nacional de Imunização*, PNI)⁷. In this regard, specific conduct can be adopted to prevent AEFIs, from reception and screening, assessment for postponement or contraindication of vaccination through to vaccination safety and quality, and AEFI monitoring and management⁶.

It is thus important and current to think about education strategies that promote meaningful learning⁸. Studies indicate Continued Professional Development (CPD) for health personnel as a strategy for improving immunisation-related safety⁹.

In 2004, the Ministry of Health introduced the National Policy of Continued Professional Development in Healthcare (*Política Nacional de Educação Permanente em Saúde*, PNEPS), which proposed to change and improve the training of health professionals, thus reinforcing the quality of nursing staffs’ vaccination training, by deploying active methodologies to encourage thinking and problem solving based on the realities of health service provision¹⁰.

CPD in healthcare makes for meaningful learning, because it enables staffs to lead the process and offer proposals for reordering their work process on the basis of their thinking about their service practices. CPD is thus essential to building quality services¹¹.

According to Google Scholar and the Virtual Health Library (VHL), in the last ten years, studies of CPD for nurses in preventing and managing AEFIs have been insufficient. The scientific literature features, in Brazil, a 2015 experience report, which discusses AEFIs, and a 2021 qualitative, descriptive study using realistic simulation as a resource for training primary health care personnel in the immunisation process. Although studies endorse immunisation-related CPD, the effectiveness of any action taken has not been assessed^{12,13}.

This study thus investigated education interventions in the prevention and management of adverse events following immunisation.

Methods

The protocol for this Systematic Review (SR) was based on Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA-P)¹⁴ and then registered with the International Prospective Register of Systematic Reviews (PROSPERO) under identifier CRD42022313144.

The manuscript was described by reference to the PRISMA 2020¹⁵ checklist and flowchart. The article selection, extraction and risk of bias assessment stages were carried out by two researchers and disagreements were resolved by a third researcher.

Using the acronym PICOS (P = population, I = intervention, C = comparison, O = outcome and S = study type) the following guiding question was asked: “Do education interventions for health professionals promote prevention and proper management of adverse events following immunisation?”

The inclusion criteria for article eligibility were that studies involve educational interven-

tions with health professionals involved in vaccination with a view to preventing and managing AEFIs and observational studies, with no language restrictions. The exclusion criteria were studies duplicating reviews or data, lacking an abstract, with no full text available after communication with the author, not answering the guiding question and reviews, case reports, abstracts submitted to congresses and conferences, study protocols, letters to the editor, personal opinions, institutional analyses, manuals, dissertations, theses, books and chapters.

The databases chosen were MEDLINE, Embase, LILACS, CINAHL and Scopus. Search strategies were formulate using controlled terms allowed by each database and uncontrolled terms and Peer Review of Electronic Search Strategies (PRESS) was also implemented to achieve a high-quality search¹⁶. These strategies are available in Chart 1 through the DOI.

Articles were selected by exporting to the Mendeley reference manager to remove duplicates and then entered into Rayyan, where they were screened by reading the titles and abstracts and those selected, by a complete reading; the excluded studies were justified. Data were extracted using a form for overall study data, method, outcome and interventions.

Thus, as the studies can be classed as quasi-experimental, the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Quasi-Experimental Studies was used to assess risk of bias. The critical appraisal checklist specifies that the answer “Yes” relates to absence of bias. Thus, studies returning 49% or fewer “Yes” answers were considered to offer high risk of bias; those returning between 50 and 69%, moderate risk; and 70% or more, low risk¹⁷.

The data from this review were separated, tabulated and analysed by database, authors, year and journal of publication, title, country, language of publication, objective, study population, type of education interventions, educational intervention effectiveness assessment instrument and outcome and, thus, discussed descriptively.

Results

Selection of systematic review studies

Initially, 2,627 articles were found in the five databases. After excluding duplicate studies, 2230 remained, which were selected by titles and abstracts. After applying the inclusion and exclu-

Chart 1. Search strategy DOI, by data base.

Data base	Search strategy DOI
MEDLINE	https://doi.org/10.1079/searchRxiv.2023.00147
Embase	https://doi.org/10.1079/searchRxiv.2023.00146
LILACS	https://doi.org/10.1079/searchRxiv.2023.00145
CINAHL	https://doi.org/10.1079/searchRxiv.2023.00144
Scopus	https://doi.org/10.1079/searchRxiv.2023.00143

Source: Authors.

sion criteria, nine articles were considered eligible. However, the full text of one study could not be accessed. Thus, eight articles were evaluated by reading the full text and two were excluded for not answering the guiding question. Thus, after article selection differences were resolved by the third researcher, six articles, as shown in Figure 1, were included in the systematic review.

Characteristics of the systematic review studies

Chart 2 shows authors and year of publication, database, periodical, title, country, language of publication, objective and populations of the study. Four of the six articles^{18,20,22} are indexed in the MEDLINE database, one¹⁹ in Embase and one²³ in CINAHL. All studies included were published between 2006 and 2021.

The studies were conducted in India^{18,20,23}, Nigeria¹⁹, the United States²¹ and South Korea²². Sample populations ranged from 20 to 323 health personnel, including nurses, doctors, pharmacists, nursing and pharmacy assistants, health agents, midwives and cold chain handlers.

As in Table 3, the content taught regarding immunisation was vaccine administration^{18,19,21,23}, waste disposal^{18,19,21,23}, care for the cold chain^{18,20,23}, AEFIs^{18,23}, vaccination calendar^{21,23}, problems in the immunisation process¹⁹, dangers of unsafe injection practices¹⁹, immunisation recording²¹, basic concepts of immunisation²¹ and vaccination coverage²¹.

The education interventions ranged from four hours to three months and most studies used pre-test and post-test questionnaires to assess the effectiveness of these interventions, except for one study²⁰, which used only a post-intervention questionnaire. Other means of assessment used were visual inspection²⁰, checklist²², supportive supervision²³, number of immunisations and

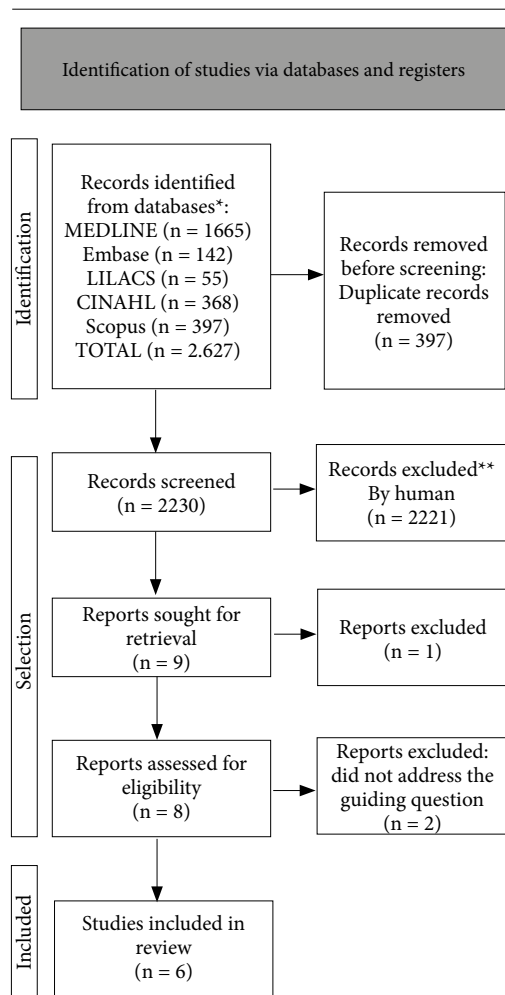


Figure 1. Flow diagram of article selection at each stage of the systematic review, following Prisma 2020.

* Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

** If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

Source: Authors, adapted from Page et al. (2021), our translation.

staff AEFIs reports following training²¹, as shown in Chart 3.

As regards the interventions' effectiveness, research showed significant improvements among staff in immunisation following the interventions, as shown in Chart 3. One study¹⁸ demonstrated that validated content transmitted by an educational module was effective in conveying knowledge at all the stages of the immunisation process.

Another study¹⁹ emphasised that content relating to safe administration of vaccines and waste disposal had significant effect on the health personnel's knowledge, although no significant improvements were found in their practice, because of precarious working conditions. The study also reported that training should be provided to all personnel involved in vaccination activities, including cleaning staff.

One study²⁰ indicated that in-depth training in the cold chain with PowerPoint presentations and detailed discussion, followed by practical training with field visits, was appropriate, while another study²¹ showed that a pilot study should be conducted to adjust the duration of the intervention. As a result, in that study, live training went from 2 hours to 4 hours with a view to improving personnel's practice time. The study also emphasised that a model combining online and live training was effective.

One study²² considered that individual guidance and distribution of educational leaflets with content on care with vaccine storage was effective training. Lastly, another study²³ showed that supportive supervision was an appropriate manner for personnel to learn at all stages of the immunisation process, as the environment and routine belonged to the participants' own workplace.

Some articles^{18,20,22} argued that interventions should not be occasional, but continuous, so one of the articles²⁰ took this issue as accounting for the positive, although unsatisfactory, results in identification of heat- and cold-sensitive vaccines, in preventive maintenance of cold chain equipment on a fixed monthly date, temperature maintenance on holidays and formulation of an appropriate emergency contingency plan, and alerted to the need for subsequent staff guidance.

Educational interventions in the immunisation process are thus essential to preventing and managing AEFIs. The educational strategy for this purpose should maintain close contact with the concrete realities of health personnel's work and a pilot study should be conducted in order to prepare the intervention. It is also necessary to combine educational resources, provide periodic interventions for all employees involved in the immunisation process and assure appropriate conditions for vaccination-related activities.

Risk of bias in systematic review studies

As shown in Chart 4, four of the six studies included in the review^{18,20,21,23} returned moderate risk of bias and two^{19,22}, low risk. All articles ad-

Chart 2. General data and methods of studies selected for the systematic review.

Authors (Year)	Database/ Periodical	Title	Country/ Language of publication	Goal	Study population
Sebastian, Parthasarathi e Ravi (2021) ¹⁸	MEDLINE/ Therapeutic Advances in Vaccines and Immunotherapy	Impact of educational intervention on the best immunisation practices among practicing health care professionals in a south Indian city	India/ English	To assess the outcome of an educational intervention for healthcare professionals on the safe and quality use of vaccines.	323 health professionals (121 doctors, 77 nurses and 125 pharmacists).
Musa, Parakoyi e Akanbi (2006) ¹⁹	Embase/ Annals of African Medicine	Evaluation of Health Education Intervention on Safe Immunisation Injection among Health Workers in Ilorin, Nigeria	Nigeria/ English	To assess the effect of health education intervention on knowledge and standard of practice of safe immunisation injection among health workers in static immunisation centre.	102 health professionals (50 Community health extension workers, 14 Community health officers, 28 nurses/midwives and 10 Junior community health extension workers); 50 participants received the education intervention and 52 did not.
Mallik <i>et al.</i> (2011) ²⁰	MEDLINE/ African Health Sciences	Assessing cold chain status in a metro city of India: an intervention study	India/ English	To assess changes in cold chain status and cold chain handlers' cold chain maintenance awareness and skills after the intervention.	20 cold chain handlers.
McKeirnan <i>et al.</i> (2018) ²¹	MEDLINE/ Journal of the American Pharmacists Association	Training pharmacy technicians to administer immunisations	United States/ English	To evaluate the effectiveness of an immunisation training program for pharmacy technicians on technicians' self-reported confidence, knowledge and number of vaccines administered	30 pharmacy technicians.
Lee <i>et al.</i> (2012) ²²	MEDLINE/ Journal of Preventive Medicine and Public Health	Vaccine Storage Practices and the Effects of Education in Some Private Medical Institutions	South Korea/ English	To inspect actual vaccine storage status and awareness, and compare them before and after education was provided.	39 health professionals (20 doctors, 12 nurses, 2 pharmacists, 3 nursing auxiliaries and 2 pharmacy auxiliaries).
Holla, Borker e Bhat (2013) ²³	CINAHL/ Annals of Tropical Medicine and Public Health	Vaccination sessions; challenges and opportunities for improvement: Experiences from Karnataka	India/ English	To assess the operational knowledge regarding routine immunisation among medical officers and the outcome of supportive supervision sessions in select immunisation sites.	195 medical officers.

Source: Authors.

Chart 3. Characteristics of interventions and outcome of studies selected for systematic review.

Authors (Year)	Type of educational interventions	Instrument for assessing effectiveness of educational intervention	Outcome
Sebastian, Parthasarathi and Ravi (2021)	Educational sessions using an educational module with content on immunisation process (storage and transport of immunobiologicals, AEFIs, vaccine administration, waste disposal and related problems).	Validated pre-test and post-test questionnaire.	Post-intervention assessment found statistically significant improvements at all stages of the immunisation process involving prevention and management of AEFIs, including storage (p-0.001), transport (p-0.001), administration, including waste disposal (p-0.001), AEFI monitoring and reporting (p-0.001) and knowledge of AEFIs (p-0.001). AEFI reporting improved by 30% after the education sessions.
Musa, Parakoyi and Akanbi (2006)	Training with content: safe injection, injection waste disposal and dangers of unsafe injection.	Pre-test and post-test questionnaire.	There were statistically significant improvements ($p < 0.05$) post-intervention in post-immunisation event prevention by vaccine administration, as the case group showed better knowledge of safe injection than the control. Improvements were also found in safe injection practices at the control group's health centres, but these were not statistically significant, except as regards single use of syringes to draw the vaccine for each patient.
Mallik et al. (2011)	In-depth training on cold chain with PowerPoint presentation and detailed discussion, followed by practical training, with field visits, on cold chain temperature monitoring, including interpretation of vaccine vial monitor, agitation testing, preventive maintenance and emergency contingency plan.	Post-intervention questionnaire and visual assessment of cold chain pre- and post-intervention.	Outcomes following the education intervention were significant ($p < 0.05$) in preventing AEFIs (internal condition of cold chain equipment, vaccine placement, temperature maintenance and designation of a cold chain handler at each point in the cold chain). Cold chain handlers' awareness and skills were unsatisfactory as regards heat- and col-sensitive vaccines, preventive maintenance, correct contingency plan and holiday temperature monitoring.
McKeirnan et al. (2018)	Training programme in immunisation administration, comprising a home study and live training with content including basic immunisation concepts, vaccine schedule, defaulter tracing, documentation and immunisation process. The home study comprised a presentation narrated by way of a Panopto video platform and the live training also consisted in presenting content and conducting vaccine administration practices until competence was acquired.	Pre-test and post-test questionnaire and number of immunisations administered by technicians and AEFIs after training.	25 pharmacy technicians completed the home and live training and the 29 who took the home study assessment passed with greater than 70% competency on the first attempt. Technicians self-reported increased confidence with immunisation skills between the pre-training and post-training surveys. From December 2016 to May 2017, the technicians administered 953 immunisations with 0 adverse events reported.

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Chart 3. Characteristics of interventions and outcome of studies selected for systematic review.

Authors (Year)	Type of educational interventions	Instrument for assessing effectiveness of educational intervention	Outcome
Lee et al. (2012)	Individual guidance and distribution of educational leaflets with content on vaccine storage precautions.	Pre- and post-intervention questionnaire and checklist.	Mean checklist score after education was 9.74 out of 15 ($p < 0.001$). Prior to the intervention, participants committed a series of immunisation errors relating to cold chain precautions, while following the intervention, there were improvements in storage temperature recording ($p = 0.016$), vaccine storage in the centre of the cold box ($p = 0.004$), storage of vaccines with other medicines and non-medical items ($p = 0.031$). Mean questionnaire score after education was 10.48 out of 14 ($p < 0.001$).
Holla, Borker and Bhat (2013)	Supervisory support and training sessions on immunisation routine with content on the national immunisation schedule, cold chain management, safe injection, waste disposal and AEFIs.	Pre- and post-test questionnaire and supervision.	Doctors' overall knowledge improved after the immunisation routine training session to prevent program component errors, including safe vaccination, cold chain precautions and knowledge of AEFIs. Mean pre-test score was 30.65% and post-test, 48.68% ($p < 0.001$) overall. Supervisory support was also useful in improving immunisation routine sessions, where 100% performance was obtained in use of correct diluents.

Source: Authors.

dressed questions 1, 2, 3 and 7, but questions 4 and 5 were not addressed in most studies. Only three studies^{19,21,22} met the criteria for question 6 and only one study²¹ failed to satisfy items 8 and 9 of the risk of bias assessment instrument.

Discussion

In this study, India was notable for studies to assess the effectiveness of educational interventions in the vaccination process to improve prevention and proper management of AEFIs. The Serum Institute in India is the largest producer of vaccines, which is believed to account for its prominence in scientific production²⁴. A literature review addressing vaccination waste as a topic also showed India to be most prevalent in studies²⁵.

This SR also found the largest number of participants to be doctors, but nurses appear to participate in half the studies, even if in small numbers. In the countries where the studies took

place, other groups were also involved in vaccination activities; this differs from Brazil, where nurses are responsible the vaccination room, where a nurse supervises the work and arranges CPD for the team²⁶.

Review studies have shown vaccination activities lacking supervision^{18,22,23}. In Brazil, nurses perform a number of duties in PHC and this work overload is known to limit nurses' activities in vaccination. This finding corroborates an integrative review of Brazilian studies that questioned the absence or limited participation of nurses in the vaccination room and how nurses' duties end up being performed by nursing technicians. This resulted in errors in the immunisation process for lack of the guidance, supervision and continued professional development fostered by nurses²⁷.

This SR found educational interventions with differing resources and durations. These considerations should be sufficient for CPD to be supported. In other words, they should provide

Chart 4. Critical assessment of studies selected for the systematic review.

Study	Questions									Classification
	1*	2**	3***	4 ⁺	5 ⁺⁺	6 ⁺⁺⁺	7 ^{&}	8 ^{&&}	9 ^{&&&}	
Sebastian, Parthasarathi and Ravi (2021)	Y	Y	Y	N	N	NC	Y	Y	Y	Moderate risk
Musa, Parakoyi and Akanbi (2006)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low risk
Mallik et al. (2011)	Y	Y	Y	N	N	NC	Y	Y	Y	Moderate risk
McKeirnan et al. (2018)	Y	Y	Y	N	N	Y	Y	N	N	Moderate risk
Lee et al. (2012)	Y	Y	Y	N	Y	Y	Y	Y	Y	Low risk
Holla, Borker and Bhat (2013)	Y	Y	Y	N	N	NC	Y	Y	Y	Moderate risk

Note: Y – Yes/ N – No/ NC – Not clear.

* Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)? ** Were the participants included in any comparisons similar? *** Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest? ⁺ Was there a control group? ⁺⁺ Were there multiple measurements of the outcome both pre and post the intervention/exposure? ⁺⁺⁺ Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed? [&] Were the outcomes of participants included in any comparisons measured in the same way? ^{&&} Were outcomes measured in a reliable way? ^{&&&} Was appropriate statistical analysis used?

Source: Prepared from JBI (2017).

health personnel with food for thought as regards their work process, with a view to improving patient care²⁸.

As regards content, the review found educational interventions at all stages of the immunisation process. It is important that the intervention address care for the cold chain, patient reception and screening, preparation, handling and administration of vaccines, as well as AEFI surveillance²⁹. Accordingly, the content analysis of the studies in this review will be discussed below, by stages of the immunisation process.

Studies in this review found that lack of cold chain equipment was an hindrance^{18,20}. Also, one SR study stated that vaccine packaging had been neglected and that all attention focused on vaccination coverage²².

These findings agree with a survey to assess the situation of the vaccination room in a town in Paraíba state, which highlighted improper conditions of refrigeration, a lack of thermometers and improper thermal boxes in insufficient quantity. The same study also found weaknesses in staffs' knowledge as to correct checking of vaccine temperatures³⁰. These deficits led to IEs and, as a result, can cause AEFIs, besides impairing immunobiologicals' effectiveness³¹.

One article in this review stressed that intervention after training significantly improved the staff's awareness as to recording immunobi-

ological storage refrigerator temperatures²². In order to yield quality results in improved staff training, educational strategies must be based on problematising work processes as experienced by nursing teams, thence to generate changes in the environment by engaging the facility's staff and management³².

In the vaccination process, screening is carried out jointly with reception and seeks to ascertain needs and priorities as regards vaccination status, as well as guiding clients about the vaccines to be administered. Reception, meanwhile, aims to produce active listening and convey confidence to the patient^{4,26}.

Studies in this review highlighted weaknesses in communication between health personnel and parents or guardians of children to be vaccinated, underlining that this relationship is necessary to ensure the confidence that results in vaccination adherence^{18,23}. The reception, screening and guidance stages are intended to engage patients by communicating that the immunisation process is reliable, so as to combat vaccine hesitancy³³.

Donnini et al. (2022)³⁴ found that the most frequent error was administering vaccines at other than the recommended age. Health personnel's weak knowledge and training as regards the vaccination schedule and the similarity of vaccine labels may be factors in this type of IE, which constitutes a failure in the stages of vaccine

screening, preparation, handling and administration.

Manufacturers are thus advised to change immunobiologicals' labelling so as to facilitate correct identification of vials at time of vaccination³⁵. Other manners of reducing occurrences of IE are by improving staff training, client participation, nurse supervision of vaccinations, as well as management that works to reduce these risks³⁶.

Nursing teams often suffer from weaknesses in vaccine preparation, handling and administration. Teixeira et al. (2021)³⁷ found that the most frequent errors were preparing several vaccine doses at the same time, inappropriate needle positioning, aspiration before vaccine administration and inserting needles into the rubber of multi-dose vials. Barboza et al. (2020)³⁶ showed that errors in vaccine administration technique were responsible for most AEFIs.

Solid healthcare waste (SHW) disposal at the vaccine preparation, handling and administration stages also requires training, as failures in this activity are considered IEs and can spread diseases to workers, public and environment³⁸.

Preparation for appropriate SHW management requires implementing a solid healthcare waste management programme, although ignored by management and health service professionals, this is what defines and details the stages of SHW management in line with current rules. It thus helps in training health workers in this activity³⁹.

As regards client guidance following administration of a vaccine, one study in this SR found that health staff did not advise parents to wait up to 30 minutes at the health service to check for adverse reactions and discovered that they omitted to do so for lack of waiting room space¹⁸. Batista et al. (2021)²⁹ agreed, pointing out that most users received no guidance on the vaccines administered, possible AEFIs or what to do should these arise.

This kind of guidance contributes to surveillance of adverse events following immunisation and is necessary in order to assure safe vaccination practices. Recommendations provided by health personnel are known to increase vaccination adherence, but for this to happen staffs must be ready to answer questions and concerns⁴⁰.

One article in this review showed that, following an educational intervention on vaccine administration, health personnel felt more confident in administering the immunobiological, recording the vaccination and providing guidance²¹.

As a contribution to continued professional development, a visual protocol was developed to assure safe vaccination of children under 1 year old. This tool covered the stages of reception, screening, vaccine preparation and administration and guidance. It was concluded that the technology helped to minimise IEs and thus AEFIs at these stages⁴¹.

From content analysis, a review study demonstrated that inadequate knowledge of the process for reporting AEFIs and lack of time led to low reporting of these events¹⁸.

In Brazil, however, under- or incomplete reporting of AEFIs and/or IEs is a reality, which in most cases can be explained by health personnel's fear, lack of knowledge about reporting, lack of commitment and overwork. Although AEFIs are associated with IEs, physical environments inappropriate for professional practice have also contributed to the occurrence of these events^{42,43}.

Note, in this connection, that these factors have their origin in the training given to these health personnel and the continuance of this educational process, as well as the support they receive from job managers. However, it should be stressed that health personnel recognise their need for, and the importance of, training on this topic^{42,43}.

In this regard, failure to recognise an AEFI and take appropriate action is reflected in vaccination adherence, as it contributes to refusal in vaccination rooms and, consequently, amplifies myths and taboos, all of which, together with anti-vaccine movements, is leading to the re-emergence of vaccine-preventable diseases that once were eradicated or controlled⁴⁴.

In view of the foregoing, there is a need for CPD to alleviate healthcare staffs' – and especially nursing teams' – fear of reporting and foster the recognition, proper management and prevention of AEFIs and/or IEs⁴⁵.

The pre-test and post-test method, used to evaluate the interventions in this review, serves to assess intentional interventions before and after, without a control group⁴⁶. Even in the absence of a comparison group, this method is an effective means of assessing the progress of interventions, because it makes it possible to judge whether the intervention was effective or not and whether changes are needed. It thus enables settings to be modified and contributes to improving a given group's training⁴⁷.

This study found that educational interventions for AEFI prevention and management were effective in improving the training of health per-

sonnel working in vaccination. For this to happen, however, they have to maintain close contact with the realities of health staffs' experience, that is, be grounded in problematisation, and they must be tested previously and assessed periodically to adjust content, resources and duration. Interventions can guarantee improvements only if associated with good working conditions. Martins *et al.* (2018)⁴⁸ noted that they are still incipient and scarce and have been carried out using traditional methodologies contrary to what is recommended by Brazil's National Policy of Continued Professional Development in Healthcare (PNEPS).

The limitations to this review included the absence of a search of the grey literature and meta-analysis, because of the heterogeneity of the

studies. Also, only observational studies were evaluated.

Note that management must improve working conditions for vaccination by ensuring appropriate environment and equipment, as well as staff to meet vaccination demand safely, particularly nurses to supervise the work. Attention is also drawn to the need to train staffs by CPD to conduct activities pursuant to National Immunisation Programme recommendations.

It is hoped that this review will contribute to other scientific studies with a view to improving the immunisation process by reducing and/or eradicating IEs and AEFIs by means of educational interventions that contribute to CPD in vaccination in primary health care.

Collaborations

DA Vasconcelos, GM Silva, AF Menezes and MSC Barreiro contributed to the conception and design of the study, analysis and interpretation of results, and writing and critical review of the manuscript. JC Nascimento and CTS Silva contributed to data analysis and interpretation, and writing and critical review of the manuscript. AM Santos and CBT Ferreira contributed to the conception and design of the study, and writing and critical review of the manuscript. All authors approved the final version of the manuscript and are responsible for all aspects of it, including ensuring its accuracy and integrity.

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