



TECHNICAL REPORT

A literature review of Training Needs Assessment (TRNA) methodology

ECDC TECHNICAL REPORT

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Abbreviations

ADDIE	Assessment, Design, Development, Implementation, Evaluation
CSTE	Council of State and Territorial Epidemiologists
EU	European Union
EEA	European Economic Area
EM	Emergency medicine
ESPH	Essential services of public health
HERO	Health Emergency Response Office
IHR	International Health Regulations
TRNA	Training needs assessment
WHO	World Health Organization

Abstract

Objective

The European Centre for Disease Prevention and Control (ECDC) conducted a literature review to guide its proposal of a methodology for assessing training needs in the European Union (EU) Member States and European Economic Area (EEA) countries. The scope of the ECDC Training Needs Assessment (TRNA) largely focuses on training needs, and countries' capacities to train in the domain of communicable disease prevention and control, using a 'harmonised assessment approach'.ⁱ The goal is also to provide some insight into the enumeration and characterisation of the epidemiological workforce in the countries. The TRNA is intended to serve as a gap analysis, in order to inform decision making in the area of public health training at ECDC.

Method

Embase and PubMed searches identified 110 articles related to training needs, which were further narrowed down to 69 for abstract review. A shortlist of 43 articles were triple-reviewed and subsequently further ranked for relevancy to the purpose of the review (5-point Likert scale). Results from 14 articles that ranked the highest (3-5 points) served as the main basis for conclusions of the literature review.

Findings

The questionnaire has been identified as the single most commonly used method (in both single-country and multi-country context), with 12 out of 13 studies presenting real assessments that refer to the use of a questionnaire. Of these studies, 75% use a questionnaire in combination with another method. The most common combination of methods is questionnaire (web-based) and an interview, in combination with one or more other methods. The findings of the literature review confirm that the methods used by ECDC until now – surveys, face-to-face consultations, country visits – are consistent with methodologies commonly used by other institutions for the same or similar purpose (multi-country context).

Conclusion

Considering a proposal for a 'harmonised assessment approach' in a heterogeneous multi-country context of 31 EU/EEA countries, the literature review confirms that, for the purpose of the planned EU/EEA-wide training needs assessment, the most optimal way is to administer an online survey. This method will reach all participants simultaneously, with the same tool and will require less resources than a combination of methods or than other methods used independently. A combination of methods is preferable because it provides an opportunity to validate the information collected via the questionnaire (i.e. by interviews with key informants, country visits or face-to-face meetings).

ⁱ As recommended to ECDC by the Internal Audit Service of the European Commission in May 2014.

Introduction

This literature review has been conducted by ECDC as a part of a 18-month project entitled Training Needs Assessment of EU/EEA countries (TRNA) carried out between June 2014 and December 2015. The project is a direct response to a recommendation by the Internal Audit Service of the European Commission from May 2014, which asked ECDC to 'tailor the training efforts to cover the existing capacity gap'. Furthermore, ECDC was, among other related activities, to 'carry out, in collaboration with the national competent bodies, a comprehensive training needs analysis in the area of disease prevention and control, **using a harmonised assessment approach**'.

In using the term 'harmonised assessment approach' we indicate an approach which is the most appropriate and standardised for all countries under consideration, and at the same time allows the heterogeneity between EU/EEA countries to be understood. In order to establish the most suitable methodology for the above-mentioned 'harmonised assessment approach', we decided to carry out this literature review on methodologies used for TRNAs at the country or institutional level (excluding TRNAs dedicated to assess the needs of individuals).

Method

Two research questions were formulated:

'Which methods are commonly used for needs assessments?'

'Which method(s) is/are the most suitable one(s) for our purpose?'

Original research articles were retrieved from Embase and PubMed online bibliographic databases on 1 September 2014. The search strategies submitted combined the concepts of training needs assessment and capacity building for a healthcare workforce, to obtain the methodology to be applied at the institutional or subnational level.

We considered the use of the title and abstract fields, and the controlled vocabulary for these concepts, but this increased noise in the results. Hence, proximity operators in multiple fields were used with Embase, in order to increase the quality of the results. Additional searches were submitted in PubMed using the title field and the MeSH terms to complement the retrieval.

Articles oriented on the same topics but specifically focused on individual needs were excluded. Results were limited to articles published from 2009 onwards in Dutch, English, French, German, Portuguese, and Spanish. Automatic updates of the search were set up in the databases to receive new results, and these were monitored until the end of 2014.

The search strategies used in the above-mentioned databases are shown in Tables 1 and 2.

Table 1. Keywords for the search strategy in Embase

Concept 1	Boolean operator	Concept 2
OR		OR
('training' OR instruction OR teaching) NEAR/3 'needs assessment':ab,ti	AND	'manpower'/exp 'manpower':ab,ti workforce:ab,ti personnel:ab,ti worker*:ab,ti 'staff':ab,ti 'human resources':ab,ti employee*:ab,ti doctor*:ab,ti nurse*:ab,ti fellow*:ab,ti
'capacity building'/exp 'capacity building' ('capacity' NEAR/5 'building'):ab,ti ('competency' NEAR/5 'building'):ab,ti ('competence' NEAR/5 'building'):ab,ti ('competencies' NEAR/5 'building'):ab,ti 'competency based assessment' ('competency based' NEAR/5 'assessment'):ab,ti ('competence based' NEAR/5 assessment):ab,ti	AND	('public health' NEAR/3 (workforce OR manpower OR worker* OR professional* OR personnel)):ab,ti ('communicable disease' NEAR/15 (workforce OR manpower OR worker* OR professional* OR personnel)):ab,ti ('communicable diseases' NEAR/15 (workforce OR manpower OR worker* OR professional* OR personnel)):ab,ti ('infectious disease' NEAR/15 (workforce OR manpower OR worker* OR professional* OR personnel)):ab,ti ('infectious diseases' NEAR/15 (workforce OR manpower OR worker* OR professional* OR personnel)):ab,ti ('epidemiology' NEAR/15 (workforce OR manpower OR worker* OR professional* OR personnel)):ab,ti 'health care manpower'/exp 'health care manpower':ab,ti 'health manpower':ab,ti 'healthcare manpower':ab,ti 'medical manpower':ab,ti

Limits: ([dutch]/lim OR [english]/lim OR [french]/lim OR [german]/lim OR [portuguese]/lim OR [spanish]/lim) AND [2009-2014]/py

Table 2. Keywords for the search strategy in PubMed

Concept 1	Boolean operator	Concept 2	Boolean operator	Concept 3
OR		OR		OR
training[TI] instruction[TI] teaching[TI]	AND	"needs assessment"[Title]	AND	manpower[TIAB] workforce[TIAB] personnel[TIAB] worker*[TIAB] staff[TIAB] "human resources"[TIAB] employee*[TIAB] doctor*[TIAB] nurse*[TIAB] fellow*[TIAB]
"Capacity Building"[Mesh]	AND	"Public Health/manpower" [Mesh]		-

Limits on languages: Dutch, English, French, German, Portuguese, Spanish; Limits on publication date: from 2009

Box 1. Inclusion and exclusion criteria for TRNA methodology literature review

Inclusion criteria

Articles that:

- Focus research on training and/or capacity building needs assessment and/or capacity assessment in public health settings, particularly those in the area of communicable disease prevention and control, field epidemiology, public health microbiology and other specific public health settings with relevance to preparedness and International Health Regulations;
- Contain a description of a needs assessment methodology performed at a territorial/country or institutional level;
- Describe and include elements of needs assessment relevant for or transferrable to the EU/EEA settings.
 - Location: worldwide
 - Publication years: 2009-2014
 - Populations: public health workforce
 - Languages: English, French, German, Dutch, Portuguese, Spanish

Exclusion criteria

- Studies specifically dedicated to assess individual training needs;
- Needs assessments performed outside the public health domain;
- Articles with a mere description of training activities and programmes being carried out.

Results

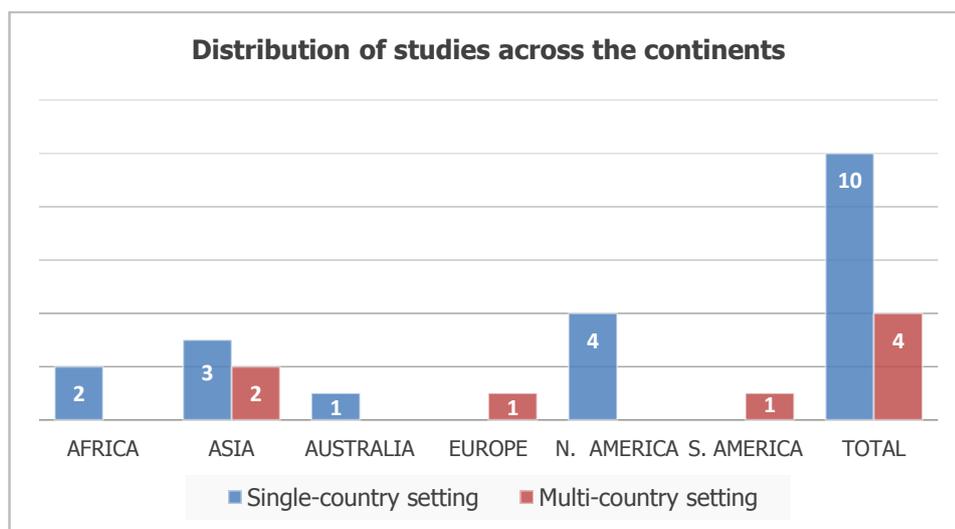
After removing duplicates, 110 articles were screened by one reviewer for relevancy based on agreed inclusion and exclusion criteria (see Box 1). This initial abstract screening narrowed the list down to 69 articles, which were then subjected to an abstract review by two reviewers. A shortlist of 43 titles (see the full list in Annex 1) was established. These articles were triple-reviewed and further ranked for relevancy to the purpose of the review (5-point Likert scale: 1=not relevant/least relevant, 5=most relevant). Results from 14 articles that ranked the highest (3-5 points) served as the bases for data extraction and conclusions of the literature review [1-14] (see PRISMA flow chart in Annex 2).

Single-country versus multi-country assessments

Out of the 14 articles, nine (64%) focused on assessments carried out in a single-country context [1,2,6,8,10-14], and four (29%) on assessments in a multi-country setting [3-5,9]. One study (7%) solely provided a description of types of assessment methodologies, their characteristics, advantages and disadvantages [7]. We decided to keep the study in the review as it provided useful guidance from a generic point of view.

The single-country studies (n=9) covered the following countries: US [1,6,11], Australia [8], Indonesia [13], Southern Sudan Autonomous Regionⁱⁱ [2], India [10], Liberia [12] and one from China [14]. Regions and multi-country samples (n=4) present in the studies were: WHO Western Pacific Region covering 37 countries [3], WHO South-East Asia Region covering 11 countries [5], a sample of 11 countries in Latin America [4] and a sample of seven countries in Europe [9]. The descriptive study (n=1) of assessment types mentioned above originated in the US [7]. All continents have been represented in this literature review, with the highest number of studies covering Asia (n=5) and North America (n=4), followed by two African studies, and Australia, Europe and South America being represented by only one study. Figure 1 below shows the distribution of single and multi-country studies across the continents.

Figure 1. Distribution of studies across the continents



Types of assessment methods

The literature review identified four studies presenting a single-method assessment (29%) with three of them being questionnaires [1,4,8] and one a set of semi-structured face-to-face interviews [9]. Nine studies presented multiple-method assessments (64%) and all of them used questionnaire as one of the assessment methods [2,3,5,6,10-14], six of them used interviews [2,6,10-12,14], six a desk-based review [2,3,5,6,12,14], four focus group discussions [10-13], one a field visit [2], one an expert opinion [14] and one an environmental scanning method [11].

ⁱⁱ Assessment was carried out in 2005-2006 before the Republic of South Sudan gained its independence.

Table 3. Total number and percentage of assessment methods used

Method	Single-country context		Multi-country context		Total (%)
	Single method	Multiple method	Single method	Multiple method	
Questionnaire	2	7	1	2	12 (37%)
Interview	0	6	1	0	7 (22%)
Desk-based review	0	4	0	2	6 (19%)
Focus group	0	4	0	0	4 (13%)
Field visit	0	1	0	0	1 (3%)
Expert opinion	0	1	0	0	1 (3%)
Environmental scan	0	1	0	0	1 (3%)
Total	2	24	2	4	32 (100%)

Questionnaire has been identified as the single most commonly used method, with 12 out of 13 studies presenting real assessments that refer to the use of a questionnaire (see Table 3). Out of these 12 studies, nine (75%) use a questionnaire in combination with another method [2,3,5,6,10-14]. The most common combination of methods is questionnaire (web-based) and interview that are used alongside one or more other methods: 1) questionnaire, interview and a desk-based review [6]; 2) questionnaire, interview and a focus group discussion [10]; 3) questionnaire, interview, desk-based review and a focus group discussion [12]; 4) questionnaire, interview, desk-based review and a field visit [2]; 5) questionnaire, interview, focus group discussions and an environmental scan [11]; and 6) questionnaire, interview, desk-based review and an expert opinion [14]. Two studies present a combination of a questionnaire and a desk-based review [3,5]. Only one study used a combination of a questionnaire and a focus group discussion [13]. Table 4 provides an overview of the combinations used in all studies.

Table 4. Overview of combinations of methods used

Study	Questionnaire	Interview	Desk-based review	Focus group	Field visit	Expert opinion	Environ. scan
Beesley [2]	x	x	x		x		
Blakely [3]	x		x				
Dhillon [5]	x		x				
Goytia [6]	x	x	x				
Kumar [10]	x	x		x			
Lin [11]	x	x		x			x
Newbrander [12]	x	x	x	x			
Pinxten [13]	x			x			
Wang [14]	x	x	x			x	

Country context and assessment methods

Out of the 14 studies, the largest proportion (50%) of assessments were multiple-method ones carried out in a single-country context [2,6,10-14]. Nevertheless, it is necessary to mention that some of these studies were either carried out in a decentralised system of federal states (US) [1] or the objective of the assessment was to reach decentralised capabilities [12]. There were two studies (14%) in each of the following groups: single method in a single-country context [1,8], single method in a multi-country context [4,9] and multiple methods in a multi-country context [3,5]. One study (7%) is classified as 'other' due to the fact that it did not present a real assessment [7], but only an overview of existing assessment methods and a descriptive analysis of their advantages and disadvantages. Figure 2 shows the proportion of each of the 'country context and assessment method' groupings.

Figure 2. Proportion of studies in single- and multi-country contexts

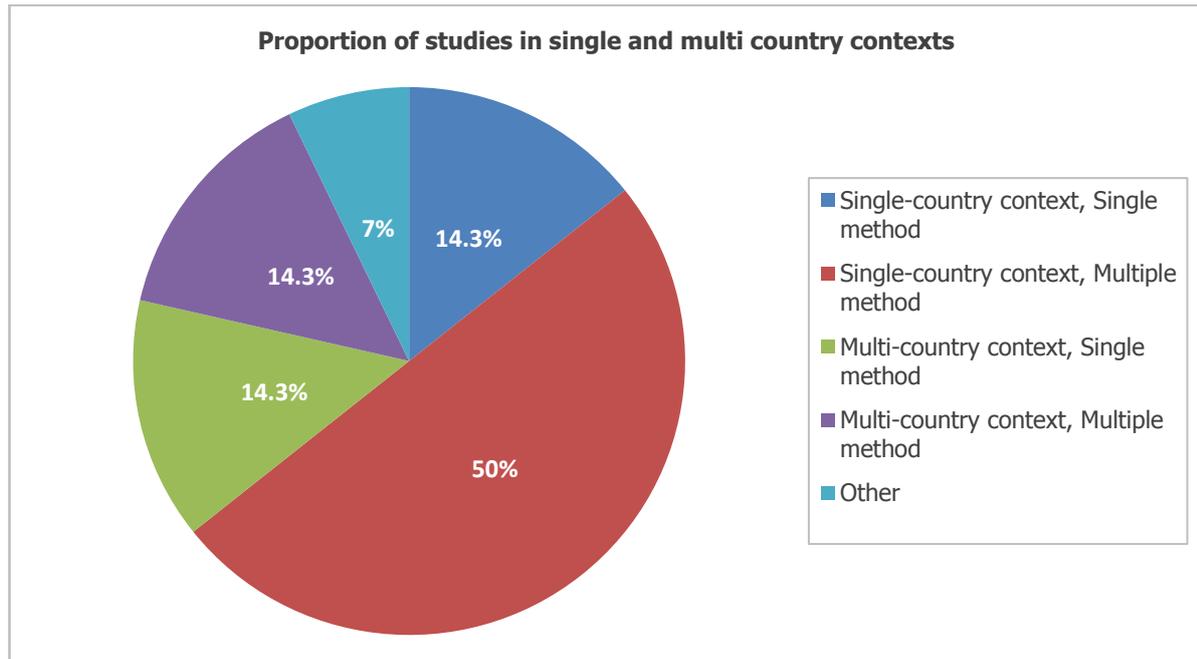


Table 5. Overview of methods used in reviewed literature

Ref No.	First Author (Year)	Assessment Method Used	Country or territory assessed (Scope)	Year of Assessment	Public Health or Health Domain	Relevance rank
Purely Descriptive Studies						
[7]	Hauer (2011)	N/A (Study provided an overview and descriptive analysis of assessment methods)	N/A (US study)	N/A	Palliative medicine	4
Assessments Studies						
Single method assessments in a single country setting						
[1]	MMWR (2009)	Web-based questionnaire to one key informant per state (state epidemiologist), who further cascaded parts to each enumerated epidemiologist	US (50 federal US states and District of Columbia)	2009	Quantification of state epidemiology capacity against four essential services of public health (ESPH)	5*
[8]	Hughes (2013)	Three modified Delphi studies involving questionnaires administered among a convenience sample	N/A (Australian study)	2003, 2009, 2012	Public health nutrition workforce	3
Single method assessments in a multi-country setting						
[4]	Blas (2011)	Web-based questionnaire with targeted invitations to a purposive sample	Latin America (11 countries responded)	2011	Research and training in Medical Informatics and Bioinformatics	3
[9]	Kugelberg (2012)	Semi-structured face-to-face interviews with a purposive sample	7 European countries (Finland, Iceland, Eireland, Slovenia, Spain, Sweden, UK)	2011	Public health nutrition workforce development	3
Multiple method assessments in a single country setting						
[2]	Beesley (2011)	Quantitative questionnaires, structured interviews, field visits and a desk-based literature review	Southern Sudan	2005-2006	Human resources (HR) assessment to formulate HR development plan in a post-conflict setting	4
[6]	Goytia (2013)	A web-based survey based on a literature review and informal interviews	US (New York City territory only)	2011	Community research needs assessment	5
[10]	Kumar (2013)	A questionnaire, focus group discussions and key informant input	India (Jharkhand state)	2012	Training needs assessment of service providers of targeted intervention for HIV/AIDS	3
[11]	Lin (2012)	A large-scale, mixed-methods needs assessment	US	2012	Emergency medicine	4
[12]	Newbrander (2012)	A semi-structured interview, a questionnaire, a guided group discussion and a document review	Liberia (6 selected counties)	2009	Needs assessment of decentralised management capabilities in the health sector	3
[13]	Pinxten (2011)	Rapid questionnaire distributed at a face-to-face meeting followed up by consensus discussions (mini-Delphi)	Indonesia	2010	Development of a competency-based curriculum in addiction medicine	3
[14]	Wang (2014)	A review of competency domains, iterative interviews, expert opinions and a large-scale online questionnaire	China (China's health emergency response offices)	2010	Developing and implementing an in-service curriculum for health emergency response offices (HEROs)	5*
Multiple method assessments in a multi-country setting						
[3]	Blakely (2011)	A desk-based study verified through structured questionnaire to key informants	WHO Western Pacific Region (WPR) (37 countries)	2010	Health status and epidemiological capacity	4
[5]	Dhillon (2012)	A desk-based study verified through structured questionnaire to key informants	WHO South-East Asia Region (SEAR) (11 countries)	2011	Health status and epidemiological capacity	4

Summaries of assessments in literature review studies

The following summaries of assessment methods provide a more contextual and in-depth overview of the studies, including relevant information on the scope of the assessments and combinations of methods used for specific purposes (see also Table 5).

Studies providing general overview of existing assessment methods

Two studies, Hauer [7] and Lin [11], provided definitions of a needs assessment:

- '[...] a systematic process of collecting and analysing information by which educational needs are identified and ranked in order of priority. It identifies the gaps to be addressed educationally and measures the discrepancy between current and desired competence.' [7] (p504)
- '[...] a systematic process to identify gaps between current and desired performance to make informed decisions.' [11] (p1420)

Hauer [7] further presented a descriptive analysis of various types of methods for educational needs assessments conducted with the aim of revision of curricula according to competency-based outcomes. The study reiterated the general applicability of steps identified by the Accreditation Council for Graduate Medical Education (ACGME) for developing competency-based curriculumⁱⁱⁱ and suggested the following steps in conducting a needs assessment:

- **Purpose:** Why is the needs assessment being done? Who will be involved in the process? Are all necessary individuals on board in the beginning?
- **Audience:** Who will use the results of the needs assessment? Is it for top management, the course provider, or an individual activity?
- **Issues:** What strategies will be used to ensure an effective needs assessment? What issues should the needs assessment address – organisational, accreditation, or program design? What techniques will be used to collect the data? How will data be analysed? What are the priorities?
- **Resources:** What resources are available to design, implement, and analyse the assessment? Do instruments already exist or do they need to be developed? What financial requirements, personnel, time and expertise are required?
- **Data collection:** What types of data should be collected? Who will collect the data? What sources of information will be used? What is the timeline?
- **Analysing the data and prioritising a need:** What is the problem the continuing education activity should resolve? Is this content being provided elsewhere? Is the intended learner aware of the need? How significant will it be if the need is not resolved?' [7] (p504)

Similarly, Lin [11] also reaffirms that the first step in a needs assessment must be defining 'what specific needs are to be investigated. This can take the form of why, what, who, how, and when' (p1420). Both studies [7,11] also provide an overview of assessments methods as presented in Table 6 below, suggesting that the deciding on a single most appropriate method is not so easy, and often the combination of two or more is the most optimal solution.

ⁱⁱⁱ The steps are the following: '1) Conduct needs assessment, 2) Identify competencies addressed by this experience (what does the learner need to know and do to be a competent physician?), 3) Write goals and objectives (what do you want the learner to be able to do?), 4) Determine teaching methods (what activity will facilitate the learning?), 5) Determine assessment method. 6) Determine programme improvement method.' (p504, [7])

Table 6. Overview of Needs Assessment Methods (adapted from Hauer [7], Lin [11], Mann [15], Lockyer [16])

Method	Type of data collected	Description	Advantages	Disadvantages
Surveys	Quantitative (scaled survey), Qualitative (comment survey)	Surveys or polls on paper or electronic with a variety of question formats. [11] An efficient and low-cost way to obtain quantitative data anonymously from large numbers of individuals, including those otherwise unavailable by distance. [7]	<ul style="list-style-type: none"> • Can sample large groups in a short time. • Inexpensive. • Data easily summarised. • Opportunity for response without fear of embarrassment. [11] 	<ul style="list-style-type: none"> • Self-identified needs dependent on the design and the quality of the questions identified for the survey. [15,16] • Potential differences between 'interests' and 'real needs'. • Time-intensive to develop an effective survey. [11]
Focus groups	Qualitative	A qualitative needs assessment strategy (small groups of 8-10 participants convened for the purpose of structured and informal discussion). [7] Steps in conducting a focus group: 1. Planning; 2. Developing core questions; 3. Facilitating of session moderation; 4. Data analysis. [17]	<ul style="list-style-type: none"> • Method beneficial for obtaining new ideas and reactions. • Can provide a broad range of qualitative data in a timely, cost-effective manner. Can help to clarify quantitative data. [7] • Real-time interaction between different perspectives. • Focus on consensus-building. [11] 	<ul style="list-style-type: none"> • Time consuming for facilitator and participants. • Difficult to analyse and quantify data. • Requires a skilled facilitator. [11]
Interviews	Qualitative	A method to gain an in-depth insight into someone's perspective and allow clarification of information. [11,18] Can be conducted face-to-face or via phone. [7]	<ul style="list-style-type: none"> • Require more time and effort, including the analysis of the descriptive data obtained. [7] • Exploration of unique qualitative information from an individual's perspective. [11] • Spontaneous feedback. [11] 	<ul style="list-style-type: none"> • Time-consuming for interviewer and interviewee. • Difficult to analyse and quantify data. • Requires skilled facilitator. [11]
Key informants	Qualitative	Leaders in the organization or profession who have valuable opinions and insights into the educational needs of a specific group. [7]	<ul style="list-style-type: none"> • Can participate in questionnaires or provide information in one-on-one interviews. [7] 	<ul style="list-style-type: none"> • May not be part of the target audience but are knowledgeable about the needs. [7]
Environmental scan	Qualitative, Quantitative	Assessment of already existing data, either internal or external to the institution. [11]	<ul style="list-style-type: none"> • Inexpensive because already existing data sets. • Often automatically updated data sets. • Does not require contact with target audience. • Externally verifiable data. [11] 	<ul style="list-style-type: none"> • Data sources may provide too broad an answer and not exactly answer targeted question. [11]
Brainstorming	Qualitative	A method for a group to provide as many solutions as possible to identified problems. [7]	<ul style="list-style-type: none"> • Can facilitate selection and ranking of the best ideas gathered (use of a flip chart). [7] 	<ul style="list-style-type: none"> • Requires a skilled facilitator. • Focus should stay on quantity rather than quality. [7]

Web-based questionnaire to one key informant (per state) with a cascade ("CSTE study")

A study from the US used a web-based questionnaire (a standardised national assessment of state departments' core epidemiology capacity) administered to each of the 50 US states and the District of Columbia [1]. The recipient of the questionnaire was the state epidemiologist, who served as the key informant and who further cascaded or distributed the questionnaire or its parts to lead epidemiologists in the respective state. Worksheets on training experience and programme areas of work were further disseminated to each enumerated epidemiologist. Deadline for filling in the questionnaire was 3 months. Although not the main objective of this review, the scope of

the assessment described in this study was also of particular interest to us, given the proximity of its context and purpose (enumeration of state epidemiologists in a multi-state context)^{iv}.

The study [1] described a comprehensive assessment that was repeated periodically. It was therefore useful, not only in enumeration of the workforce and identification of needs and gaps in capacity, but also in the understanding of trends over time. Furthermore, it defined an epidemiologist^v as 'any person who, regardless of job title, performed functions consistent with the definition of epidemiologist^v in *A Dictionary of Epidemiology* [19]'. This definition provides an essential basis for distinguishing the workforce to be enumerated. Identified limitations of the assessment were the fact that the survey did not assess the capacity at the local level and that the methods used by each state to reach their capacity estimates were subjective and likely to vary.

Web-based questionnaire with targeted invitations to a purposive sample

A study of a training and research needs assessment in medical informatics (MI) and bioinformatics (BI) targeted relevant professionals from Latin America [4]. The questionnaire asked respondents to rate existing courses in MI and BI on a scale of 1 to 5 (1=unimportant, 5=very important), and to suggest courses common for both domains. In addition, the questionnaire offered an open-ended question to list priority areas for research that are perceived as needed in their respective country. The survey was sent to 330 participants, out of which 142 responded, covering 11 Latin American countries. The questionnaire was live for 70 days.

Another study [8] described a comparison of three modified Delphi studies conducted in 2003, 2009 and 2012 involving three rounds of questionnaires administered among a convenience sample. Each Delphi study facilitated 'ratings and open-ended responses to over 180 separate competency elements derived from the white and grey literature and these were further categorised into 14 competency areas'. The study and its findings gave emphasis to the consensus development process for identification, and prioritization of essential competency requirements for the future workforce in nutrition.

A rapid questionnaire distributed at a face-to-face meeting followed up by consensus discussions (mini-Delphi)

The Pinxten study [13] described a training needs assessment carried out as the first step in the process of developing an evidence and competency based curriculum in addiction medicine in a single country setting (Indonesia). During a study group meeting of 13 high level representatives of national addiction centres in Indonesia, a consensus was reached to develop a national short course in the above-mentioned domain. The group then called a 2-day workshop with a purposive sample of 31 participants, the objective of which was to agree on core competencies based on needs identified through a rapid needs assessment in the form of a questionnaire^{vi}. The questionnaire was distributed to all participants on the first day and they were given 30 minutes to fill it in. The following day, the findings of the training needs assessment were shared and a set of competencies were presented for consensus (mini-Delphi).

A desk-based study verified through structured questionnaire

Two articles presented results of desk-based studies, verified through structured questionnaires with open questions to non-systematic samples of regional stakeholders [3,5]. These stakeholders were universities, TEPHINET (Training Programs in Epidemiology and Public Health Interventions Network), WHO and governmental

^{iv} The main objectives of the US web-based questionnaire assessing the national core epidemiology capacity through state departments conducted by the Council of State and Territorial Epidemiologists (CSTE) were to 'count and characterize the state-employed epidemiologist workforce and measure current core epidemiology capacity' (p1373). The questionnaire was structured around assessment of capacity in four most epidemiology-related essential services of public health (ESPH) and nine programme areas, and the estimates of capacity were categorised in the following scale: 'full capacity = 100% of the activity, knowledge or resources described within the question are met; almost full = 75%-99%; substantial = 50%-74%; partial = 25%-49%; minimal = some but <25%; and none = 0' (p1374). In addition, for each programme area, the assessment asked to estimate the 'ideal number of epidemiologists needed to fully meet epidemiology and surveillance capacity' (p1374). For enumeration of current efforts in each area, the assessment measured this in reported full time equivalents.

^v 'An investigator who studies the occurrence of disease or other health-related conditions or events in defined populations. The control of disease in populations is often also considered to be a task for the epidemiologist, especially in speaking of certain specialised fields such as malaria epidemiology. Epidemiologists may study disease in populations of animals and plants, as well as among human populations.'

^{vi} The scope of the questionnaire covered 30 questions distributed into three professional domains (assessment and diagnosis, starting treatment, and managing treatment), with a 5-point Likert scale (not at all proficient, slightly proficient, adequate, fairly proficient, extremely proficient). (p104)

institutions (non-systematic convenience sampling followed by snowball sampling) [3,5]. The desk-based studies of the assessments covered the domains outlined in Table 7.

Table 7. Summary of the desk-based study domains

Study	Domain
Summaries of descriptive epidemiology	Mortality, disease burden, risk factor contribution, inequalities [3,5], morbidity, social determinants, research capacity, health education, workforce and systems [5] using latest available global and regional data (i.e. the latest editions of The World Health Statistics); in case of discrepancies between international and national data, national experts were consulted [5]
Quantitative assessments of capacity to publish	Medline-indexed [7] and PubMed peer-reviewed [5] journal articles ^{vii} per country and the topic of the publication to represent the relative contribution of published outputs within the selection of countries of the region, and their comparison to the burden of disease data
Overview of other relevant domains (training, research, funding, workforce and health systems)	Training (long-term training, short-term training, and epidemiology as a part of graduate and postgraduate training in preventive and social medicine or other diploma programmes), research, funding, workforce [3,5] and health systems [5] in the respective regions. One study also took into consideration regional WHO conference proceedings and publications for further guidance of the desk-based research [5]. Based on the summary of relevant educational and training programmes, both [3] and [5] concluded with perceived training needs and capacity gaps.

The limitations that were identified were absence of relevant data on workforce and low response to the survey, resulting on lack or absence of data on some countries from the regions [3,5]. The selection of the respondents to the survey was not systematic [3].

A web-based survey based on a literature review and informal interviews with local and national informants

One study [6] described a community research needs assessment in New York City [6] carried out through an online survey, the creation of which was informed by a literature review and informal interviews with a convenience sample. The domains of the survey were identified through a consultative process (expert opinion) of a partnership board composed of leaders from key stakeholder organisations (research-interested community-based organisations (CBOs) and community-interested academics from one academic institution and its affiliates in New York City). The board held retreats and bi-monthly meetings during which its members identified key areas of focus and a research capacity building sub-committee (made up of two researchers and two representatives of the board). The sub-committee reviewed the work carried out so far in the domain, conducted a literature review and key informant interviews with research-interested CBOs and community-engaged research groups locally and nationally. The sub-committee then developed a needs assessment survey and piloted it with board members' organisations. The survey was administered online and followed up by mail, email and telephone calls over a 90-day period. The authors carried out substantial follow-up with non-responders. Limitations identified were a small sample size, low response rate (54%) and failure to identify key differences between characteristics of non-responders and responders to draw conclusions and recommendations for the future strategy for assessment.

Semi-structured face-to-face interviews with a purposive sample of key informants

Kugelberg [9] presented a qualitative study composed of semi-structured face-to-face interviews to understand constraints and enabling factors in public health nutrition workforce development in Europe. Countries were selected based on their geographical location and degree of workforce development. Authors of the study used a purposive sample with a snowball technique. The significant selection criterion of the key informants was their known experience in various areas of public health nutrition. An interview guide was developed and covered areas of context, workforce development, needed roles and competencies of public health nutritionists. All interviews were recorded and transcribed verbatim. A content analysis was applied on the transcribed interview data and the study included 60 key informants from seven European countries. The study relates the description and suitability of this method for their purpose; the authors included explanation of the data analysis method chosen (content analysis) as well as methodological considerations in terms of concepts of credibility, dependability and transferability in qualitative research^{viii}.

^{vii} Search strategy in PubMed was the following: 'epidemiology' as a MeSH heading or 'epidemiol*' in the title or abstract, with countries in the respective region either included as a MeSH heading or appearing in the title or abstract in a period of 10 years. (p1114)

^{viii} 'Transferability' refers to the degree to which the findings can be transferred to another context [...]. 'Credibility' refers to how well data and analysis address the research focus. [...] '[D]ependability' refers to the degree to which data change over time and alterations are made during the data analysis. (p1992)

A questionnaire, focus group discussions and key informant input

The Kumar study [10] described a training needs assessment of personnel involved in a targeted intervention for high risk populations vulnerable to HIV infection in a state in eastern India. The assessment comprised a set of questionnaires administered to groups of staff involved in the targeted intervention (program managers, counsellors and outreach workers), with a specific questionnaire developed for each group. The questionnaire aimed to assess their existing knowledge, skills and attitudes to inform development of 'a strategy to address identified gaps through training, supportive supervision, and handholding' (p366) by the responsible institutions. The questionnaire was complemented by qualitative input from focus group discussions and 'evaluator's observations and comments [...which contained] observations, process and quality with regard to the performance of staff in targeted interventions based on the National AIDS Control Organisation's indicators and guidelines' (p366). The size of the convenience sample was 60, with each group of staff being represented equally (20 staff per group).

A set of quantitative questionnaires, structured interviews, field visits and a desk-based literature review

The Beesley study [2] aimed to describe an assessment of human resources for health in order to direct the formulation of a human resources development plan for Southern Sudan in 2005-2006. A combination of methods were used: quantitative data collection through a set of questionnaires, structured interviews with key informants to assess additional data, field visits, and a review of literature. Data collection was focused on obtaining information on a dozen variables for each health worker. Upon interpretation of the data, a consultation with key stakeholders took place in order to discuss the findings and implications of the assessment. The key challenges the authors faced were: insufficient communication and unclear delineation of each actor's part in the assessment (Ministry of Health Southern Sudan and WHO consultants); 'lack of adequate information and strategic orientation' (p447); high effort necessary for the assessment (35 person-months and around 11800 datasheets); absence of a job classification table to standardise categories and levels of staff (250 self-defined job titles → unreliable agglomeration). In a dynamic context such as newly developed states, the data could be representative for only a short period of time (less than 6 months).

A large-scale, mixed-methods needs assessment

The Lin study [11] described a process of determining the right training needs assessment method for seven primary stakeholders with the objective of defining a two-year education fellowship in emergency medicine (EM). The priorities for discussion were decided through a modified Delphi method with a convenience sample of 23 participants of a breakout session held at a consensus conference for Academic Emergency Medicine in 2012. The sample was further broken down into smaller focus groups to facilitate discussions. The authors referred to the 'common pitfall in conducting needs assessment [of] over-reliance on a single assessment approach or a limited population sample' (p1421) and therefore constructed a large-scale, mixed-methods (quantitative and qualitative) needs assessment using the following methods:

- Survey (scaled and open-ended responses) administered to the following stakeholders: department chairs, education leaders, faculty interested in education research;
- Structured interviews with SWOT analysis conducted with directors of EM education fellowship;
- Semi-structured interviews carried out with current students of the EM fellowship and with directors of the faculty development programs in education scholarship;
- A combination of environmental scan and a semi-structured interview was carried out with the graduates of the EM education fellowship.

A semi-structured interview, a questionnaire, a guided group discussion and a document review

The Newbrander study [12] described 'a management capacity assessment tool developed to be used in fragile states' (p276) where there is a need to assess decentralised management capabilities. When designing the assessment tool, authors outlined three primary objectives: 1) tool should enable data collection from all levels of the health system, 2) it should incorporate both quantitative and qualitative data, and 3) it was to be adaptable, so that it could be re-used in other fragile states and/or at any other post-conflict phase (p282). The selection of the assessment tools was guided by the need to gain a broad understanding of the existing management system through a variety of sources, and to allow for triangulation of data. The scope of the assessment involves six critical management areas: 1) oversight and coordination, 2) human resources, 3) resource management, 4) health financing, 5) community involvement and 6) health information management. These are assessed in regard to their

capacity in three core management functions: 1) planning, 2) implementation and 3) monitoring and evaluation. The assessment was carried out in six counties in Liberia and it was designed to take about 2-3 days per county. The authors produced four data gathering tools to be applied:

- Semi-structured interviews carried out with the most senior manager at the decentralised level and with managers at the central Ministry of Health;
- Questionnaire to determine the relief-to-development transition stage in a given district; this tool is to collect quantitative information, but also to prepare the survey respondents for a guided group discussion;
- Guided group discussions were conducted with small management teams to explore findings from the interviews and the questionnaire (the first two tools must be reviewed before the group discussion);
- Document and record review functions as a checklist of key relevant documents, such as policies, guidelines, tools and other information that contributes to the management decision making at the decentralised level.

Newbrander concludes on the potential of the tool to, not only provide a snapshot of the status quo in the respective counties, but to also facilitate prioritization in identifying areas for urgent attention and providing a tool for developing a roadmap of action (p291).

The authors evaluated the application of the tool as effective for gathering information, useful in identifying gaps to be addressed, including identification of twinning opportunities between counties. It also appeared to have been less labour-intensive than originally expected due to the fact that focus groups, thanks to the prior information gathered through interviews and a questionnaire, quickly provided all necessary information from all the stakeholders. Further validation was conducted during the study and the tool was further improved and a generic version delivered. This was intended to be tailored for use in other countries.

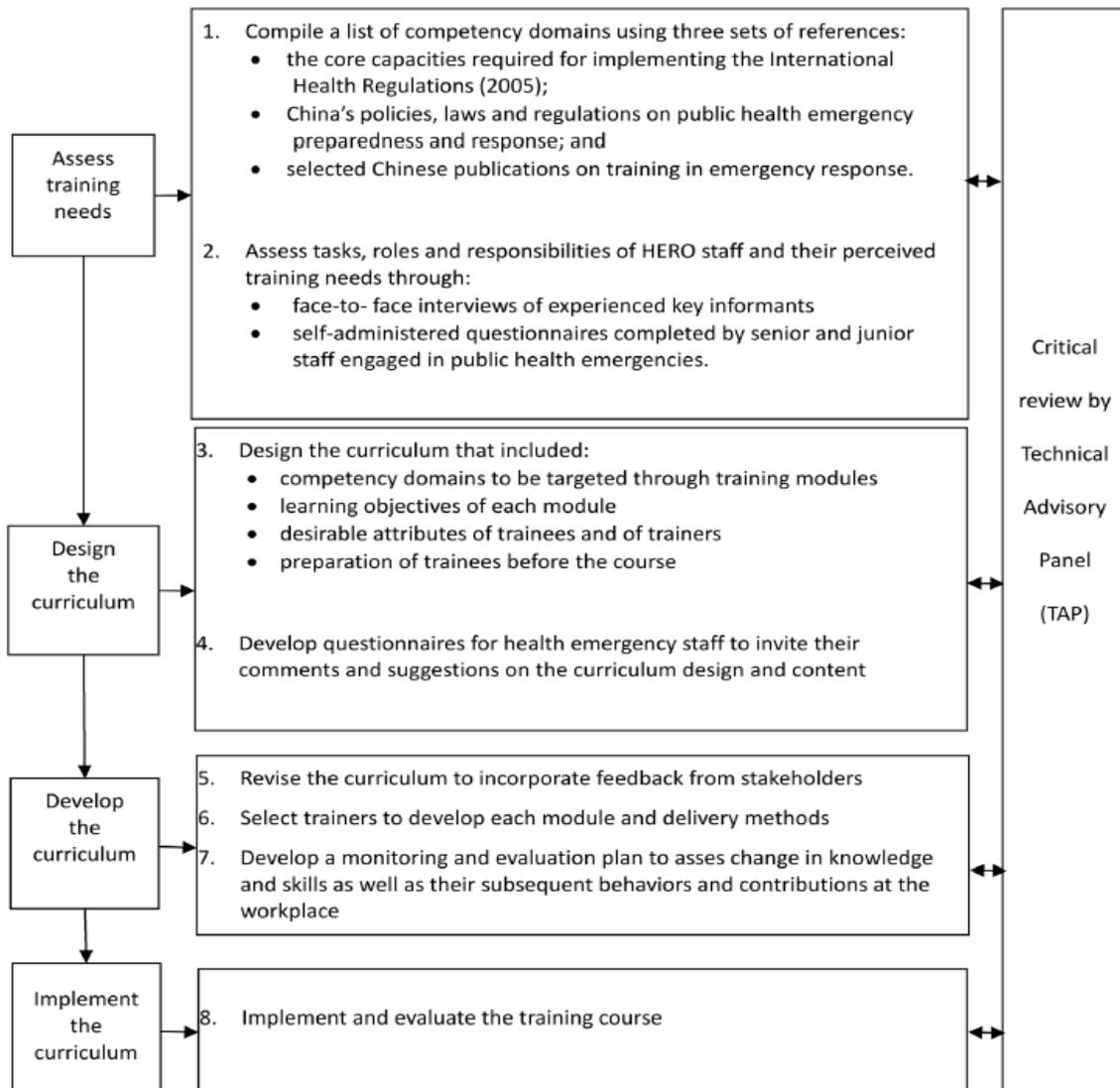
A multi-method assessment with review of competency domains, iterative interviews, large-scale self-administered questionnaire and an expert opinion

The Wang study [14] outlines a consultative multi-method process used to inform development of a competency-based curriculum to strengthen capacities at China's relatively newly-established Health Emergency Response Offices (HEROs)^{ix}, to further facilitate meeting the core capacity requirements under the WHO International Health Regulations 2005 (IHR 2005) [20]. Authors described the ADDIE model (Assessment, Design, Development, Implementation, and Evaluation) used for instructional design as shown in Figure 3. The study also presented a definition of competency as 'a cluster or related knowledge, skills, and attitudes that reflects a major portion of one's job (a role or responsibility), that correlates with performance on the job, that can be measured with well-accepted standards, and that can be improved with training and development' [21].

- The first step in the assessment method was a desk-based review of competency domains based on data from three sources: 1) IHR core capacities, 2) Inter-related Chinese laws and regulations and 3) National publications on 'general guidelines for training health workers and from curricula for training technical staff based in surveillance units, laboratories and the environmental health sector' (p2, [14]).
- The next step was a set of face-to-face interviews with eleven key informants with a snowball sample. The interviews reviewed the tasks, roles and responsibilities and needs of HERO staff and the common knowledge of the existing training, as well as curriculum delivery preferences. The same scope was assessed through a self-administered questionnaire, which was sent to a convenience sample of 115 HERO staff during a face-to-face training workshop.
- The third step was a revision of all the findings from the assessment by China's Ministry of Health-appointed technical advisory panel composed of eight nationally acknowledged experts in the subject matter from the Ministry of Health, Chinese Centres for Disease Control, HEROs and the Academy of Military Medical Science (p2, [14]). This three-step process led to curriculum design, which was subject to further validation process.

^{ix} Authors of the Wang study inform that the context of setting up the HEROs resulted from new legal instruments that are being put in place as a consequence of various outbreaks in the region and worldwide (particularly SARS and influenza H5N1). There has been a higher emphasis on China's emergency preparedness, which gives further support to training and capacity building in this area. HEROs were set up, but the authors argue that the staffing was done opportunistically and in an ad hoc fashion, which resulted in need to strengthen the staff's capacities in the area of emergency response. (p1, [14])

Figure 3. Adaptation of the ADDIE model to develop the national in-service curriculum for strengthening the performance of staff of health emergency response offices (HEROs) in China. (Wang [14])



In the next phase of the assessment, the authors distributed the proposed curriculum design to the HERO staff and administered a large-scale online questionnaire to a sample of 1700 staff (700 at provincial and municipal levels and 1000 at local level) with the objective to provide comments and suggestions to the proposal and assess the demand for training. Technical advisory panel members also provided feedback on the curriculum design.

The study presents a process of active engagement with experts in government and academia as well as potential beneficiaries. Authors conclude that '[t]he multi-method approach to curriculum development by engaging actively with senior policy-makers, researchers, and experienced practitioners can be applied in other country settings to ensure training is responsive and customised to local training needs, resources and priorities.' (p6)

Discussion

Evidence from the literature review indicates that a combination of two or more assessment methods is more commonly used, particularly in a single country context. Questionnaire has been identified as the most commonly used method in assessing needs or capacities, with 12 out of 13 studies that present real assessments referring to the use of a questionnaire. Of these 12 studies, nine used questionnaire in a combination with another method, most commonly with an interview and a desk-based review to either inform the form and/or content of the assessment, or to verify the findings of another assessment method.

With regard to the scope and content of the reviewed assessments, we found two studies particularly informative – the so called 'US CSTE Study' and the Wang study [1,14] - despite the fact that both describe assessments in a single-country setting and one was a single method assessment. In its objective, the 'US CSTE Study' [1] is the closest to the planned ECDC training needs assessment, though its assessment at the national (or state in the US context) level is beyond the scope of ECDC. It covers areas of non-communicable diseases and it involves a cascade to each enumerated epidemiologist at the state level. Representing the EU/EEA context, we found that the assessment provided a particularly useful definition of an epidemiologist, and a standardisation of reporting on full-time equivalents of staff involved in tasks contributing to the provision of ESPH. This approach allows for less ambiguous reporting, however we must acknowledge the use of a 'top-down' process for administering the assessment.

The Wang study [14], as described above, offers a more consultative and inclusive process with various stakeholders, including the beneficiaries. This process was clearly outlined with an ADDIE model, a similar approach to the training cycle that ECDC follows. The content of the study was close to our subject matter as it focused on facilitation of meeting the IHR core capacity requirements – a process relevant to the EU/EEA setting too. Inspiration could be taken in consulting relevant national laws and regulations as well as national publications on general guidelines for training in public health domains relevant to IHR.

During the review, we noted a number of limitations in some of the reviewed studies: the Blas study [4] is addressing the participants in previous courses, who do not necessarily belong to the same institution or organisation. Since the assessment was carried out in a multi-country setting, which is more relevant for our purpose, we decided to keep the study in the review, despite it being on the border of the inclusion and exclusion criteria. The Hughes study [8] talks about the future workforce and the scoring of core competencies and domains, which, to our understanding, is a different exercise from pure training needs assessment. Nevertheless, it should be noted that future workforce needs and trends may change due to increased international travel, spread of antimicrobial resistance and other emerging challenges in the area of communicable disease prevention and control. Another constraint was identified in the Pinxten study [13] where the participants in the meeting comprised a relatively small sample and they did not belong to an institution. The authors identified a curriculum based on the competencies that are perceived as more relevant, but not necessarily because of specific existing gaps in training. Ideally, it is understood that a consensus on core competencies and key domains for a function/job/profile is an initial requirement, and only after these have been developed can the training needs assessment be carried out.

Conclusions

The purpose of this literature review is to inform our proposal of a 'harmonised assessment approach' in a heterogeneous multi-country context of 31 EU/EEA countries. The literature review confirms that when considering a systematic and harmonised approach alongside available resources (budget, staff and time), for the purpose of the planned EU/EEA-wide training needs assessment, the optimal assessment method would be a combined one. Ideally, an online survey is administered first, followed by other assessment methods. Online surveys have the advantage of reaching all participants at once with the same tool and combination of methods. This preferred method provides the opportunity to validate the information collected via the survey (i.e. by interviews with key informants, country visits or face-to-face meetings).

From a communication and social science perspective, it may be more acceptable for participants in surveys to contribute in a context where qualitative information can be provided, without restricting themselves to dichotomous or quantitative variables, particularly when there is lack of information, or survey fatigue due to multiple demands.

A multi-annual assessment, inspired by previous ECDC practice (i.e. the self-assessment questionnaire of ECDC's tool for Assessment of Non-EU Countries' Capacity in communicable disease prevention and control (ANECC tool) and the Assessment of the Influenza Pandemic Preparedness in Europe, conducted by ECDC, WHO and European Commission in 2006-2007) is considered the best solution.

The online survey should preferably be complemented by other methodologies, such as desk-based review, interviews with key informants, meetings with all countries, regional workshops and country visits that could serve the purpose of validating the data and complementing the survey, in a multi-annual cycle.

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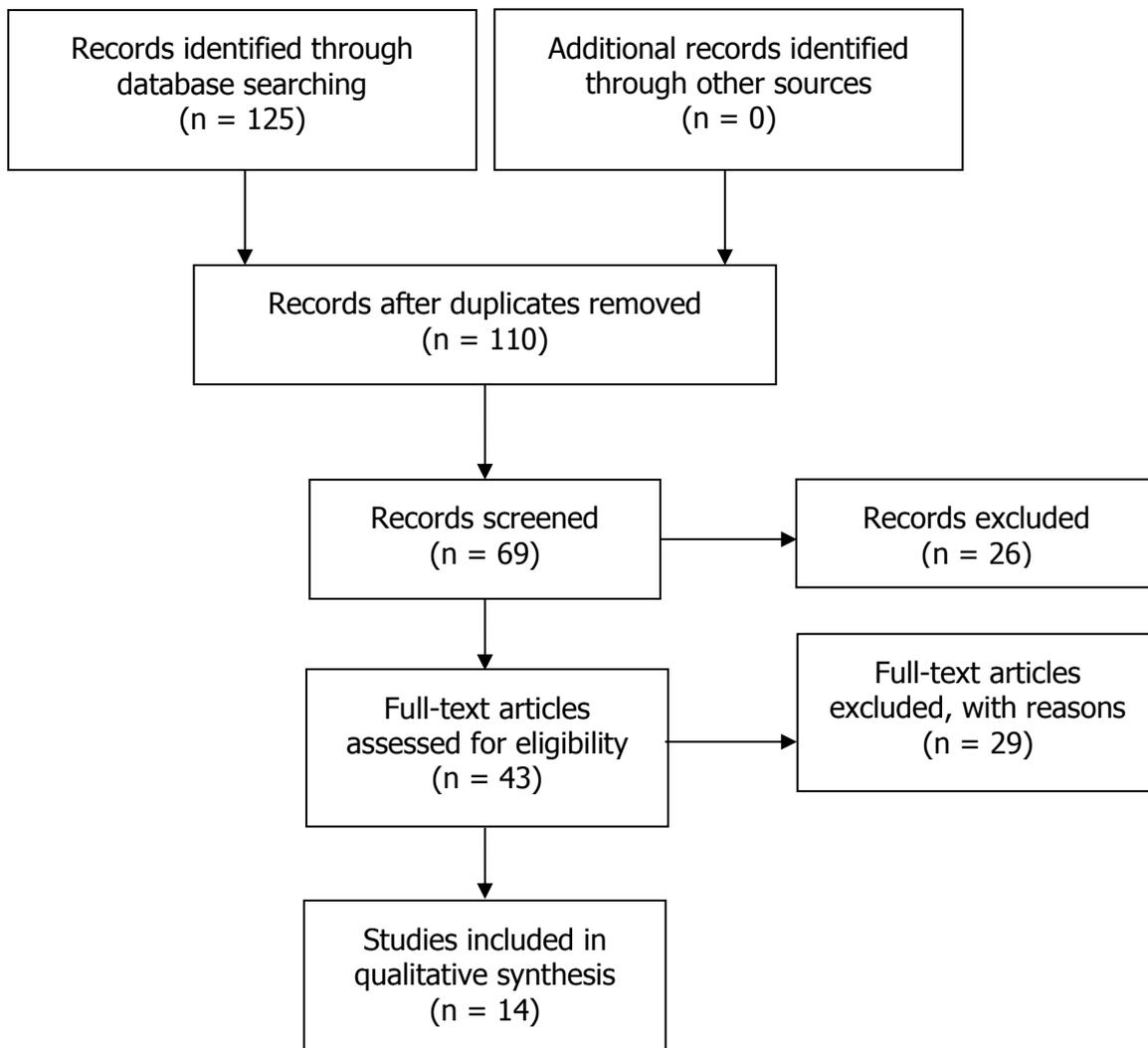
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Annex 2. PRISMA flow diagram



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