Evaluation and Program Planning 60 (2017) 194–201

Contents lists available at ScienceDirect

Evaluation and Program Planning

journal homepage: www.elsevier.com/locate/evalprogplan

Perspectives on the strategic uses of concept mapping to address public health challenges

Lynda A. Anderson, PhD[a,b,1], Amy Slonim, PhD[c,d,*]

[a] Director Healthy Aging Program, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway, NE, Mailstop F-78, United States
[b] Rollins School of Public Health, Emory University, Atlanta, GA, 30341, United States
[c] CDC-AARP Liaison, Michigan Public Health Institute, Health Promotion and Disease Prevention Program, 2436 Woodlake Drive, Okemos, MI, 48864, United States
[d] Robert Wood Johnson Foundation, United States

ARTICLE INFO

Article history:
Received 25 July 2016
Accepted 22 August 2016
Available online 28 August 2016

Keywords:
Concept mapping
Public health
Program development
Assessment
Qualitative methods

ABSTRACT

We examine the adaptation of approaches used to plan and implement the steps of concept mapping to meet specialized needs and requirements in several public health projects. Seven published concept mapping projects are detailed to document how each of the phases were modified to meet the specific aims of each project. Concept mapping was found to be a useful tool to complement public health roles such as assessment, program development, and priority setting. The phases of concept mapping allow for a blending of diverse perspectives, which is critical to public health efforts. The adaptability of concept mapping permits the use of multiple modalities such as the addition of face-to-face brainstorming; use of qualitative methods, including structured interviews; and review and use of published literature and guidelines. Another positive aspect of concept mapping for public health practice is its ability to identify program elements, provide a visual map of generated ideas and their relationships to one another, and assist in identifying priorities. Our reflections on the adaptability should help inform another generation in designing concept mapping projects and related products that may benefit from unique adaptations and the rapidly expanding social media technology and platforms.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Historically, concept mapping has been used by numerous disciplines and groups of individuals to enhance creative thinking or to help identify and facilitate the organization of diverse ideas. This has been referred to as “idea mapping” or “mind mapping” (Kane & Trochim, 2007). For several decades, public health has applied concept mapping for structured conceptualization processes involving groups of stakeholders who have an interest in the topic or may be affected by the outcomes (Kane & Trochim, 2007). Although numerous studies have described the various uses and applications of concept mapping, the adaptability of concept mapping methods is often overlooked (Johnson, Biegel, & Shafran, 2000).

In this article we examine the flexibility or adaptation of approaches used to plan and implement the steps of concept mapping to meet specialized needs and requirements across representative public health projects. We first present an overview of the phases involved in concept mapping. We then present seven published concept mapping projects, authored by one or both of the authors, to document how each of Trochim’s (1989) steps within the concept mapping phases were modified to meet the specific aims of the project. Finally, we conclude with lessons learned and tactics that may assist others in concept mapping planning and implementation in the context of public health practice.

2. Overview of concept mapping process

Concept mapping is typically organized into six phases (Fig. 1) (Trochim, 1989). Developing the focus, phase one, includes defining the primary question of interest and selecting participants that will be invited to brainstorm ideas relative to the question of interest or project aim. The next phase, generation of statements, is

* Corresponding author at: Amy Slonim, Senior Program Officer, Route 1 & College Road East, P.O. Box 2316, Princeton, NJ, 08543, United States.
E-mail address: aslonim@rwjf.org (A. Slonim).
[1] Retired.

http://dx.doi.org/10.1016/j.evalprogplan.2016.08.011
0149-7189/© 2016 Elsevier Ltd. All rights reserved.

Phases of Concept Mapping as Originally Conceptualized by Trochim[a]
Phase 1: Preparation
Developing the Focus -- Planning group identifies a single focal question or prompt that will best serve the goal of the project and the criteria for rating the responses.
Selecting the Participants -- Planning group identifies participants to generate ideas through brainstorming.
Phase 2: Generation of Statements
Brainstorming -- Participants brainstorm ideas in a single in-person session or online.
Phase 3: Structuring of Statements
Sorting of Statements -- Planning group identifies and invites external participants to sort the core group of items.
Rating of Statements -- Planning group identifies and invites external participants to rate the core group of items.
Phase 4: Representation of Statements
Development of Maps -- Consultants or staff compute a series of maps using concept-mapping software (multidimensional scaling and cluster analysis).
Phase 5: Interpretation of Maps
Refining of Maps -- Planning group examines maps and agrees on a descriptive phrase or word that captures the meaning or essence of each cluster.
Phase 6: Use of Maps
Use of Maps -- Planning group relates maps and associated materials to the original goal of the project (planning and evaluation uses) and produces plan for further action.

Fig. 1. Phases of Concept Mapping, Trochim (1989).

carried out through brainstorming, conducted during an in-person meeting, or via mail, fax, or web-based platforms. Brainstorming in this case is a technique that includes an open forum to share ideas, does not allow people to comment on or modify each other's ideas, and generates a large set of unedited statements. In the third phase, structuring of statements, the planning group reviews the statements to create a manageable set ($\leq$100) of statements that each represent a single idea. Similar statements can be combined, complex statements simplified, or statements eliminated if they are not relevant to the project aim(s). The final set of statements is then distributed for sorting and rating. The representation of statements, phase four, includes statistical analysis that involves multidimensional scaling and cluster analysis. Software programs are available to assist with this phase. The interpretation of maps, phase five, includes a group of stakeholders making sense of the maps and defining the concepts and possible themes. In the final phase (six), use of maps, the planning group applies the various maps and related reports to accomplish its original aim(s) of the project.

3. Methods

The projects we highlight in this paper serve as "cases" to illustrate adaptations in various concept mapping steps. Adaptability or flexibility refers to modifications in concept mapping steps that deviate from or modify the original approach outlined by Trochim (1989). We reviewed the seven case publications and abstracted information specific to how each step within each phase was or was not adapted from the original method. For the purposes of this work, we report only on adaptations and avoid detailing the process if it was consistent with the original method.

Our seven public health applications included the following abbreviated aims: to develop a framework and public health priorities for end-of-life efforts (Rao et al., 2005); to determine the roles for public health departments in addressing lower-prevalence chronic conditions (Wheeler, Anderson, Boddie-Willis, Price, & Kane, 2005); to create a national program framework, or logic model, for the Centers for Disease Control and Prevention's (CDC's) Prevention Research Centers (PRC) (Anderson et al., 2006); to develop competencies for chronic disease public health practice (Slonim, Wheeler, Quinlan, & Smith, 2010); to identify actions and establish priorities for the Healthy Brain Initiative 2007 Road Map (Anderson, Day, & Vandenberg, 2011); to create a framework to identify strategies to promote mobility in community-dwelling older adults (Anderson et al., 2014); and, to identify and prioritize action items for the Healthy Brain Initiative, 2013–2018 Road Map (Anderson & Egge, 2014). In each of our projects we engaged a broad group of stakeholders such as public health practitioners, academia, community members, urban planners, specialized clinicians, and policy-makers. In Table 1, we describe the study aims, methods, results, use of maps, and project products and outcomes for each project.

4. Findings

Upon review and abstraction of these seven projects, we identified a number of adaptations that we and our colleagues had made within five of the six concept mapping phases (Table 2). Table 2 provides a summary description of the Concept mapping phases, the public health adaptation made to that phase, and the rationale for and impact of the adaptation to the results and outcomes. Although concept mapping analyses have expanded over time to incorporate various computed results such as pattern matching and go-zone displays (Kane & Trochim, 2007, p. 106), we made no adaptations to the analysis used across our projects (i.e., phase four, representation of statements). Rather, we consistently used concept mapping software (Concept Systems, Inc., Ithaca, NY) to conduct all of the analyses.

Across these projects, we made a number of adaptations to the development of the focus question and selection of participants, phase one (Table 2). Several projects explicitly included an additional component that involved a document review designed to help inform the development of the focus question. In one project, we expanded beyond using only a single focus question because we desired distinct perspectives. We also made modifications to the selection of participants. A variety of approaches were used to identify participants that ranged from inclusive, empowering approaches that involved stakeholders selecting the group of invitees to exclusive, restrictive invitations by the planning group that would allow for selection of specific experts in the domains of interest.

In phase two, generation of statements, we often expanded our approaches to move beyond the traditional single brainstorming session (Table 2). For example, for the first Healthy Brain Initiative Road Map, we used work groups that met over a period of time rather than a single brainstorming session. Not only were these work groups asked to develop action statements, they were also asked to generate specified rationale for why the statement should be included. The statements, along with accompanying rationale, were included in the subsequent phase, structuring the statements. We also generated statements from literature and document reviews as well, and conducted expert interviews that were reviewed and combined with brainstormed statements. Finally, once a set of statements was generated by one group, those statements were distributed to an additional set of external experts who provided input and helped determine the face validity of those statements prior to final review by the planning group. This was achieved in one case by in-depth interviews and in another case via survey methodology.

In terms of structuring of statements, phase 3, we included several adaptations to sorting or rating. Among the modifications

Table 1
Overview of Seven Concept Mapping Projects.

Projects	Specific Project Descriptors						
	Project Aim(s)	Phases of Concept Mapping[a]					
		Preparation		Generation of Statements: Brainstorming	Structuring of Statements: Sorting and Rating	Interpretation of Maps	Use of Maps
		Focus Prompt	Participants				
Development of Public Health Priorities for End-of-Life (EOL) Initiatives	To help state health departments better understand their potential role in addressing end-of-life issues and develop initial priorities for end-of-life activities	"To enhance the lives of seriously ill, injured or dying people, a specific thing that the state or local health department could do or enable others to do is . . . " Rating by importance and feasibility	An advisory and steering committee (core team = 48) Invited additional stakeholders to ensure diverse representation among groups with interest in end-of-life issues (n = 163) Total stakeholder group (n = 211)	All stakeholders were invited to provide ideas online, by fax, or via mail This process yielded 124 unique statements	The core group sorted and 211 stakeholders invited to rate statements Analysis resulted in 9 clusters	The core group attended 1 of 2 in-person meetings to interpret the concept maps and next steps	Identified short-, immediate-, and long-term actions for EOL initiatives for collective public health action Applied modified Delphi to determine 5 priority actions among short-term actions Results Used to create an on-line training course www.cdc.gov/aging/advancecareplanning/index.htm, which more than 1000 professional have taken (Rao et al., 2007Rao, Also see Theis, Rao, Anderson, & Thompson (2007); Rao, Abraham, &, Anderson (2009)
State Public Health Agencies' Roles in Addressing Less Prevalent Chronic Conditions	To examine the perceived role of state health departments in addressing less prevalent chronic conditions (LPCC)	"If relatively uncommon chronic conditions are to be addressed effectively, a specific action, program, or service that state public health agencies could do or facilitate is . . . " Rating by importance and feasibility	Steering committee (n, not specified) Stakeholder group (n = 145)	All stakeholders were invited to provide ideas online, by fax, or via mail This process yielded 100 unique statements	53 were invited to sort and 145 were invited to rate statements Analysis resulted in 9 clusters	The steering committee attended an in-person meeting to review results and formulate recommendations for action	Identified and prioritized top 5 recommendations for state health departments concerning LPCC. Given this was a new topic for public health this process helped build consensus and develop strategies to collectively move forward in several key areas.
Using Concept Mapping to Develop a Logic Model for the Prevention Research Centers Program	To develop a logic model for the Prevention Research Centers (PRC) Program, a national network of research centers	National level: "To ensure national excellence in prevention, a PRC should have the following specific characteristic or function . . . " Community level: "To successfully promote health in a community, an effective PRC should have the following specific characteristic or function . . . "	Collaborative evaluation design team (CEDT) (n = 10) National stakeholders including representatives from 33 university-based research centers and a large number of public health organizations (n = 175) Community stakeholders representing the 33 communities associated with the PRCs (n = 165)	All stakeholders were invited to provide ideas online, by fax, or via mail This process yielded 88 unique statements for national and 75 for community	Sorted by national subgroup (n = 35) and community (n = 30) Analysis resulted in 9 clusters for national and 11 for community	CEDT placed the concept map data into logic model categories; conducted 3 regional meetings to obtain feedback on 2 logic models; based on feedback the 2 logic models were combined into 1 logic model; logic model was sent to PRC network and approved	Developed a logic model for the PRC program in which national and community members alike could see their roles and their contributions to community-based participatory research The logic model informed the development of the Request for Applications for the next PRC funding cycle and continues to be used by the PRC Program The logic model was adopted by CDC Injury Center (See Wright et al., 2008)
Designing Competencies for Chronic Disease Practice	To develop a comprehensive set of competencies for public health practitioners working in chronic disease prevention and control	"A specific thing that leaders and managers of chronic disease programs in states need to know or be able to do is . . . " Conducted initial literature and document review of competencies	Competency planning group (n = 10) Stakeholders (n = 37)	All stakeholders were invited to provide ideas online This process yielded 100 final statements	All stakeholders sorted the statements Analysis resulted in 7 clusters	Public health leaders were interviewed and planning group reviewed and added 4 competencies for a total of 104 competencies	Created a framework for competencies for public health practice that was used to determine professional development plans, position descriptions, and inform curriculum development for chronic disease practitioners The literature and

Table 1 (*Continued*)

Projects	Specific Project Descriptors						
	Project Aim(s)	Phases of Concept Mapping[a]					
		Preparation		Generation of Statements: Brainstorming	Structuring of Statements: Sorting and Rating	Interpretation of Maps	Use of Maps
		Focus Prompt	Participants				
							document reviews ensured competencies were consistent with prior work
Using a Concept Map as a Tool for Strategic Planning: The Healthy Brain Initiative	To develop a framework and actions for the Healthy Brain Initiative Road Map	Work groups were charged to "develop a set of recommended actions for moving the nation forward over the next 3–5 years toward the long-term goals of maintaining and improving the cognitive function of adults" Rating by importance and feasibility	Steering committee (n = 12) 4 work groups (prevention research, surveillance, communication, policy), with no more than 20 per group 141 additional stakeholders determined face validity	Workgroups developed an initial set of ideas This process yielded 42 items	31 stakeholders were invited to sort the statements 141 stakeholders were invited to rate the statements Analysis resulted in 8 clusters	The steering committee attended an in-person meeting to review results, determine final list of action items (added action items for a final total of 45), and select top priorities (10 actions),	Developed a national road map (www.cdc.gov/aging/pdf/thehealthybraininitiative.pdf) The 4 workgroups helped ensure that all domains were represented in the final set of recommendations Disseminated to more than 1000 dementia experts, and cited in numerous publications and grants
Developing a Framework and Priorities to Promote Mobility Among Older Adults	To develop a framework to better understand mobility issues (or needs) among older adults and establish priorities for state health departments	"One specific action that can lead to positive change in mobility for older adults in the United States is . . . " Rating by potential impact and feasibility in next 3 years	Steering committee (n = 12) Total stakeholder group (n = 211)	All stakeholders were invited to provide ideas via secure website This process yielded 102 unique statements	50 stakeholders were invited to sort the statements 211 stakeholders were invited to rate the statements Analysis resulted in 9 clusters	The steering committee participated in a conference call to review the results	Prior work in this area had primarily focused on theoretical models Brought together diverse disciplinary perspectives to create a framework to better understand actions to enhance mobility strategies for older adults Applied modified-Delphi methods to determine priority actions (4 items) for state and local public health practitioners
Expanding Efforts to Address Alzheimer's Disease: The Healthy Brain Initiative	To develop a framework and actions for the second Healthy Brain Initiative Road Map	"A specific action that state or local public health could do – on their own or with other national, state or local partners – to address or promote cognitive functioning for people living in the community and the needs of care partners is . . . " Rating by criticality and feasibility	Leadership committee (n = 15) Total stakeholder group (n = 287)	All stakeholders were invited to provide ideas via secure website This process yielded 54 unique statements	79 stakeholders were invited to sort the statements 287 stakeholders were invited to rate the statements Analysis resulted in 4 clusters	The steering committee attended an in-person meeting to review results, determine final list of action items (35 action items in Road Map), and select the priority actions where movement could be achieved in near term (12 actions)	Developed and disseminated road map (www.cdc.gov/aging/pdf/thehealthybraininitiative.pdf) Allowed diverse perspective buy-in, particularly from state public health practitioners that were only beginning to engage in this topic Disseminated at a special session at the Alzheimer's Association International Conference

[a] Five of the six phases of concept mapping are reported in this Table, per Fig. 1. "Representation of Statements" (Phase 4) is not included as all projects used Concept Mapping Software to conduct the analyses, including go zone and pattern matches.

were: elimination of the rating component, because the project focus was to organize the statements into meaningful groups and not to prioritize them; the use of two independent groups of raters and sorters; and collection of demographic information on the raters in order to conduct comparative analysis across different groups of raters. As stated previously, no specific modifications were made to representation of statements, phase four.

We made a number of modifications to the process for phase five, interpretation of maps. For all of our projects, we went beyond a single review of generated maps, clusters, and themes by the planning group. One approach included not one, but a series of in-person meetings including external stakeholders. Another review process incorporated a structured feedback approach using a survey that was distributed via email and included a series of

Table 2
Summary of Public Health Adaptations in Concept Mapping Approaches.

Concept Mapping Phases/Steps	Public Health Adaptations	Rationale for and Impact of Adaptations *In departure from the traditional concept mapping process, . . .*
Preparation *Developing the Focus* *Selecting the Participants*	• Planning group conducted a literature review and document analysis (Slonim et al., 2010). • Planning group provided a definition of key terms along with the focus prompt (Anderson et al., 2014). • Planning group developed two focus prompts one directed at the national level and the other at the local level (Anderson et al., 2006). • Planning group gave a "charge" to 4 established work groups to develop recommendations along with rational statements (Anderson et al., 2011). • Planning group identified two independent groups of stakeholders that each responded to a unique prompt (Anderson et al., 2006; Kane et al., 2006). • Planning group applied a snowball technique to identify a diverse and expansive set of stakeholders (Rao et al., 2005). • Actions were created by small workgroups selected for their expertise. (Anderson et al., 2011).	• An additional step, a literature and document review, was conducted to ensure that potential actions could be compared and aligned with accepted standards in the field concerning competencies. This resulted in the ability to use available core competency conventions and translate the concept mapping clusters into aligned competency domains for the National Association of Chronic Disease Directors. • A definition of mobility was included along with the focus prompt because of the transdisciplinary nature of the task combined with the complexity and differing salience of the concept of mobility among the various disciplines engaged in the process and working in this area. The definition was used not only in the focus prompt but in the release of the findings and in subsequent activities to create action plans for state chronic disease directors. • Two independent focus prompts were created. One queried national level program excellence and the other focused on promoting health at the community level. Two different prompts were used as steering committee members assumed ideas concerning program characteristics would differ at the national and local levels. This two-tiered process helped guarantee that important stakeholder voices would be elicited, heard and incorporated into the development of the logic model. The positive results of this effort were documented in a subsequent article (Wright et al., 2008). • A general "charge," rather than a focused question, was provided to 4 working groups who developed a set of actions for each areas. The groups worked independently and submitted action items to the steering committee. • Two independent stakeholder groups were created, one for national level participants and the second for community representatives working at the local level. National stakeholders included CDC leaders, representatives from national organizations, national review groups, and members of PRCs. Community stakeholders were drawn from the PRC local community committees, local health department participants, and PRCs. A small group of stakeholders working in the PRCs who had both national and local perspectives were asked to respond to both focus prompts. This allowed national and community stakeholders' recommended actions to be examined separately. Ultimately, the perspectives were combined into one logic model, while still affording the ability to identify national vs. local roles and contributions to the PRC program. • The planning group identified a core set of stakeholders (n = 48) and then asked those stakeholders to reach out to others in the field with interest or expertise in end-of-life issues to ensure a wide variety of perspectives were captured. An additional 163 stakeholders were identified through this process and invited to participate in the concept mapping process. • A small group of experts were invited to participate in workgroups to develop the action items with explicit guidance to help ensure that the statements were grounded in current science. The work group members were selected based on criteria to ensure relevant expertise and experience in specific areas in which action statements were to be developed – surveillance, policy, communication, and research.
Generation of Statements *Brainstorming*	• Statements were derived from expert interviews and literature and document reviews along with traditional brainstorming (Slonim et al., 2010). • Work groups met multiple times rather than for a single brainstorming session. (Anderson et al., 2011). • An additional step beyond brainstorming was added to assure face validity of draft items and statements by vetting with external reviewers (Anderson et al., 2011).	• Interviews with experts and literature and document reviews supplemented traditional brainstorming to help ensure that the derived competencies for chronic disease practice were grounded in previous related initiatives. • Experts were selected by steering committee members to participate in workgroups over a period of 3 months to write action items. Each group worked independently with guidance from the steering committee. Submitted action items included a rational statement along with definitions of key concepts, principles, and identified target audiences who may be involved in implementation. • Action items and rationale statements were shared with the external raters and sorters for two reasons: 1) to help ensure that raters and sorters understood how the action statements related to the mission of the project and public health research and practice, and 2) to provide evidence of face validity for action items.
Structuring of Statements Sorting and Rating of Statements	• Only reported sorting, no rating (Slonim et al., 2010; Anderson et al., 2006). • Included two independent groups of stakeholders that sorted the generated statement sets (Anderson et al., 2006).	• Sorting alone was applied to construct the competencies for chronic disease practice (Slonim et al., 2010) and add elements to the program logic model (Anderson et al., 2006). However, ratings were conducted later in the second project to compare responses and

Table 2 (*Continued*)

Concept Mapping Phases/Steps	Public Health Adaptations	Rationale for and Impact of Adaptations *In departure from the traditional concept mapping process, . . .*
	• Instructions for sorting and rating were pretested (Anderson et al., 2014). • Collected descriptive information on sorters and/or raters to compare across subgroups (Rao et al., 2005; Wheeler et al., 2005; Anderson et al., 2014).	document similarities among stakeholders' responses across key domains (Sundra, Gwaltney, Anderson, Brownson, Scherer, 2004). • Two independent subgroups from the larger stakeholder group sorted the statement sets, which was consistent with use of two independent focus questions. • An extra pretesting step was used to ensure that the instructions would be understood among the diverse group of stakeholders, many who were unfamiliar with the use of qualitative methods involved in the sorting process. Pretesting helped insure that sorters understood what was being asked of them. • The steering committee requested descriptive information on stakeholder respondents, while still ensuring anonymity, to help describe and contrast perspectives among participant groups.
Representation of Statements	Used software and experts to conduct the analyses	
Interpretation of Maps	• External experts' input was solicited through interviews and structured assessments (Wheeler et al., 2005; Slonim et al., 2010; Anderson et al., 2011). • Final reviews were conducted through in-person meetings and structured input via e-mail (Anderson & Egge, 2014; Anderson et al., 2011; Rao et al., 2005; Slonim et al., 2010; Wheeler et al., 2005). • Final clusters were compared to another project with a similar aim to determine if the resultant clusters were parallel in nature and overlapped in terms of essential elements of public health (Wheeler et al., 2005). • Planning group restructured items, added items, moved clusters (based on changed items) and ultimately had analyses re-run (Anderson & Egge, 2014; Anderson et al., 2011). • The planning group reviewed program documents and external reports, such as authorizing legislation and program guiding principles, to identify other activities and outcomes to help ensure that all information relevant to the project was incorporated into the final product (Anderson et al., 2011; Slonim et al., 2010).	• Additional interviews were conducted after the initial concept maps were compiled to identify potential gaps in the actions and resulting domains. Findings for each project were reviewed by the project steering committees and in all cases additional actions were added beyond those generated in the concept mapping process in response to the input from the interviews. • Additional mechanisms were employed to engage stakeholders in dissemination and application of findings through facilitated in-person discussions, meetings and structured e-mail input. • Concept mapping clusters were compared with the essential elements of public health state programming, which helped confirm that the roles of state health departments were consistent with the essential elements of chronic disease programs. • Additional processes, such as re-running analyses, were used after the concept maps were produced to identify potential gaps in the actions and resulting domains. Findings for each project were reviewed by the project steering committees and some actions were restructured, added or refined beyond those generated in the concept mapping process. • An additional step, review of additional documents and reports, was conducted to ensure that potential actions could be compared and aligned with accepted standards in the field.
Use of Maps	• Documented resultant use of the concept mapping results in the field.	• Produced an agreed upon, comprehensive set of integrated skills and knowledge requirements to lead and manage state chronic disease prevention and control programs. These were adopted and continued to be used after almost ten years by national, state and local chronic disease programs. (Slonim et al., 2010). • Program documents, stakeholder feedback and national and community concept maps and associated logic models were combined to develop a single, representative logic model for national and community Prevention Research Center Programs across the country. The resultant logic model has been used with few modifications since its development and as a model for other CDC national networks (Anderson et al., 2006). • Produced a series of strategic planning documents, referred to as "road maps," designed to support coordinated and focused national, state and local efforts to promote cognitive functioning, address cognitive impairment for individuals living in communities, and support care partners (Anderson & Egge, 2014; Anderson et al., 2011). • Defined short-, intermediate- and long-term recommendations for end-of-life initiatives through concept mapping and prioritization using a modified-Delphi process. Four of the five recommendations have been implemented through a series of projects (Rao et al., 2005).

conference calls with a select group of representative stakeholders. Still another used structured interviews with known leaders or experts to get the final input and interpretation. Beyond the planning and external group reviews, in three projects we compared results to established guidelines, core principles, or comparable processes to ensure alignment with or representation of reputable recommendations. In all projects, our planning groups had significant input into the findings, and in several cases asked for additional analyses to be run to further interpret or reconfigure the maps.

During the final phase, use of maps, most projects moved beyond producing maps to create specific products. The planning

group and consultants applied the results to create public health tools and resources such as logic models; professional competencies; road maps or blueprints for national, state, or local strategic focused actions; and short- and long-term recommendations for program development, promotion, or evaluation. We also combined concept mapping results with other methods to prioritize findings (such as modified Delphi or nominal group process).

5. Discussion

Concept mapping is a useful tool that complements the roles of public health, including assessment, program development, and priority setting, and clarification of the underpinnings of the theory of change for public health efforts. Additionally, as documented by our highlighted projects, concept mapping is flexible and easily integrates diverse perspectives, expertise, and experiences in several phases of the processes. These processes allow for a blending of perspectives and use of multiple modalities such as published literature, guidelines, and documents; face-to-face brainstorming; virtual solicitation of input or document review; and qualitative methods, including structured interviews. Another positive aspect of concept mapping is the ability to integrate broad participation and additional content from experts, end users, and community members in several phases. However, these participatory methods are flexible as well. For our projects, this included conducting expert interviews and obtaining structured input from experts to expand both statement generation and vetting of the maps.

We chose concept mapping rather than other single quantitative or qualitative approaches because concept mapping is a mixed-method approach, which includes group processes and provides a visual representation of the findings. Further, concept mapping could be flexibly applied with a range of available project resources and timeframes. For example, the PRC application had substantive resource allocation that afforded hiring a project manager, supported multiple face-to-face meetings both nationally and regionally, as well as support for local liaisons to foster community member engagement in the generation of statements, vetting of the maps, and determining optimal application of the maps and findings. On the other end of the spectrum, the mobility framework project had comparably fewer resources and a shorter timeframe, but the concept mapping process was still aptly applied.

Although concept mapping is known to be efficient, our case studies document that with experience, the process can be streamlined. For example, the entire development of the second Healthy Brain Initiative Road Map took only nine months, compared with 18 months for the first road map. The nine months included the creation of the planning committee, generation of statements, and sorting/rating by over 280 stakeholders, as well as writing, publishing, and releasing the road map. For five of the projects, the planning committee clearly delineated a product or set of products beyond creating a traditional map. These included tools, strategic plans, and documents that are still being used in practice today (Anderson et al., 2006, 2011, 2014; Rao et al., 2005; Slonim et al., 2010).

6. Lessons learned

The findings from our review are in alignment with many of the observations in the text book by Kane and Trochim (2007). However, we believe that by our careful review and focus on the issue of adaptations we help to shine a light on this topic and bring together numerous examples highlighting the flexibility of the process used in concept mapping. We recognize that our seven projects do not cover all of the possible adaptations that can be made to concept mapping. It is our hope that this article can assist planners and evaluators when they design and implement their concept mapping studies and point out the importance of understanding and documenting any modifications to help enhance the understanding of the process and results for end-users and others interested in their work. Documenting and sharing those adaptations with the broader research and practice community provides a fuller understanding of concept mapping at this point in its evolution. With that in mind, and based on our learnings from these experiences, we offer seven suggestions or tactics to assist future concept mapping users.

- Make sure that the planning committee has an agreed-upon set of goals, identified target audience(s) or end user(s), and set of end products prior to beginning the concept mapping process.
- Develop a project plan and determine the level of resources (e.g., finances, personnel needs such as project management and analysis) for each step of the process, recognizing the trade-offs for decisions and utility for end users.
- Conduct initial research (interviews and review of literature, documents, and guidelines) to refine project aim(s) and to help ensure benefits from broad-based input/learning.
- Determine how aligned the end product or generation of statements should be to the level of scientific evidence or with existing priorities, recommendations, polices/regulations, or competencies.
- Build in time and procedures to pre-test the focus question and any scales that will be used in sorting and rating with end users.
- Ensure participatory approaches for each step in the process, paying particular attention to end-user representation and perspective.
- Make sure the processes and protocols are transparent, well-documented, and widely available to all participants, especially when adaptations are made.

We hope our case studies encourage practitioners to explore how concept mapping is useful as well as an adaptable method to support their work. As noted previously by Anderson et al., 2011 and aptly summarized in Trochim's (1989) seminal paper, "The uses of the map are limited only by the creativity and motivation of the group" (p. 12). This reflection on the adaptability of concept mapping – along with the articles describing methods, measures, and analysis – should help inform another generation of concept mapping projects and related products that may benefit from unique adaptations and the expanding social media technology and platforms.

Acknowledgments

We want to thank Cheryl Schott, MPH, Michigan Public Health Institute, for her assistance with the logistics in preparing the manuscript.

Disclaimers: The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. Use of trade names is for identification only and does not imply endorsement of any of the groups named above.

References

Anderson, L. A., & Egge, R. (2014). Expanding efforts to address Alzheimer's disease: The healthy brain initiative. *Alzheimer's Dementia*, *10*(5), S453–S456. http://dx.doi.org/10.1016/j.jalz.2014.05.1748 special issue.

Anderson, L. A., Gwaltney, M. K., Sundra, D. L., Brownson, R. C., Kane, M., Cross, A. W., et al. (2006). Using concept mapping to develop a logic model for the prevention

research centers program. *Preventing Chronic Disease 2*(3), 1–9. http://www.cdc.gov/pcd/issues/2006/jan/05_0153.htm.

Anderson, L. A., Day, K. L., & Vandenberg, A. E. (2011). Using a concept map as a tool for strategic planning: The Healthy Brain Initiative. *Prevent Chron's Disease*, *8*(5), A117 [serial online]. Available at: http://www.cdc.gov/pcd/issues/2011/sep/10_0255.htm Accessed November, 2014.

Anderson, L. A., Slonim, A., Yen, I. H., Jones, D. L., Allen, P., Hunter, R. H., et al. (2014). Developing a framework and priorities to promote mobility among older adults. *Health Education & Behavior*, *41*, 10S. http://dx.doi.org/10.1177/1090198114537492 special issue.

Johnson, J. A., Biegel, D. E., & Shafran, R. (2000). Concept mapping in mental health: Uses and adaptations. *Evaluation and Program Planning*, *23*, 67–75.

Kane, M., & Trochim, W. M. (2007). *Concept mapping for planning and evaluation*. Thousand Oaks, CA: Sage.

Rao, J. K., Alongi, J., Anderson, L. A., Jenkins, L., Stokes, G. A., & Kane, M. (2005). Development of public health priorities for end-of-life initiatives. *American Journal of Preventive Medicine*, *29*(5), 453–460. http://dx.doi.org/10.1016/j.amepre.2005.08.014.

Rao, J. K., Abraham, L., & Anderson, L. A. (2009). Novel approach, using end-of-life issues, for identifying items for public health surveillance. *Preventing Chronic Disease 6*(2), A57. http://www.cdc.gov/pcd/issues/2009/apr/08_0120.

Slonim, A., Wheeler, F. C., Quinlan, K. M., & Smith, S. M. (2010). Designing competencies for chronic disease practice. *Preventing Chronic Disease*, *7*(2), A44 http://www.cdc.gov/pcd/issues/2010/mar/08_0114 Accessed November, 2014.

Alzheimer's Association and Centers for Disease Control and Prevention (2013). *The healthy brain initiative: The public health road map for state and national partnerships, 2013–2018*. Chicago, IL: Alzheimer's Association.

Theis, K. A., Rao, J. K., Anderson, L. A., & Thompson, P. M. (2007). End-of-life content in comprehensive cancer control plans: A systematic review. *American Journal of Hospice Palliative Care*, *24*(5), 390–398.

Trochim, W. (1989). An introduction to concept mapping for planning and evaluation. *Evaluation and Program Planning*1–16 http://www.socialresearchmethods.net/research/epp1/epp1.htm Accessed November, 2014.

Wheeler, F. C., Anderson, L. A., Boddie-Willis, C., Price, P. H., & Kane, M. (2005). The role of state public health agencies in addressing less prevalent chronic conditions. *Preventing Chronic Disease* http://www.cdc.gov/pcd/issues/2005/jul/04_0129.htm Accessed November, 2014.

Wright, D. S., Anderson, L. A., Brownson, R. C., Price, P. H., Gwaltney, M. K., Scherer, J., et al. (2008). Engaging partners to initiate evaluation efforts: Tactics used and lessons learned from the prevention research centers program. *Preventing Chronic Disease* . http://www.cdc.gov/pcd/issues/2008/jan/06_0127.