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Concept mapping as a method to enhance evidence-based public health

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ABSTRACT

In this paper we explore the suitability of concept mapping as a method for integrating knowledge from science, practice, and policy. In earlier research we described and analysed five cases of concept mapping procedures in the Netherlands, serving different purposes and fields in public health. In the current paper, seven new concept mapping studies of co-produced work are added to extend this analysis.

For each of these twelve studies we analysed: (1) how the method was able to integrate knowledge from practice with scientific knowledge by facilitating dialogue and collaboration between different stakeholders in the field of public health, such as academic researchers, practitioners, policy-makers and the public; (2) how the method was able to bring theory development a step further (scientific relevance); and (3) how the method was able to act as a sound basis for practical decision-making (practical relevance).

Based on the answers to these research questions, all but one study was considered useful for building more evidence-based public health, even though the extent to which they underpinned actual decision-making varied. The chance of actually being implemented in practice seems strongly related to the extent to which the responsible decision-makers are involved in the way the concept map is prepared and executed.

1. Introduction

Evidence-based public health is necessary for doing the right things right (Muir Gray, 2009). Consistent with the definition of evidence-based medicine, evidence-based public health can be defined as " . . . the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of communities and populations in the domain of health protection, health maintenance and improvement (health promotion)" (Jenicek, 1997).

Public health researchers therefore face the challenge of how to underpin public health decisions with the best available evidence. One might argue that evidence-based public health is a utopian dream, for the scientific evidence is either not (always) available, or poor in quality or not applicable in a specific context. However, evidence-based public health is not guided by scientific evidence alone. Sacket's concept of evidence-based medicine values the individual clinicians' expertise and the patients' state and preferences as equally important to making the right clinical decisions (Sackett, Rosenberg, Muir Gray, Brian Haynes, & Scott Richardson, 1996). Accordingly, in public health the scientific evidence should be integrated with evidence from public health professionals, as well as with contextual knowledge of the community.

Unfortunately, practice-based evidence is often considered of low value in science. The tacit knowledge of practitioners, patients, citizens, policy-makers and managers is thought to be only locally applicable, rarely published, and possibly harmful by replicating errors. However, when tacit knowledge is used to learn from adverse events to improve measures and practices, new knowledge can be created (Muir Gray, 2009). Moreover, for evidence-based public health, the tacit knowledge of professionals is crucial, especially when conclusive scientific evidence is not available. For instance, Muir Gray (2009) states: "absence of excellent evidence

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Table 1
An overview of the twelve concept mapping studies (first 5 studies based on earlier research[a]).

Study	Aim	Background
1) The development of a theoretical framework for the quality of regional public health reporting[b]	Construction of a theoretical framework	In the Netherlands, municipal health assessments are carried out by 28 Regional Health Services (RHS), serving 418 municipalities. Differences in these assessments between RHSs, for example in the selection of topics reported, methodological issues, and reporting format, made it difficult to compare the public health status of a particular municipality with the national public health status or that of other municipalities. Moreover, the RHSs faced the problem of making their epidemiological knowledge more useful for both regional and local public health policy. From this perspective, two main issues arise. First, little is known about the extent to which epidemiological information is used in local and regional health policymaking, and which factors, such as the characteristics of public health reports, may influence the actual use of such information. Second, there is a lack of a systematic overview of the different RHSs' public health reports and the way in which they are produced, so that a comparison on relevant characteristics cannot be made. Therefore, a concept map was set up to develop a theoretical framework for the quality of regional public health reporting in the Netherlands.
2) Defining a strategy for implementation of the Dutch national Guideline for municipal health policy[c]	Design of implementation strategy	In the Netherlands, the National Institute for Public Health and the Environment (RIVM) revised and integrated four national guidelines (including recommended interventions for health promotion) to address obesity, alcohol abuse, smoking and depression on the local level into one 'Healthy Community Guideline'. This Guideline is primarily targeted at Local Authorities and secondly at the Regional Health Services (RHS), which have an important role in the preparation and formulation of local health policy by order of the Local Authorities. In the absence of thorough understanding of specific conditions for effective use of this Guideline by RHSs, implementation strategies were developed and tested in two pilot RHSs. To target these strategies, the implementation goals were made explicit in both RHSs separately through the construction of concept map, conceptualizing the characteristics of successful implementation of the Guideline.
3) Concept mapping as a tool to guide (conduction and) evaluation of complex interventions: overweight prevention in Dutch youth	Evaluation planning	The Dutch "Young people on a healthy weight' approach" (JOGG) can be regarded as a complex intervention, especially since multiple stakeholders from public and private parties are involved. Evaluation of such an intervention is also complex and should be guided by a proper plan. The first step is the formulation of program objectives. In this study, concept mapping was used to conceptualize these objectives.
4) Mapping the concept of the quality of psychosocial care after incidents to guide the construction of a questionnaire to measure the quality of post-disaster psychosocial care in the Netherlands[d]	Construction of a questionnaire	In the aftermath of a disaster, one of the aspects of care giving to victims is psychosocial support. As with the other aspects (like rescue work, medical care, practical assistance etc.), this type of support should be of high quality. However, so far there are no explicit quality criteria or any instruments to evaluate and monitor the quality. The research project 'Quality of Psychosocial Care' strives to overcome these problems by seeking consensus on quality of psychosocial support during the first six weeks after an incident, and by designing a questionnaire that can be completed by victims in order to evaluate the quality of the care that was delivered to them. Yet, the Dutch field of psychosocial care consists of a broad network of various players with different interests and approaches. In order to reach consensus, and to enhance acceptance of the resulting questionnaire as an evaluation instrument, the method of concept mapping was chosen. To a certain extent, quality indicators can also be derived from literature, but in this case, it was very important to generate indicators that perfectly fit the Dutch organisation of support, endorsed both by professionals from different organisations and by victims.
5) Defining the added value of a new approach of Youth Health Care	Formulation of ambitions and targets	In the Regional Health Service (RHS) Hart voor Brabant, a transition is taking place from a supply-oriented organisation into a more demand-oriented organisation in which care is given to citizens in their own environment as much as possible. The RHS wants to be more close to those citizens who are the most in need of the RHS's (preventive) care, making use of all available expertise in the RHS (integrated care). Therefore the organisation model changed from a product-oriented division (Youth Health Care, Infectious Disease Control, and Health Promotion) into a geographic-oriented division (three regions). For Youth Health Care, this means that it will be organized as a program, crosswise arranged through the geographic divisions. Both the new orientation of youth health care (more close to youth in their own environment, integrated care) as the new organisation induced the RHS to develop a vision on the RHS's care for youth health, to serve as a framework for program strategy and action planning.

Table 1 (*Continued*)

Study	Aim	Background
6) Quality aspects of Dutch general practice–based data[e]	Define and describe quality aspects	General practice registration networks (GPRN) collect information from individual practices and collate data in a (central) database. However, recording criteria differ between GPRNs, due to different purposes, different type of information collected, and the method general practitioners use to record information. These differences in recording criteria might reflect different perspectives of good data quality, resulting in different interpretations of the data derived from different GPRNs. This study aimed to identify common aspects of good Dutch general practice–based data quality, resulting in a conceptual framework to describe quality of data.
7) Define building blocks of an EU health information system[f]	To identify key-features of a health information system on EU-level	A health information system can be understood as an infrastructure that allows professionals and lay people to use, interpret and share health-related information, and to enable decision making of relevant stakeholders and policy makers regarding the extent and the design of required actions. On EU-level elements of a health information system exist but it is fragmented and incomplete. By conceptualizing opinions and valuations of practitioners and policy makers the study aims to summarize required key features of a comprehensive EU health information system.
8) Guide the development of a questionnaire for recovery from mental disorders	Construction of a questionnaire	Formerly, for mental disorders. the remission of psychiatric symptoms or the recurrence of role functioning was seen as recovery. These days, living a meaningful life, despite psychiatric disabilities, is also seen as recovery. However, little is known about the clients' concept of personal recovery, let alone that valid instruments are available for the measurement of personal recovery from the clients' perspective. The purpose of this study is the development of a conceptual framework for the clients' perception of personal recovery from mental disorders in order to construct a questionnaire. This questionnaire could serve as a personal recovery measure for Routine Outcome Monitoring purposes.
9) Define quality of local care and support services in rural areas to guide planning and evaluation	Guide planning and financing policy	Through decentralization of national tasks since January 1 st 2015, municipalities In the Netherlands are held responsible for, amongst others, the support of and care for the disabled and elderly. In this whole operation, 'transition' plays a central role. This means that the citizens' own capacities are the starting point for assessing their need for care and support and that specialized care is only for those who are not capable of taking care for themselves or lack a sufficient informal network to support them. The Local Authorities of Laarbeek, a small rural municipality in the south of the Netherlands, wanted to assure the quality of support and care for their disabled and elderly in the four villages within the municipality. However, it is hypothesized that the understanding of quality of care and support differs between stakeholders involved, such as citizens, health care providers and financers of health care. The Local Authorities wanted to do right to all these different perceptions of quality in their planning and financing policy. Therefore, this study aimed to construct a common definition of quality of care and support in the municipality of Laarbeek by using the concept mapping method.
10) Define the added value of the participation of Youth Health Care professionals in primary school health care advisory teams to guide evaluation and quality improvement	Guide steering and evaluation	In the Municipality of Tilburg, in the south of the Netherlands, the Local Authorities wanted to develop outcome-indicators for the added value that youth health care physicians and nurses put in the so-called "care advisory teams" (CAT) of primary schools. With such outcome-indicators, the Local Authorities would be better able to steer the efforts of youth health care professionals with regard to content of the care given instead of steering by prescribing the input of hours. For the development of these outcome-indicators, Local Authorities specifically wanted to define the added value of the efforts of the youth health care physicians and nurses in the primary schools' CATs, on top of the efforts of other professionals participating in these CATs. The method of concept mapping was used to define this added value, as a basis to develop the outcome-indicators for steering and evaluation.
11) Assess key elements for monitoring socially vulnerable groups	Construction of a monitor	A Monitor socially vulnerable groups can support Local Authorities and local health care institutions to gain insight into the size and nature of problems of vulnerable people in the local community. Already several municipalities were executing such a monitor, but often based on different, partly overlapping conceptual approaches. However, authorities at the local and the national level are in the need of a general model for a Monitor socially vulnerable groups, both for efficiency reasons and to achieve more uniformity and comparability between the local monitors. To determine which components should form the basis of such a Monitor socially vulnerable groups, a concept mapping procedure was undertaken.
12) Build a theoretical framework for local integrated public health policy[g]	Construction of a theoretical framework	Integrated public health policy (IPHP) intends to contribute to the population's health through coherent efforts of various policy sectors and organisations. This makes IPHP a very complex and multilevel undertaking. On the one hand different theoretical approaches have

Table 1 (*Continued*)

Study	Aim	Background
		been proposed, while on the other hand local IPHP practices, often experimental of nature, are hard to identify for operational criteria, and characteristics to identify IPHP are lacking. This hinders monitoring and evaluation of IPHP, and, as a result, the strengthening of the evidence-base for IPHP. Conceptualization IPHP is needed to guide IPHP development, implementation and evaluation.

[a] Van Bon-Martens et al. (2014).
[b] Van Bon-Martens et al. (2012).
[c] Kuunders et al. (2016).
[d] Holsappel et al. (2013).
[e] Van den Dungen et al. (2013).
[f] Rosenkötter et al. (2015).
[g] Tubbing et al. (2015).

does not make evidence-based decision making impossible; what is required is the best evidence available, not the best evidence possible" (Muir Gray, 2009). In addition, in public health, other factors than evidence influence policymaking, such as coincidence, timing, power, and competition (Fafard, 2008; Hoeijmakers, 2005; Kingdon, 1984; Oxman, Lavis, Lewin, & Fretheim, 2009). Therefore, to stress the role of evidence and the ambition to improve the extent to which policy decisions are informed by research evidence, the term 'evidence-informed' is often used rather than evidence-based in the case of public health policy (Nutley, 2003; Oxman et al., 2009). In this paper, evidence-based is meant in this broader sense of 'evidence-informed'.

Another challenge is that in public health the problems to be solved are of a different complexity than in clinical medicine, especially due to contextual variations. Determinants of health can be identified and may be influenced at different and interacting levels: individual, population, organisation, and society (Kelly et al., 2009, 2010). This requires broader scientific evidence than that contributed by the biomedical disciplines alone. Different research methods from different disciplines, like psychology and sociology, providing different types of evidence, are needed in a multidisciplinary approach (Kelly et al., 2010).

In addition, theories play an important role in public health, either explicitly, such as with behaviour and behaviour change theories, or more implicitly, such as through policy assumptions. This implies that theory development can play an important role in evidence-based public health. Theory development might address different levels of evidence, crossing disciplinary boundaries. Theories can be seen as a framework, to serve as a sound basis for program planning and evaluation. Crossing disciplinary boundaries and applying program-planning frameworks are some of the key components of evidence-based public health (Brownson, Fielding, & Maylahn, 2009).

Public health researchers face the challenge to underpin public health decisions with the best available evidence in order to do the right things right. The integrated approach of concept mapping has the potential to be a valuable social research method to achieve this goal (Kane & Trochim, 2007; Trochim & Kane, 2005; Trochim, 1989). First, it is an appropriate method to integrate tacit knowledge from professionals, such as practitioners, patients, citizens, policy-makers and managers, for it involves different groups of stakeholders. Second, the method can be used to engage the community in decision making, another key component of evidence-based public health (Brownson et al., 2009). This is why concept mapping is considered a useful approach in the field of community-based participatory research (Windsor, 2013). Third, it operates with different epistemological concepts and crosses disciplinary boundaries, combining quantitative and qualitative research methods. Fourth, the method is suitable for theory development because it represents the ideas of a group in a variety of visual results, making inferences possible about the relations between those ideas. The resulting concept map may serve as a theoretical framework for program planning and evaluation.

This paper builds on earlier work in which we explored the suitability of concept mapping as a method to integrate knowledge from science, practice, and policy. In that research we described and analysed five cases of concept mapping procedures in the Netherlands, serving different purposes and fields in public health (Van Bon-Martens et al., 2014). In the current paper, seven new concept mapping studies of co-produced work are added to extend this exploratory review.

2. Method

In addition to the five concept mapping studies we described in our previous paper, we included seven new concept mapping studies of co-produced work in the period 2011–2014. The first five concept maps aimed to: 1) develop a theoretical framework for the quality of regional public health reporting (Van Bon-Martens, Achterberg, van de Goor, & van Oers, 2012); 2) define an implementation strategy of a Dutch guideline for municipal health policy (Kuunders, van Bon-Martens, van de Goor, Paulussen, & van Oers, 2016); 3) guide the evaluation of overweight prevention in Dutch youth; 4) guide the construction of a questionnaire to measure quality of post-disaster psychosocial care (Holsappel, Fassaert, Dorn, & te Brake, 2013); and 5) define the added value of a new approach of Youth Health Care. The seven concept maps added to extend our analyses aimed to: 6) assess the quality aspects of general practice-based data (Van den Dungen, Hoeymans, Schellevis, & Van Oers, 2013); 7) define building blocks of an EU health information system (Rosenkötter et al., 2015); 8) guide the development of a questionnaire for recovery from mental disorders; 9) define quality of local care and support services in rural areas to guide planning and evaluation; 10) define the added value of the participation of Youth Health Care professionals in primary school health care advisory teams (CATs) to guide evaluation and quality improvement; 11) assess key elements for monitoring socially vulnerable groups to guide monitor development; and 12) build a theoretical framework for local integrated public health policy (IPHP) (Tubbing, Harting, & Stronks, 2015).

An overview of the twelve studies is given in Table 1, their concept mapping procedures are described in Table 2 and their concept map results are presented in Table 3.

All studies used the integrated approach as described by Trochim, involving six steps: preparation, generation of

Table 2
Step 1–5 of the concept mapping procedure of the twelve concept mapping studies (first 5 studies based on earlier research[a]).

Study	Step 1: Preparation	Step 2: Generation of statements	Step 3: Structuring	Step 4: Graphic representation	Step 5: Interpretation
1) The development of a theoretical framework for the quality of regional public health reporting[b]	The researchers identified the participants and the brainstorm focus.	- In two different brainstorming sessions, participants came up with 111 statements. - The researchers removed 25 duplicates and supplemented the list with 10 international criteria.	The statements were sent to each participant for rating and sorting.	The main researcher processed the results statistically. The point map and the possible cluster solutions were represented graphically. A cluster tree was constructed by the main researcher.	The output was discussed and interpreted in a small working group (researchers and some participants), leading to the final concept map.
2) Defining a strategy for implementation of the Dutch national Guideline for municipal health policy[c]	The first RHS choose to invite their staff members only to set their own implementation targets.	In one brainstorming session, 15 participants produced 55 statements.	In the same session all statements were rated and sorted by the participants individually.	The point map and cluster solutions were constructed by the researcher and four participants.	The output was discussed by the main researcher and all participants.
	The second RHS aimed to set implementation targets not only in their own policy, but also in the policy of other stakeholders. Therefore, the second RHS invited other stakeholders to participate.	In two separate brainstorming sessions, (12 and 17) participants produced 95 statements. The researchers and project leader removed 7 duplicates.	The statements were sent to the participants for rating and sorting. Sorting and rating tasks were completed by 18 participants.	The main researchers and project leader processed the results statistically. The point map and the possible cluster solutions were represented graphically. A cluster tree was constructed by the main researchers and the project leader.	The final concept map was discussed by the researchers and participants.
3) Concept mapping as a tool to guide (conduction and) evaluation of complex interventions: overweight prevention in Dutch youth	Concept mapping was used as a starting point to guide the formulation of (shared) program objectives for the JOGG approach in the municipality Veghel.	In a brainstorming session, members of the JOGG project team were asked to formulate short statements that expressed when they felt 'JOGG Veghel' to be successful. Several persons were asked to supplement this list by mail. Seventy-four statements were collected.	The statements were sent to the participants for rating and sorting.	The main researcher processed the results statistically. The point map and the possible cluster solutions were represented graphically. A cluster tree was constructed by the main researcher.	The results were discussed in the project team, leading to the final concept map.
4) Mapping the concept of the quality of psychosocial care after incidents to guide the construction of a questionnaire to measure the quality of post-disaster psychosocial care in the Netherlands[d]	As participants, 7 professionals from the field of Public Health, 2 professionals from the field of Public Safety, 6 Acute Care professionals (GP's, the Red Cross, Victims Support, psychologists, post-disaster pastoral care, social work), and 10 victims from past incidents, were selected by the researchers. Thus, variety and balance between different parties were well ensured.	Those who were not able to join the session (3 professionals and 7 victims) were interviewed on the beforehand by the researchers. This way, two to five statements per person were gathered, which were mentioned by the researcher during the brainstorm session with the remaining participants. After an hour of group brainstorming, a set of 79 numbered statements was generated.	The sorting and rating tasks were completed by all participants except two victims, so that the final concept map is based on the input of 23 people.	The main researcher processed the results statistically. The point map and the possible cluster solutions were represented graphically. A cluster tree was constructed by the main researcher. Initially, this led to a cluster solution with 10 clusters, with a minimum of 2 and a maximum of 21 statements per cluster.	In a second group session, a cluster solution with eight clusters was adopted, and cluster labels were discussed. Each cluster label outlines a principle of good psychosocial care. Apart from the expert group that delivered the actual input for the concept map, a steering committee was formed with policy makers and researchers from all three fields, who also reflected on the resulting concept map, accrediting it for their respective organisations.
5) Defining the added value of a new approach of Youth Health Care	A small working group, including the manager, identified the participants and the brainstorm focus.	The participants formulated 75 short statements in one brainstorming session.	In the same session all statements were rated and sorted by the participants individually.	The main researcher processed the results statistically and produced the output (point map, possible cluster solutions, and a cluster tree). The main researcher proposed the cluster solution, labelled the clusters and the dimensions and made a short report on the results.	The cluster tree and the short report were discussed in a small working group.
6) Quality aspects of Dutch general practice–based data[e]	The research group formulated the brainstorm focus and invited the participants. The participants were all related to a general	Participants formulated 65 statements in one brainstorming session. The main researcher added 7 statements from literature.	The statements were sent to each participant for rating and sorting. Participants were asked to invite other experts from their GPRN to broaden the basis of the exercise.	The main researcher processed the results statistically, and constructed a point map and a cluster tree. The research group evaluated all possible clusters using	The participants discussed the labelling of the clusters in the second face-to-face meeting. Based on this discussion, the research group determined the definitive

Table 2 (*Continued*)

Study	Step 1: Preparation	Step 2: Generation of statements	Step 3: Structuring	Step 4: Graphic representation	Step 5: Interpretation
	practice registration network.			the cluster tree. Based on this input, sent beforehand, the participants determined the final number of the clusters during a second face-to-face meeting.	labels and identified the two dimensions (the axes of the concept map).
7) Define building blocks of an EU health information system[f]	The research group formulated the brainstorm focus and invited 261 participants by e-mail. Additionally a general invitation was sent to an expert group of the European Public Health Association.	During a brainstorming exercise organized through the project website (http://www.healthinfo-concept.info/) 34 participants formulated 217 statements in a period of 2.5 weeks. The main researcher published and updated daily all statement entries on the website to facilitate the exchange of ideas. The research group finally revised and edited the too complex statements to clarify, specify of simplify them and removed the duplicate entries. The final list contained 93 statements.	The statements were sent to each participant via e-mail, using a prepared Excel sheet for rating and sorting.	The main researchers processed the results statistically, and constructed a point map and a cluster tree. They proposed a 10 cluster solution of the concept map, with labels for the clusters, and the endpoints of the axes.	The research group discussed the 8–12 cluster solutions, determined the final number (10) of the clusters, as well as the labels for the clusters and dimensions.
8) Guide the development of a questionnaire for recovery from mental disorders	The project group, consisting of researchers, clients, and professionals, formulated the brainstorm focus and invited 16 participants.	The participants formulated 67 statements in one brainstorming session.	In the same session all statements were rated and sorted by the participants individually.	The main researchers processed the results statistically, and constructed a point map and a cluster tree. The final number of clusters was chosen by the researchers.	The researchers formulated labels that covered the content of the clusters and identified the two dimensions (the axes of the concept map).
9) Define quality of local care and support services in rural areas to guide planning and evaluation	The project group, with researchers and representatives of Local Authorities, formulated the brainstorm focus and chose the categories of participants. The Local Authorities invited 21 participants.	The participants formulated 80 statements in one brainstorming session.	In the same session all statements were rated and sorted by the participants individually.	The main researcher processed the results statistically, and constructed a point map and a cluster tree. The final number of clusters was chosen by the researchers, using a cluster tree. The researchers proposed the cluster labels.	A selection of participants, representing different perspectives, discussed the labelling of the clusters and chose the definitive labels in a second face-to-face meeting. They also identified the two dimensions (the axes of the concept map).
10) Define the added value of the participation of Youth Health Care professionals in primary school health care advisory teams to guide evaluation and quality improvement	The project group, with researchers and representatives of Local Authorities, formulated the brainstorm focus and chose the categories of participants. The Local Authorities invited the participants.	The participants formulated 45 statements in one brainstorming session.	In the same session all statements were rated and sorted by the participants individually.	The main researcher processed the results statistically, and constructed a point map and a cluster tree. The researchers proposed the final number of clusters using a cluster tree.	The project group chose the final number of clusters, discussed the labelling of the clusters and chose the final labels. They also identified the two dimensions (content of the axes of the concept map).
11) Assess key elements for monitoring socially vulnerable groups	The researchers formulated the brainstorm focus and invited the participants.	Three brainstorm meetings were organized for different groups of participants. The researchers removed the duplicate entries and added statements from literature, up to a total of 92 statements.	The statements were sent to each participant for rating and sorting.	The main researcher processed the results statistically, and constructed a point map and a cluster tree. The researchers chose the final number of clusters.	The researchers labelled the clusters and identified the two dimensions (the axes of the concept map).
12) Build a theoretical framework for integrated local public health policy[g]	The researchers formulated the brainstorm focus and invited 237 potential participants.	Participants were invited through an e-mail with a link to a collective brainstorming page. Statements were collected during a period of 2 weeks. Two reminders were sent at equal intervals. Researchers edited the 177 statements	Researchers invited a subgroup of 100 participants for the web-based rating and sorting tasks. Statements were rated based on relevance and measurability.	A panel of five experts from science, policy and practice individually assessed the different cluster solutions provided by the software, using a checklist, while the number of clusters per solution decreased step by step from 20 to 4.	The panel of five experts also indicated the most appropriate cluster labels. The researchers decided on the number of clusters and the cluster labels and identified and labelled the dimensional axes. Moreover, they partitioned clusters into

Table 2 (*Continued*)

Study	Step 1: Preparation	Step 2: Generation of statements	Step 3: Structuring	Step 4: Graphic representation	Step 5: Interpretation
		received: they split statements containing more than one idea, removed duplicate items, merged largely overlapping items and corrected language mistakes. Together with an external health promotion expert, the researchers finally added 10 statements from literature which they felt were both missing and essential. This resulted in a list of 97 statements.		Furthermore, pattern matches were produced to support the interpretation.	themes using the concept mapping software and labelled these themes.

[a] Van Bon-Martens et al. (2014).
[b] Van Bon-Martens et al. (2012).
[c] Kuunders et al. (2016).
[d] Holsappel et al. (2013).
[e] Van den Dungen et al. (2013).
[f] Rosenkötter et al. (2015).
[g] Tubbing et al. (2015).

statements, structuring of statements, representation of statements in the form of a concept map, interpretation, and utilisation (Kane & Trochim, 2007; Trochim, 1989). Eleven of the twelve studies used the Ariadne software for the quantitative analyses (Severens, 1995). In study 12, the Concept Systems® software was chosen because it offered advanced online possibilities for generating and structuring statements remotely. The Ariadne software deviates from the method described by Trochim and from the Concept Systems® software in that it uses Principal Component Analyses (PCA) instead of a two-dimensional nonmetric multidimensional scaling (MDS) of the similarity matrix of the aggregated sort data (Kane & Trochim, 2007; Trochim, 1989). These techniques are related statistically and both try to reduce data into a smaller number of dimensions. PCA tries to put as much information as possible in a flat area with two dimensions, whereas MDS tries to leaves the – Euclidean – distances between two points as intact as possible. PCA is a linear method, whereas MDS integrates both a linear (usually using PCA) and nonlinear algorithm. Both use eigenvalue decomposition to find the best solution. The sum of eigenvalues of the first two dimensions divided by the number of items is presented as the proportion of variance explained by PCA. The stress-factor is the key diagnostic statistic in MDS and can be interpreted as the proportion of unexplained variance (Kane and Trochim, 2007). PCA and MDS might lead to different positions of the statements on the point map. However, considering the minor differences in methodology, those differences probably will not lead to interpretation differences for the topic at hand.

We performed an exploratory review of these 12 concept mapping studies. For each of the studies we examined: (1) how the method was able to integrate knowledge from practice with scientific knowledge by facilitating dialogue and collaboration between different stakeholders in the field of public health, such as academic researchers, practitioners, policy-makers and the public; (2) how the method was able to bring theory development a step further (scientific relevance); and (3) how the method was able to act as a sound basis for practical decision-making (practical relevance).

Based on the available publications (scientific papers or reports) of the studies, we described the study characteristics and the resulting concept maps using the format of Tables 1–3 and we developed preliminary answers for our three research questions. Subsequently, we asked the primary researchers to check and complete Tables 1–3 as well as our answers to the three research questions. Finally, the reactions of the primary researchers were processed by one of the authors into the final tables and answers.

3. Results

3.1. Integrating knowledge from practice and science

The answers to the first research question – how the concept mapping method was able to integrate knowledge from practice and science – are given in Table 4 for each of the twelve studies. Here, we will describe our subjective summary of these answers.

According to the aim of the concept map, the twelve studies differ in the way they included different stakeholders from policy, practice and research. Eight studies included participants from all three disciplines (1–4, 7, 10–12). Three studies included just one type of stakeholder: study 5 (practitioners), study 6 (researchers), and study 8 (clients).

In most studies (10 out of 12), statements were collected using one or more brainstorming sessions. In study 11, those brainstorming sessions were held separately for the different stakeholders. In one study (study 4) a few statements were also collected beforehand through interviews and brought in during the brainstorm session by the primary researcher.

The concept maps of the twelve studies represent the ideas of the stakeholders involved. However, dialogue and interaction between stakeholders were perceived as more difficult or even absent when different languages were involved (study 7) or when brainstorming was performed remotely (study 7 and 12).

Participation of different types of stakeholders in one brainstorming session encouraged interaction, making them more aware of their differences and empowering them to better understand the different jargons used. Moreover, a jointly constructed concept map encouraged collaboration by providing a focal point in a process that they were all part of (study 4). Two studies explicitly evaluated the procedure with their participants. In study 5, participants were enthusiastic and proud to have achieved a common sense of their organisation's vision and targets. In study 10, the participants expressed that the meeting

Table 3
The results of the twelve concept mapping studies (first 5 studies based on earlier research[a]).

Study	Participants	(n)	Dimensions	Clusters	(n)	Items (n)
1) The development of a theoretical framework for the quality of regional public health reporting[b]	- producers (staff of the RHSs: epidemiologists, policy advisors, and management) - the intended users (municipal officials) - national stakeholders (such as the Ministry and the Inspectorate)	35	1) Product, ranging from production to content 2) Context, ranging from science to policy	1) solution orientation, 2) policy relevance, 3) policy impact, 4) interpretation, 5) problem analysis, 6) position policy cycle, 7) data integration, 8) scientific foundation, 9) reliability, 10) interaction, 11) marketing, 12) undefined, 13) broad utility	13	98
2) Defining a strategy for implementation of the Dutch national Guideline for municipal health policy[c]	- staff of the RHS: epidemiologists, policy advisors, project staff, manager	15	1) Sustainability, ranging from preconditions to usage 2) Application, ranging from policy to practice	1) inclusion health topics in local health memorandum, 2) RHS uses Guideline and encourages use by municipalities, 3) commitment and use by municipal officer and manager, 4) usage for systematic policy and integrated health, 5) priorities in local memorandum based on Guideline and regional public health report, 6) municipalities can transfer Guideline to local situation, 7) municipalities and partners remain satisfied with Guideline, 8) municipal officer finds required information more easily, 9) partner health providers use Guideline, 10) municipality uses and evaluates approved interventions, 11) alignment of execution between municipalities and local partners, 12) broad application for policy in urban and rural regions, 13) Guideline saves time when writing local memorandum	13	55
	- staff of the RHS: epidemiologists, policy advisors, project staff, managers - Local Authorities - regional partner organisations (mental health, dietician, primary care, sports)	18	1) Application, ranging from policy to practice 2) Sustainability, ranging from preconditions to usage	1) recognition added value, 2) actual results 3) usable for practical implementation, 4) fixed component in method of RHS, 5) use by municipalities, 6) broad support, 7) joint use by relevant organisations, 8) usable for municipal policy, 9) joint use in policy making relevant organisations, 10) structural funding and embedment	10	95
3) Concept mapping as a tool to guide (conduction and) evaluation of complex interventions: overweight prevention in Dutch youth	- Members of the JOGG project team: - public health practice - care - local policy - education - sports	15	1) Health care continuum, ranging from prevention to care 2) JOGG model, ranging from input to outcome	1) primary goals, 2) health policies, 3) intervention supply, 4) targeted care, 5) exercise facilities, 6) healthy behaviour, 7) embedding of JOGG	7	74
4) Mapping the concept of the quality of psychosocial care after incidents to guide the construction of a questionnaire to measure the quality of post-disaster psychosocial care in the Netherlands[d]	- professionals from the field of Public Health (n = 7) - professionals from the field of Public Safety (n = 2) - Acute Care professionals (GP's, the Red Cross, Victims Support, psychologists, post-disaster pastoral care, social work; n = 6) - victims from past incidents (n = 10)	23	1) structure and process 2) information and support	1) an approach that is in accordance with the needs and capacities of the victim, 2) stimulating social support, 3) individually appropriate care, taking diversity among victims into account, 4) different organisations offering care that is coherent and complementary, 5) providing incident-related information in a timely and targeted manner, 6) providing information on normal reactions, 7) offering access to information and advice on legal issues and questions about media, 8) monitoring victims and initiating follow-up where needed	8	79
5) Defining the added value of a new approach of Youth Health Care	- Staff members of the RHS, based on diversity of: - working division (Infectious Disease Control, Health Promotion, Youth Health Care 0–4 yrs, and Youth Health Care 4–19 yrs) - level of operation (management, advisors, professionals) - three working regions	16	1) youth health care delivery, ranging from care giver to care receiver 2) preventive care orientation, ranging from population to individual	1) demand oriented, 2) accessible, 3) focus on child and parent, 4) care chain, 5) professionalism, 6) timing, 7) relation with target population, 8) population orientation, 9) relation with Local Authority, 10) visibility, 11) method of working, 12) environment	12	75
6) Quality aspects of Dutch general practice–based data[e]	- Representatives (experts) of 10 GPRNs: - 10 (of 15) participated in the brainstorming session	17	1) context of providing health care, ranging from multidisciplinary care to	1) episode oriented recording, 2) coding of information, 3) complete health record, 4) recording agreements, 5) diagnostic validity, 6) residual category	6	72

Table 3 (*Continued*)

Study	Participants	(n)	Dimensions	Clusters	(n)	Items (n)
	- 17 (of 19) completed the structuring task - 10 participated in the face-to-face interpretation session		individual GP care 2) content of medical recording, ranging from basic recording to complete recording			
7) Define building blocks of an EU health information system[f]	• Public health professionals or policy makers representing 20 European countries: • 34 participated in the brainstorming phase • 28 participated in the structuring phase, mainly public health practitioners and working at the national level (research and/or public administration)	34	1) organisational strategy, ranging from efforts to achievements 2) professional orientation, ranging from science to policy	1) quality of data and information, 2) identify policy needs, 3) system development, 4) assist policy implementation, 5) sustainability, 6) user orientation, 7) develop policy preparation, 8) information improvement, 9) knowledge provision, 10) information coverage	10	93
8) Guide the development of a questionnaire for recovery from mental disorders	Participants were experts by experience, with different backgrounds: eight women and eight men. They all had experienced (severe) mental illnesses in their lives	16	1) connection with 'the self' and others, ranging from individual to society 2) attitude towards illness, ranging from disabilities to possibilities	1) empowerment, 2) development of a positive identity and self-confidence, 3) development of self-esteem, 4) acceptance and knowledge of disability, 5) coping with disabilities, 6) connection with others, 7) acceptance of social roles, 8) acceptance of social support	8	67
9) Define quality of local care and support services in rural areas to guide planning and evaluation	• Participants were selected based on their function and their origin (the four villages): • 21 participated in the brainstorming and structuring phase: care consumers (n = 4), informal care givers (n = 5), volunteers (n = 3), health care professionals (n = 8), civil servant (n = 1) • 9 participated in the interpretation phase: informal care givers (n = 1), volunteers (n = 3), health care professionals (n = 4), civil servant (n = 1)	21	1) course of care, ranging from supply to performance 2) delivery of care, ranging from provider to client	1) care at home, 2) respect and autonomy, 3) communication, 4) united care, 5) efficient use of resources, 6) accessibility, 7) harmonized services, 8) tailored care, 9) having eye for informal care, 10) linking up people, 11) participation, 12) availability services	12	80
10) Define the added value of the participation of Youth Health Care professionals in primary school health care advisory teams to guide evaluation and quality improvement	Participants were selected based on their function, in order to represent all relevant perspectives: youth health care (nurses, physicians, manager), social work, primary education, civil servants, and a national expert on CAT at primary schools. They all participated in the brainstorming and structuring phase	12	1) Added value of actions, ranging from acting to input of knowledge 2) Specificity of input, ranging from general/integral to case-specific	1) input of social-medical information and expertise, 2) strengthening early detection, 3) strengthening team and network, 4) broad perspective, 5) strengthening relation with parents, 6) thinking in connections, 7) help close to home, 8) putting forward the social context, 9) knowledge of educational concepts	9	45
11) Assess key elements for monitoring socially vulnerable groups	• Participants were selected based on their involvement with public mental healthcare from policy, practice and science: • 28 participated in the brainstorming phase: • session 1: policy advisors on public mental healthcare from regional health services and the Netherlands centre for social development Movisie (n = 8) • session 2: civil servants (n = 4), researchers from regional health services (n = 4), the Dutch Health Care Inspectorate (n = 1), other institutions (n = 4) • session 3: public mental healthcare professionals (n = 7) • 14 participated in the structuring phase: originating from session 1 (n = 5), session 2 (n = 7) and session 3 (n = 2).	28	1) content, ranging from information to implementation 2) context, ranging from socially vulnerable people to policy makers	1) size of the socially vulnerable groups, 2) problems of the socially vulnerable groups, 3) data quality, 4) policy relevance, 5) healthcare chain and healthcare provision, 6) data presentation, 7) general approach of the target group	7	92
12) Build a theoretical framework for integrated local public health policy[g]	- Potential participants were identified, working in different fields (science, policy, and practice), largely from the health sector, and fairly diversified based on geography,	62–86	1) policy phases, ranging from design to implementation 2) input-output, ranging from	1) policy coherence, 2) organising connections, 3) positioning health, 4) addressing determinants, 5) generic aspects, 6) network and actors, 7) conditions for collaboration, 8)	11	97

Table 3 (*Continued*)

Study	Participants	(n)	Dimensions	Clusters	(n)	Items (n)
	gender, amount of experience and position. - 62 participated in the brainstorming phase. Participants were working in the field of science (n = 21), policy (n = 17) and practice (n = 24) - 24 participated in the sorting and rating phase, 21 participants completed both sorting and rating, 2 only sorting and 1 only rating: - 21 completed the sorting task: working in the field of science (n = 11), policy (n = 8) and practice (n = 4) - 22 completed the rating task: working in the field of science (n = 11), policy (n = 9) and practice. (n = 2)		capacities to health outcomes	boundary work, 9) learning process, 10) scope, 11) citizen and neighbourhood		

[a] Van Bon-Martens et al. (2014).
[b] Van Bon-Martens et al. (2012).
[c] Kuunders et al. (2016).
[d] Holsappel et al. (2013).
[e] Van den Dungen et al. (2013).
[f] Rosenkötter et al. (2015).
[g] Tubbing et al. (2015).

was already one step forward towards a better functioning of youth health care in the CATs, for they all individually and explicitly named what they thought as relevant for the subject at hand, contributing to a better mutual understanding of needs and expectations.

Besides through the interaction and collaboration during the brainstorming session, the integration of science and practice was also achieved through the content and the structuring of the statements. Between the brainstorming and structuring phase, statements from the literature were added to the statement list to integrate scientific knowledge (study 1, 6, 11, 12). In the same way, statements from practitioners were added to integrate knowledge from practice (study 3). Nevertheless, the different jargons used were considered to still leave room for misinterpretation (study 11).

Most primary researchers were confident that the perspectives of science and practice were integrated in the resulting concept map, due to the procedure followed. In study 3, the resulting concept map even contained one axis representing the scientific perspective and the other axis the practical perspective.

3.2. Advancing theory development

The answers to the second research question – how the concept mapping method was able to advance theory development (scientific relevance) – are given in Table 4 for each of the twelve studies. Here, we will describe our subjective summary of these answers.

There seems to be a difference between studies that were mainly science-driven (1, 2, 4, 6–8, 11–12), practice-driven (3,5) and policy-driven (9–10).

In six of the eight science-driven studies, an effort has been made to compare the results with existing literature. According to the primary researchers, the concept maps in these six studies contributed to further theory development. In most studies, this was achieved by revealing new statements and/or new clusters for the topic at hand. In some studies, the scientific relevance of the concept map was also achieved by summarizing and prioritizing existing theories. The maps organized a major part of earlier separately reported and presented aspects into clusters and statements, while showing the extent of interconnectedness between them. In a few studies, the concept map advanced theory development by putting more emphasis on existing clusters. In one study (study 12) the positions of the clusters suggested a distinction between specific and generic themes.

Two science-driven studies didn't compare the resulting concept map with existing literature. Study 2 focussed on the comparison of two concept maps for the same topic – implementation of a guideline – in different contexts. The similarities and differences in the concept maps were related to implementation theories and confirmed the importance of involving the stakeholders in the implementation planning of innovations. Study 11 was not aimed at theory development at all.

One practice-driven study (study 3) concluded that the resulting concept map led to new scientific insight, showing more aspects than considered before. The other practice-driven study as well as both policy-driven studies did not compare their results with scientific literature. They provided a bottom up empirical approach that enabled a synthesis of experiences and opinions from different perspectives into a more conceptual framework (the clusters and dimensions distinguished).

3.3. Improving practical decision-making

The answers to the third research question – how the concept mapping method was able to improve practical decision-making (practical relevance) – are given in Table 4 for each of the twelve studies. Here, we describe our subjective summary of these answers.

In most studies the resulting concept map was used in practice, however not always in specific and direct ways, or in the ways that were initially intended. The only concept map that wasn't used at all was the practice-driven concept map in study 5. This was explained by organisational changes, shortage of capacity, and changing ambitions of the organisation at hand. In the other practice-driven study (study 3), the concept map was directly used to target the prevention program, to prioritize proposed activities, and to guide evaluation.

The concept maps in the science-based studies were put into practice by translating them to a checklist and/or toolbox (study 1

Table 4
The answers to our three research questions for the concept mapping studies (first five studies based on earlier research[a]).

Study	Integrating knowledge from practice and science	Scientific relevance	Practical relevance
1) The development of a theoretical framework for the quality of regional public health reporting[b]	Disciplines were included from research, policy, and practice with different perspectives on public health reporting: as user or producer, working in national, regional or local organisations. Some of them had worked before on international quality criteria for public health reporting, so they could put these criteria forward in the brainstorm. Due to the procedure followed, all relevant international practice-based criteria were represented in the concept map.	This study provided a theoretical framework for the quality of regional public health reporting, indicating relevant domains and criteria. The concept map came up with new criteria, not yet covered by the international criteria. In this Dutch concept map more attention was given to 'production', especially 'interaction', than in the case of the international criteria. The identification of the cluster 'interaction' fitted well into the theoretical perspective of research utilisation, where interaction is seen as an important condition for implementing research findings into policy. The theoretical framework can act as a sound basis for further research where domains and criteria can be translated into operational indicators for evaluating regional public health reports.	The theoretical framework for regional public health reporting in the first study is now used in practice by RHSs as a checklist for improving the quality of their public health reports during their development. For greater effectiveness, 'interaction' is already given a more prominent role in this. A national toolkit to support RHSs in public health reporting has added a chapter to these quality criteria.
2) Defining a strategy for implementation of the Dutch national Guideline for municipal health policy[c]	This study had a twofold goal. First, concept mapping was used to guide the separate implementation strategies of a Dutch Guideline in two pilot RHSs. The choice of participants was therefore made by each RHS separately. Second, the concept maps were used to bring differences in implementation strategies of the Dutch to the light. Therefore, the same concept was mapped in two RHSs. In both procedures, research, policy, and practice were represented, though the first RHS invited their own staff only. Due to different numbers and constellations of participant groups, the second concept map with a broader group of participants produced a wider variety of statements on successful implementation than the first. This might also relate to the fact that the first RHS sets its implementation targets primarily to internal adoption of the Guideline by its professionals and managers, while the second RHS highlights the importance of adoption by municipalities.	Despite different numbers and constellations of participant groups, the two RHSs in this study showed similar dimensions and top three clusters on successful implementation of the Guideline. However, this correspondence of implementation criteria did not lead to similar strategies for implementation when change was actually put into practice. Implementation theory of the last decade emphasises to take into account theory and views or beliefs of practitioners who are involved (bottom-up) when innovations are to be introduced. The concept mapping method helps to consciously confront theory and practice in order to stimulate feasibility and desirability of innovations and to stimulate or adjust ideas.	The results of this study showed emphasis on the alignment process and control issues between Local Authorities and RHS organisations. In developing a strategy for implementation of the Guideline, the first RHS considered municipal commitment conditional for the method of implementation in their own RHS organisation whereas the second RHS targeted their strategy on developing local ownership of relevant stakeholders, Local Authorities included. The first RHS used the final concept map internally as a basis for the development of a questionnaire aimed at a broader assessment and prioritisation of implementation targets. Both RHSs used the final concept map to target and evaluate their implementation of the Guideline and considered the concept map a useful method to do so.
3) Concept mapping as a tool to guide (conduction and) evaluation of complex interventions: overweight prevention in Dutch youth	The combination of practical and theoretical notions is represented in the labelling of the axes of the concept map. Within this concept map, one of the dimensions is a practice based dimension (the care continuum), while the other dimension is a theory based dimension (the continuum of the logic intervention model for 'JOGG' – a local integral approach of overweight and obesity in youth).	Initially, this study was primarily focussed on practical relevance. However, the resulting concept map led to new scientific insight, showing that both the input and outcome of the logic model are more multifactorial than they were considered before. The concept map thus directed the attention to factors that may otherwise have been more or less neglected, in practice as well as in theory building. Input (activities and actions) should not only be directed at health policies, effective interventions and promotion, but also at embedding of the JOGG concept and ideas. Similarly, a successful outcome for JOGG is not just simply a reduction in overweight of youth. Realisation of exercise facilities or actual changes in health behaviour are also regarded as valuable outcomes.	The concept map in this study was used by the JOGG project team to define secondary goals and to prioritize proposed activities. It was concluded that concept mapping was a helpful method in the first step of writing an evaluation plan: the formulation of (shared) program objectives. Based on results from the concept map (amongst others), the focus shifted from short-term preventive interventions to development and implementation of structural measures for overweight prevention and care and organising an effective connection between those two. At the time the concept map was made, the project team of JOGG Veghel was already functioning for approximately one year. One of the participants noted that 'we should have done this at the start', indicating that the investment was considered useful.
4) Mapping the concept of the quality of psychosocial care after incidents to guide the construction of a questionnaire to measure the quality	The choice to follow the concept map procedure was motivated by the desire to create a shared point of view from professionals, policy makers and victims (in fact the 'clients'). Variety and balance	This study strived for more specificity in the broad and heterogeneous field of psychosocial care. The resulting map and its labels corresponded rather well with findings from literature and with	The concept map in this study has proven to be a useful starting point for the development of a questionnaire to evaluate delivered psychosocial care from a victim's perspective. Besides, the

Table 4 (*Continued*)

Study	Integrating knowledge from practice and science	Scientific relevance	Practical relevance
of post-disaster psychosocial care in the Netherlands[d]	between different parties were well ensured with professionals from the field of Public Health, Public Safety, and Acute Care and with victims from past incidents. It resulted in a list of quality characteristics that was confirmed and authorized by the different players in the field, bringing them closer to each other by providing a focal point in the process they were all part of.	guidelines such as TENTS or Psychological First Aid instructions which underlines its relevance and reliability. Still, on the other hand, the concept map is unique in that it summarizes and prioritizes existing theories from a practice-based perspective. More than a literature review, the concept map shows the point of view from the field, consisting both of victims and professionals. Thus, it is a solid basis for evaluation, in that it perfectly mirrors central practical issues.	eight clusters are as principles a point of reference in the revision of the Dutch guidelines for post-disaster psychosocial support. Thus, the processes of preparation, intervention, and evaluation can become more consistent, by grouping them around the clusters as 'landmarks' in the field.
5) Defining the added value of a new approach of Youth Health Care	Disciplines within the RHS were included with different perspectives and working fields. A plenary evaluation held at the end of the brainstorming en structuring session showed that all participants were enthusiastic and proud to have achieved a common sense of what the vision and targets of their organisation should be for the new approach of Youth Health Care. Moreover, the final concept map covered all main domains as described in different national policy papers.	This study showed a conceptualisation of the new approach for Youth Health Care. However, no effort has been put into scientific research yet for a critical appraisal of this theoretical framework.	Though the concept map was undertaken to serve as an integral base for the RHS's formulation of ambitions and targets for the new youth health care program, no effort has been put in the formulation of such a program yet, mainly due to organisational changes, shortage of capacity, and changing ambitions with regard to vision formulation.
6) Quality aspects of Dutch general practice–based data[e]	This study involved experts of General Practice Registration Networks (GPRNs). The concept map therefore only represents the ideas of this group of experts. Nevertheless, the function of all experts is at the intersection of science and practice, making integration of science and practice an intrinsic part of their work. Moreover, as perceived by the researchers, the concept mapping procedure had effects in a sense that the GPNRs became more aware of their differences, and were better able to understand the different languages used.	In study 6, on quality aspects of general practice-based data, though literature emphasises the importance of data completeness and correctness, the concept map showed that these issues were not regarded as the most important ones. Episode oriented recording was ranked as most important for it represents a better indicator of the quality of the diagnostic information, for it links different information (e.g. referrals, prescriptions) to one health problem and therefore makes it more plausible that a person actually has the specific disease. Moreover, structuring data in care episodes enables the distinction between new and existing health problems and shows whether a problem is recurring. This shows that the tacit knowledge resulting from this study provided added value in further building theoretical models in this area.	In study 6, on quality aspects of general practice-based data, the statements can be made operational and measurable to use the concept map to assess data quality of general practice registrations. Next, criteria about the variation level should be formulated. For different purposes of the GPRNs, different aspects of the data quality can be regarded as important. A side-effect is that the networks learned to speak each other's languages better, and realized that they really are too different to produce comparable morbidity data. One of the goals is to align the data as much as possible to each other. The concept map procedure made clearer what still needs to happen to reach that goal.
7) Define building blocks of an EU health information system[f]	Due to the broad range of invited public health experts and policy makers across Europe, this study was able to integrate the opinions and valuations from science and practice. In contrast, participation of policy makers was low. The brainstorming and structuring was performed via internet, for participants were invited from all over Europe. As a result, direct interaction between participants from practice, science and policy was limited. The process was kept transparent by daily publishing and updating the statements on the project webpage. As the concept mapping was performed in English, the exact formulation of statements or the understanding of different notions of statements within the sorting and structuring task might have been limited.	In this study, it could be shown that the key features are very much in line with elements of the definition of public health surveillance (Thacker and Berkelman, 1988). But in addition to the elements of this standard definition, it became apparent that the context in which this concept mapping was performed was highly relevant. It led to the identification of necessary key features, like sustainability in terms of content, infrastructure and resources, when a so far non-existing health information system is discussed, striving for system development on supranational level.	The concept map of this study is intended to be used to guide the planning and development of a health information system on European level. The results were disseminated and discussed among relevant European stakeholders. There are indications that currently work is being done towards the development of a European health information system. However, whether the identified key features of a European health information system from the mapping results will be applied to their full extent needs to be shown in the future.
8) Guide the development of a questionnaire for recovery from mental disorders	This study involved clients with mental disorders only, for its purpose was to improve development of the theoretical concept of recovery from the clients' perspective. By doing so, the concept map itself did not integrate the different perspectives. The clusters of the map	Results of this study suggest that recovery from mental disorders (among experts by experiences in the Netherlands) seems to be a more of a psychological process with intra-personal developments, which is in line with the scientific literature. However,	In this study, the method helped to select the most suitable operationalization for the concept of recovery from mental disorders, taking into account a client's perspective for the Netherlands. Currently, the developed

Table 4 (*Continued*)

Study	Integrating knowledge from practice and science	Scientific relevance	Practical relevance
	were used to operationalize the concept of recovery for the questionnaire for clients with mental disorders.	connection with others is considered to be less important, while in the scientific literature, connectedness and being part of the community are regarded as important factors for recovery. In this respect the concept map method has brought added value to the scientific literature by specifically contributing information from the client's perspective.	questionnaire, based on the concept map, is being validated.
9) Define quality of local care and support services in rural areas to guide planning and evaluation	The researchers involved citizens (consumers), care-givers (formal and informal), volunteers, and civil servants from Local Authorities (planners and financers). However, scientists were not involved as participants in the concept mapping procedure, nor were items added from literature in the brainstorming phase. As a result, the concept map 'only' reflected the perspectives and knowledge of public, practitioners and policy. Remarkably, no one mentioned statements regarding professional standards or guidelines as a characteristic of good quality of local care and support services in the rural villages. Perhaps it was implicit understood that formal caregivers act according professional standards.	The primary purpose of this study was mainly policy-driven. The construction of a common definition of what good care and support entails was entirely based on knowledge of the different stakeholders, i.e. practice-based. However, the results of this study could be compared with existing theoretical considerations about the contributing elements of quality of support and care. In this way it can add to building the client-system perspective into the quality of care concept. Further research amongst different stakeholders in more settings, applying concept-mapping amongst other methods, could be aimed at improving theory development.	The Local Authorities stated that the concept map gave them enough handles to do right to all the different perceptions of quality in their planning and financing policy of local care and support services. Even though no unexpected characteristics came up, the clusters were seen as handy to structure further discussion and choices that have to be made. Both the items and clusters offer concrete quality criteria and the ranking gives direction for setting priorities. Even though it's not possible right now to translate the clusters and items directly into indicators of quality, they can be seen as a first step towards valid indicator development. For now they can be used to guide the negotiations between the Local Authorities (as a planner and financer) and the care and support delivery organisations in order to discuss and to settle the desired level of quality delivered.
10) Define the added value of the participation of Youth Health Care professionals in primary school health care advisory teams to guide evaluation and quality improvement	This study integrated the perspectives and knowledge of different relevant stakeholders. Only one national expert in the field was invited. However, this concept map was thought to be specific for the Dutch context. As a result, the concept map mainly reflected the knowledge of practitioners (from different disciplines) and policy. In the evaluation of the procedure, the participants all agreed upon the relevance of this method to discuss the functioning of youth health care in the CATs. They even expressed that the meeting was already one step forward towards a better functioning, for they all individually and explicitly named what they thought as relevant for the subject at hand. By sharing their ideas, they already contributed to a better mutual understanding of needs and expectations.	The primary purpose of this study was also mainly policy-driven. Nevertheless, the approach contributed to the formation of more theoretical dimensions and concepts of integrated care for children. It provided a bottom up empirical approach that enabled a synthesis of professional experiences and opinions into a more conceptual framework (the clusters and dimensions distinguished). And in this way it helps to come to a more common understanding of the added value of different disciplines in the CATs.	The results in this study made it very clear for the Local Authorities that their initial plan, to expand registrations with indicators of outcome, was not the best way to steer the efforts of youth health care professionals with regard to the content of care given. For example, they were surprised by the finding that most items were not specific to youth health care professionals but were more addressing 'common competences within a CAT'. Based on the results, they preferred a qualitative rather than a quantitative evaluation of the efforts of the youth health care professionals. For this, a short questionnaire about the functioning of youth health care was constructed based on the concept map, to be filled in by the participants of the CAT. First, the results of these questionnaires will be used for quality improvement within the team itself, through discussion about the results and mutual expectations and, based on this discussion, by making new agreements about the collaboration within the team. Second, the (aggregated) results will be used by the Local Authorities to steer the efforts of youth health care based on outcome rather than input hours, by making agreements about minimum scores and by 'benchmarking' the CATs.
11) Assess key elements for monitoring socially vulnerable groups	In this study, three brainstorming sessions were organized, mainly divided by discipline: policy-makers, researchers and professionals. As a result, limited dialogue between these disciplines took place. However, the statements of the three sessions as well as statements from literature were put together as input for the structuring task, to be executed by all participants.	This study was not aimed at theory development at all, and so it did not elaborate on existing theories or models. In spite of that, scientists were involved in the procedure, bringing in existing scientific knowledge. The resulting concept map mainly served a practical purpose, but could be compared with existing theories about the key	The concept map resulted in practical advice to construct a 'Monitor socially vulnerable groups' that mirrored needs of Local Authorities, practitioners, and researchers. For the clusters Size of the socially vulnerable groups, Problems of the socially vulnerable groups, Healthcare chain and healthcare provision, and General approach of the target group, the items can be

Table 4 (*Continued*)

Study	Integrating knowledge from practice and science	Scientific relevance	Practical relevance
	Therefore, the statement list integrated the perspectives from policy, practice and science, with an integrated concept map as a result. Nevertheless, the language used in the different brainstorming sessions could be dominated by the participating disciplines, leaving room for misinterpretation in the structuring tasks where all disciplines together were involved.	components for the monitoring of socially vulnerable groups.	operationalized into a list of indicators. These clusters are all situated on the information-side of the content axis. For the clusters Data quality, Policy relevance, and Data presentation, the items can serve as a checklist to optimize the implementation of the monitor into actual local policy. These clusters are all situated on the implementation side of the content axis.
12) Build a theoretical framework for integrated local public health policy[g]	Integration of practical and scientific knowledge was established during the statement generation phase. In that phase a substantial number of actors from science, policy and practice participated. Since the brainstorming was performed via internet, direct interaction between these groups however was limited and language differences between disciplines may have led to different interpretations of the statements.	In this study, the method resulted in a framework that thematically organizes a major part of earlier separately reported and presented aspects of local integrated public health policy into themes, clusters and statements, while showing the extent of interconnectedness between them. Second, the concept map suggests a distinction between core and peripheral themes. The core themes are regarded as typical for local IPHP, the peripheral themes are regarded as more generic policy aspects. Third, the way the core and peripheral themes are positioned towards both axes supports the development of more specific theories of the policy process while putting IPHP in local policy practices.	As a result of the specific formulation, the statements of the concept map could be operationalized into criteria and characteristics to assess local IPHP, though the participants were not too optimistic about the measurability of such indicators. The concept map is also included in a toolkit for bringing local IPHP in practice, where it may serve as a frame of reference when areas of special interests are identified for local IPHP, and as a tool for discussion during the development and implementation of local IPHP.

[a] Van Bon-Martens et al. (2014).
[b] Van Bon-Martens et al. (2012).
[c] Kuunders et al. (2016).
[d] Holsappel et al. (2013).
[e] Van den Dungen et al. (2013).
[f] Rosenkötter et al. (2015).
[g] Tubbing et al. (2015).

and 12), by translating them into a questionnaire or monitoring instrument (study 4, 8 and 11), by using them for the revision of guidelines (study 4), by targeting and evaluating implementation (study 2), by creating a better understanding between stakeholders (study 6) or by creating a sense of urgency for collaboration and action (study 6 and 7).

One of the policy-driven concept maps (study 9) gave the Local Authorities the opportunity to address the variety of different perceptions of quality in their planning and financing policy of local care and support services. This was also the initial aim of the concept map. As a direct result of the other policy-driven concept map (study 10), the Local Authorities changed their initial plan, choosing a qualitative rather than a quantitative evaluation of the efforts of the youth health care professionals. For this purpose, they translated the concept map into a short questionnaire to guide and discuss quality improvement within health care teams.

4. Discussion

For the purpose of this special issue, we performed an exploratory review of the concept mapping studies of our own or co-produced work, based on three research questions. However, we did not perform a systematic review of the published literature on concept mapping. Not all of the 12 concept mapping studies were published in scientific journals, and some lacked precise documentation of the process and results, for example on the composition of the participants in the different phases of the concept mapping procedure. We did not define strict criteria to determine and asses the answers to the research questions. For example “enhanced dialogue” and “collaboration” were not defined in an exact and replicable manner. Our review should be seen as a qualitative and exploratory examination of the 12 studies involved, to stimulate thought and discussion on the suitability of the method of concept mapping to enhance evidence-based public health.

In our earlier study we found that in four out of five studies concept mapping was judged to be of value for evidence-based public health, according to the answers to our research questions (Van Bon-Martens et al., 2014). In addition, the seven newly added studies in the current paper all appear worthwhile for building more evidence-based public health, even though the extent to which they underpinned actual decision-making varied.

A strong feature of the concept mapping procedure is that it is able to combine the tacit knowledge of different groups of stakeholders and even offers the opportunity to add statements, for example from literature. In the procedure, the contribution of the participants is of equal value, independent of their background. This is assured by the brainstorming rules in the group and the individual structuring tasks. By doing so, typical group dynamics are avoided, such as monopolizing the discussion or conformity bias (Burke et al., 2005). Depending on the goal of the concept map, researchers can compose their group of participants in a way that combines evidence from practice, science and policy. It might even be solely focused on one group of stakeholders at a time, as in the studies 6 and 8. According to Kane & Trochim, this might be logistically simple and works well to conceptualize a framework quickly, for example, for an operational planning model. However, for strategic planning and evaluation, a broader sampling of viewpoints may be indicated (Kane and Trochim, 2007). The researchers of all studies appreciated concept mapping as a

powerful instrument for facilitating dialogue, coherence and collaboration within and between researchers, practitioners, policy-makers and the public. Nevertheless, in two studies (7 and 12), the brainstorming was done remotely, through the internet. Advantages of a remote approach are, amongst others, the possibility to include larger groups of stakeholders, a longer period of time for the participants to come up with statements, and the potential for involving stakeholders from a larger geographical area, which is especially convenient for international studies, such as in study 7 (Kane and Trochim, 2007; Trochim, Cook, & Setze, 1994). In study 11, brainstorming took place in different meetings for different groups of stakeholders. In this study, the actual dialogue between different perspectives is missing, which might lead to less mutual understanding and/or misinterpretation of each other's statements, due to differences in jargon. The studies differ in the variety of viewpoints that were involved, to fit the purpose of the concept map. This choice will affect the external validity of results of the different studies, important for scientific relevance, as well as internal validity, important for practical relevance.

The concept mapping method contributes to theory building by integrating existing knowledge and by making tacit knowledge from different perspectives explicit. This is done in such a way that a theoretical framework can be built to serve as a sound basis for planning research, action and evaluation. In some of the studies we examined, no effort has been put into theory development: no scientists were involved as participants, no statements were added from literature and the results were not compared with the existing scientific knowledge. Nevertheless, these studies may have come up with new scientifically relevant insights. It is a missed opportunity that these studies have not been published in the scientific literature to add to the body of scientific knowledge.

The involvement of different stakeholders strengthens the external validity of the concept map because – scientific – evidence is enriched by crossing disciplinary boundaries, and evidence from theoretical and practical perspectives are integrated. By repeating the procedure on one topic several times, in different contexts and with different stakeholders, one could work towards a more fully saturated concept map to increase external validity, giving it a broader and more versatile meaning, robustly matching the many actors involved in public health. On the other hand, even a fully saturated concept map should be updated regularly to reflect the state-of-the art of the topic at hand, especially in a as fast changing a field as public health.

Concept maps are explicitly constructed to serve as a theoretical framework for program planning and evaluation in a tangible and usable way (Kane & Trochim, 2007; Trochim, 1989). Consequently, concept mapping facilitates two key components of evidence based public health: 'applying program-planning frameworks' and 'engaging the community' (Brownson et al., 2009). By engaging the different stakeholders and enabling them to contribute jointly to the program-planning framework, implementation chances of the program, based on that framework, are increased. In fact, the concept mapping procedure can already be seen as a first step towards implementation.

In all the studies we examined, the final concept maps can serve as a sound basis for planning, decision-making and evaluation in practice. Moreover, the chance of actually being implemented in practice seems strongly related to the extent to which the responsible decision-makers are involved in the way the concept map is prepared and executed.

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