Knowledge mapping as a technique to support knowledge translation

S Ebener,[a] A Khan,[a] R Shademani,[a] L Compernolle,[a] M Beltran,[b] MA Lansang,[c] & M Lippman[a]

Abstract This paper explores the possibility of integrating knowledge mapping into a conceptual framework that could serve as a tool for understanding the many complex processes, resources and people involved in a health system, and for identifying potential gaps within knowledge translation processes in order to address them.

   After defining knowledge mapping, this paper presents various examples of the application of this process in health, before looking at the steps that need to be taken to identify potential gaps, to determine to what extent these gaps affect the knowledge translation process and to establish their cause. This is followed by proposals for interventions aimed at strengthening the overall process. Finally, potential limitations on the application of this framework at the country level are addressed.

Bulletin of the World Health Organization 2006;84:636-642.

Voir page 641 le résumé en français. En la página 641 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة 641.

Introduction

In the knowledge economy, the generation and exploitation of all types of knowledge play a vital role in the creation of wealth.[1] However, despite the available knowledge, mortality and morbidity from preventable causes persist, especially among poor children and women throughout the world, in part because a gap remains between what is known and the application of that knowledge in policy and practice.[2] To bridge this gap, it is crucial to understand the mechanisms of knowledge creation and use, or "knowledge enterprise", at the different levels of health systems, such as policy-making, institutional management, technology R&D, clinical practice and services, as well as at the community level. Knowledge mapping helps us to understand how knowledge flows and where the assets and the gaps are.

   This paper reviews and discusses the importance of knowledge mapping as a tool for understanding the many complex processes, resources and people involved in a health system. Although a comprehensive search strategy was employed, it was non-systematic and selective, focusing on concepts, tools and examples that are directly relevant to knowledge mapping and knowledge translation.

Overview of knowledge mapping

A knowledge map is "an association of items of information (e.g. process, network, policy, geography, ...), preferably visual, where the association itself creates new, actionable information" (adapted from Vail[3]).

   Knowledge mapping is the process of creating a knowledge map. This process consists of five steps, as shown in Fig. 1.

   The purpose of this figure is to depict the manipulation or transformation which occurs during the process; it could be applied to information or knowledge instead of data, depending on the association of items of information the process is looking at.

   The most comprehensive approach to knowledge mapping examines the dynamics at play in a health system or area of work; where knowledge resources and assets are located; how these elements move around the organization or an area of work; where the elements are created; and where they are needed and should be used.

   To be effective, the resulting knowledge map should be created with reference to four perspectives, known as the visual framework:[5]

- the function of the map (including coordination, motivation and elaboration);
- the knowledge type (know what, know how, know why, know where, know who);
- the recipient (individual, group, organization, network); and
- the visualization type (sketch, diagram, image or map).

The success of the knowledge mapping process depends to a great extent on the people who apply it; their ability to engage all the participants in the exercise, ensuring that people understand the process and are able to interpret the map; and the integration of all four perspectives in the visual framework, rather than on the tools themselves which are used to produce the map. Scott et al.[6] provide an example of a map which illustrates how knowledge mapping allows information to be conveyed in a manner that a non-illustrative approach could not.

   Scott et al.[6] present the result of a social network analysis performed in a primary care clinic looking at whom is consulted when significant decisions need to be made in the practice.

   Visualizing the result of this process makes it easier to share the information and allows a more integrated analysis of

the large amount of information that could not be easily captured in a single table or piece of text and already provides some possibilities for analysis (e.g. the identification of hubs corresponding to the person who is most often consulted).

Examples of application of knowledge mapping

The examples from the literature can be grouped according to the health-system levels: policy-making, institutional management, technology R&D, clinical practice and services, and the community. Most emphasis is put on the exercise which took place in the Philippines as this is the most recent and is also the closest to the framework presented in the next section.

The institutional level

Examples of knowledge mapping at the institutional level are difficult to find, mainly because many of these projects are bound by non-disclosure agreements which make them inaccessible to third parties.

Nevertheless a comprehensive mapping was performed by the Swiss pharmaceutical company Hoffmann-La Roche to improve the (knowledge-intensive) process for the approval of new drugs and

therefore decrease the time-to-market of new products.[7] Starting from catalogues of relevant experts or "Yellow Pages", the map also included a question tree, examples of best practice as well as knowledge links showing with whom and at what point in the process a person or group should have shared their knowledge. The use of this map not only resulted in a reduction of the processing time but in a better recognition of the work performed by the employees.

The community level

The Hawaii Department of Health used concept mapping techniques to engage experts and local stakeholders in defining the community and system factors that affect the behaviour of individuals in relation to tobacco, nutrition and physical activity.[8] This exercise allowed them to rapidly define the feasibility and importance of each factor and therefore to develop a health improvement plan for the state in a timely fashion.

The policy level

The first example is that of Ecuador, where the US Agency for International Development conducted a political mapping exercise in the context of the introducing of new methods of financ-

ing health service delivery. The map which resulted from this exercise helped the health sector reform team to reduce the opposition of health worker labour unions to the reform.[9]

PolicyMaker software[10] is also used in the context of political mapping exercises in:

- the Dominican Republic, where it has been applied in a team-building effort for the Health Reform Group, with support from the Inter-American Development Bank;[11]
- Mexico, where it has been used in an assessment of the political feasibility of a major reform of the national health system.[12] The political analysis was carried out in conjunction with a comprehensive examination of the epidemiological, economic, organizational and financial factors that affect health system reform in Mexico.
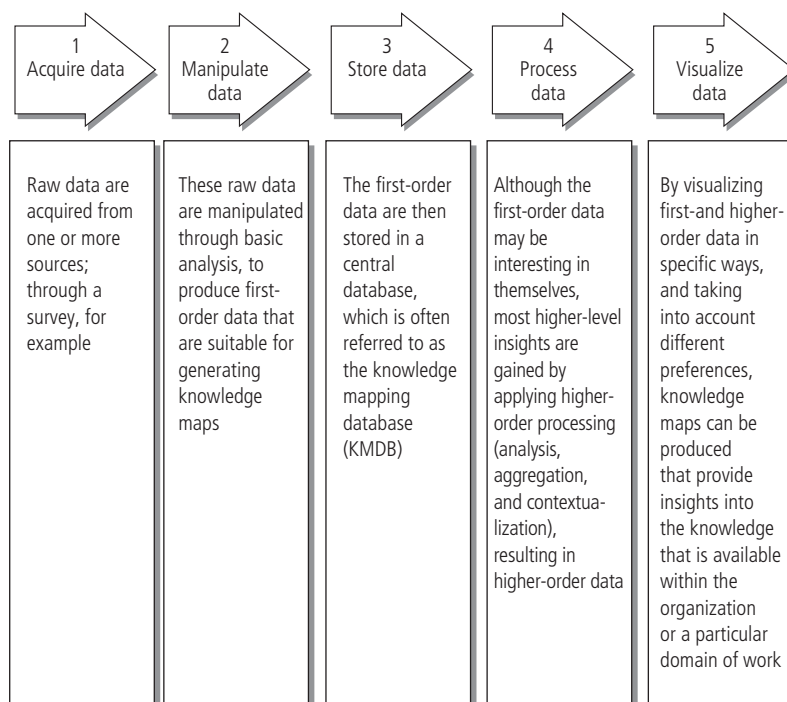
Philippines

Another example of mapping at the policy level is that of the Philippines' Department of Health (DOH) which took place as part of a "knowledge audit". This exercise looked into the knowledge assets related to policy-making processes, taking into account some of the bureaus and units in the DOH which were involved in the development of policy for the health sector reform. Specifically, the study identified the assets of each bureau in terms of databases, documents, professional knowledge and links with stakeholders. The study also tried to determine how the policies of the central office of the DOH would trickle down and be adopted by the local government units.

The knowledge management framework that was considered for this exercise consisted of three layers.

- *The core processes of policy development*: these processes represent the organizational context in which critical information and knowledge is needed.
- *The five core knowledge activities*: these are identification, creation, storage, sharing and use of knowledge.
- *Personal and organizational knowledge capabilities*.

Based on the above framework, documents were reviewed and interviews were conducted using structured matrices. These interviews involved key personnel at both the national and subnational levels of the DOH and some staff of selected local governments.

Fig. 1. **The knowledge-mapping process**

1 Acquire data	2 Manipulate data	3 Store data	4 Process data	5 Visualize data
Raw data are acquired from one or more sources; through a survey, for example	These raw data are manipulated through basic analysis, to produce first-order data that are suitable for generating knowledge maps	The first-order data are then stored in a central database, which is often referred to as the knowledge mapping database (KMDB)	Although the first-order data may be interesting in themselves, most higher-level insights are gained by applying higher-order processing (analysis, aggregation, and contextualization), resulting in higher-order data	By visualizing first-and higher-order data in specific ways, and taking into account different preferences, knowledge maps can be produced that provide insights into the knowledge that is available within the organization or a particular domain of work

*Source*: adapted from Ref. 4.

WHO 06.107

Even before knowledge maps had been generated, this exercise allowed the identification of knowledge assets and resources as well as of the knowledge gaps and weaknesses in policy-making. It was able, for example, to verify that the main *knowledge assets and resources* for DOH policy-making are health staff, information systems, databases and health research. These knowledge resources are being used for policy development. However, gaps were also identified; such as incomplete, outdated or unreliable databases; insufficient reports on the monitoring of implemented policies; absence of a systematic approach for linking research results with the core processes of policy-making; and lack of systematic diagnosis and documentation of best practices in the field. Furthermore, there were areas of weakness in professional knowledge, which highlighted the need to improve staff capability for policy analysis and political mapping, as well as their skills in professional legislative lobbying and negotiation.

In terms of the *core processes from knowledge creation to sharing*, this first phase of the mapping process also revealed some inadequacies which included weak monitoring and evaluation systems and limited documentation of "lessons learned" and good practices. There were also serious flaws in knowledge storage. The responsibilities for maintaining, updating and assuring the integrity and quality of the existing databases in the various technical fields and DOH units were not always adequately defined. In addition, procedures and methods to make tacit knowledge explicit were weak: no expertise database or mechanisms to preserve the knowledge of staff or experts leaving the DOH have yet been institutionalized.

This exercise also emphasized weaknesses in terms of *knowledge flows*, either top-down or bottom-up, in the policy-making process. In a devolved health system, the numerous interfaces in the line of control of the DOH and at the local government level create risks of errors and flaws in the transmission, interpretation and operationalization of policies issued at the level of local government units. The policy cycle was most commonly broken when a local government unit implemented the policies developed by the DOH.

Fig. 2. **Proposed framework for improving the knowledge translation process using knowledge mapping**
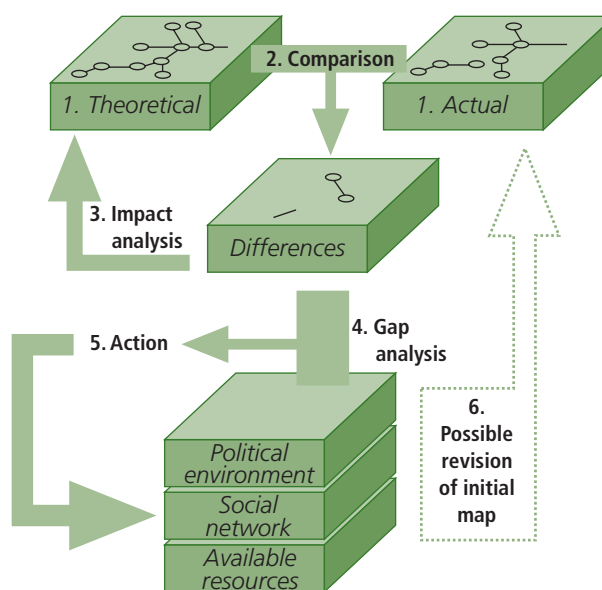
WHO 06.108

Knowledge mapping in the context of knowledge translation

Knowledge translation (KT) has been proposed as a strategy to help bridge the know–do gap. The term was coined by the Canadian Institutes of Health Research[13] and has been defined as "the synthesis, exchange and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people's health".[14]

Knowledge translation is a complex process, involving factors such as the type of knowledge in question, its perceived relevance, the actors involved and the context. What is considered to be knowledge may vary from context to context; identifying potential gaps and proposing means of filling them is an additional challenge.

Knowledge mapping offers an opportunity to elucidate and assist with the analysis of complex processes and hence play a role in knowledge translation. This paper will initiate the exploration by providing a potential framework for undertaking this analysis based on the examples described above. The exploration will be structured around a proposed framework (Fig. 2) which uses knowledge mapping as a technique for identifying potential gaps or flaws in the knowledge translation process. The framework consists of a set of associated knowledge maps.

Combining all of the layers allows decision-makers to understand the knowledge translation process by providing answers to the following questions:

- *Research priorities*: Who sets them? (e.g. researchers, communities, ministry officials, external donors, national funding agencies, task forces, networks or universities). Who enforces them? What factors are used to determine priorities?
- *Research proposals*: How are they submitted? To whom are they submitted? Do they have a knowledge translation component (i.e. a mechanism to promote or guarantee use)? Who follows up on proposals, whether accepted or rejected? How is information about proposed research disseminated?
- *Research in progress*: Who monitors research being carried out? Who verifies that research projects have been approved? What are the consequences of carrying out research that is in breach of the regulations?
- *Completed research*: Who receives the

S Ebener et al.

results of completed research? How are the findings disseminated? Who uses them? Who owns or has access to the raw data? Who validates the findings against those of other studies? What follow-up takes place?

- *Policy-making*: Who makes policy? What is the process for policy being implemented? What kind of evidence is used? What sources of information are used? How does policy feed back into determining research priorities?
- *Knowledge from practice*: Is there a mechanism to capture the knowledge that is generated through the knowledge translation process (synthesis, exchange or application)? What are the lessons learned and the useful experiences?

This list does not aspire to be comprehensive and is limited mostly to health research. Knowledge, on the other hand, draws from a wide net of sources, including research. The process will vary from context to context as will the questions.

At the beginning of the process reported in this framework (indicated by the number 1 in Fig. 2), both a theoretical and an actual map are generated.

- The first map depicts all of the key players, knowledge assets and resources, as well as providing an indication of the flows *seen* as necessary for effective knowledge translation. This map represents a *theoretical* translation process, i.e. how knowledge *should* circulate, based on the elements and structures as depicted in the map.
- The second map depicts the same elements as the first map, but this time as they are observed in the knowledge translation process currently in place. This map represents the *actual* translation process, i.e. how knowledge *does* circulate.

The comparison between the two maps (step 2) aids decision-makers in recognizing potential gaps or flaws in the process and helps them to identify possible improvements. The identification of potential gaps might be enhanced by following a product through its life-cycle. For example, for a research proposal, the theoretical processes involved in producing the proposal (as depicted on the theoretical map layer) could be examined to see if they are a faithful representation of what happens in practice (as depicted on the actual map layer).

This comparison alone may provide a wealth of information. The real impact of these gaps, however, as well as their causes, will not necessarily be straightforward. Separate analyses will therefore be required, starting with an impact analysis (step 3), to gain more insight. At this stage it might emerge that the theoretical map was incorrect and that some players, connections or flows were not necessary for optimal knowledge translation. In this case the theoretical representation of the knowledge translation process would have to be modified and the comparison with the actual process redone (step 2).

If it is confirmed that some of the gaps do have an impact on the knowledge translation process, the identification of their cause(s) would then take place in the context of a gap analysis (step 4), which would consider the following non-exhaustive list of layers:

- the political environment;
- the social network; and
- the available resources.

The objective of *political mapping*, which can be compared to the political analysis described by Reich,[10,15] would be to identify facilitators and potential obstacles to the effective translation of knowledge resulting from policies or political considerations in place (cost-effectiveness, strategies). See section on application of knowledge mapping for examples.

Social network mapping aims to identify connections and information flows between the actors involved in the knowledge translation process. Unlike many other uses of social network analysis,[16,17] the primary concern is not the strengths of network ties, or topics such as innovation, diversity, power relations or the propagation of rumours. The premise of this use of social network analysis is that the actual execution of work processes involves relationships between people other than those found on organization charts. Mapping these relationships produces not a "top-to-bottom" set of boxes as found on an organization chart, but rather a variety of different patterns which may change over time in response to both formal and informal forces. Such patterns can establish themselves on the basis of several parameters which include:

- working structure (team-based) and management;
- geography;
- connectivity (information and communication technologies);
- politics;

- culture; and
- opportunities (e.g. meetings and conferences).

The same set of parameters would be considered in the context of the gap analysis. Each parameter could be considered as a sub-layer of social network mapping.

Each of these parameters could also be the cause of a knowledge gap between some actors, which would have an impact on the translation of knowledge within the system. Careful consideration should be given to the parameter(s) selected for this mapping, especially if several parameters are integrated into a single measure.

Finally, the availability of *resources* would be mapped in a new layer containing information regarding not only the location of the financial and material assets, but also the expertise available at each step of the knowledge translation process. In this regard, this layer would go one step further than the social network layer by attaching expertise and skills to each of the players. This way the individual attributes of the players are exposed relative to their network roles as well as to the professional roles that they play. Links to expertise locator systems, profiles or Yellow Pages are a further step that could turn a knowledge map from a visual representation into a practical tool for navigating within a knowledge-based system. Another purpose for such analysis could be to inform capacity building or competency development planning at the individual, unit and organization levels.

In any case, this analysis would be of value only if it led to concrete actions to be taken (step 5). These actions might have an impact on all or a subset of the layers used for performing the gap analysis and should lead to the revision of the original map (step 6). Priority should be given to the actions that lead to the greatest improvement in the knowledge translation process.

Discussion

The following discussion touches upon some of the challenges that remain, the added value of this conceptual exercise and the necessity to ensure that the processes envisioned are actionable within realistic time periods and carried out with a strong mandate as highlighted in the conclusion. Several next steps are also identified.

Challenges

Some challenges remain to be addressed. The first concerns the need, in some situations, to have a theoretical representation of the knowledge translation process It will also be crucial to identify the kind of knowledge to be considered.[18]

Secondly, there is the issue of availability of the information necessary to draw these different maps. Challenges in this regard will depend on the complexity of the data to be used; its accuracy; its diversity, depending on the stakeholders and actors involved; and the possibility of estimating and illustrating uncertainty, which might result from the compilation and combination of data from different sources. All of this is closely related to the information technology systems and databases that should be in place to provide health researchers and managers with the necessary data.

The variety and complexity of the data available as well as the level of uncertainty might represent an important limitation when the objective of the mapping exercise is to perform a comparison between two different knowledge translation processes or the different contexts in which the same process is applied.

By attempting to identify gaps in the process, this framework goes further than the one proposed by Den Hertog et al.[19] for mapping innovation processes in health care services. This is because the gap analysis proposed here might identify issues located at various levels of the translation process and would therefore involve a large number and range of actors (political entities, researchers, service providers, patient groups and civil society). This may lead to a series of actions that require the support of strong leadership, not only in countries but, depending on the actors involved, also within the international community, to ensure a real impact on the knowledge translation process.

Moreover, the exercise in the Philippines has shown that knowledge mapping is a rigorous and meticulous exercise requiring dedicated time and staff participation. Given the many activities competing for priority within the DOH, the mapping activities are considered additional duties and are therefore given less importance by the staff involved, resulting in incomplete and sometimes haphazardly undertaken knowledge mapping audit project matrices and questionnaires. Stakeholder involvement and understanding of the value of the mapping exercise are thus important. This exercise also demonstrated that valuable information can be obtained through the application of the knowledge mapping process even without drawing the map. It will nevertheless be interesting to see what added value the map provides once drawn.

Conclusion

Knowledge mapping has the advantage of being concrete and tactical. It makes tacit and explicit knowledge graphic and visual. The analysis and application phases of process-based knowledge mapping are oriented towards the definition and planning of a pragmatic project or activity, or towards implementation of a knowledge management strategy or programme. Knowledge mapping also has the potential to increase the involvement of the key stakeholders in the process, enabling them to influence it and therefore to ensure more effective outcomes.

Even if the proposed knowledge mapping framework remains abstract at this stage, the application of the conceptual framework proposed in this paper could support the identification of gaps in the knowledge translation process and their potential causes. The value is to a great extent in the process itself and in increasing people's understanding of the complexity of health systems, enabling them to be more informed actors within it. The information gained can be used to find ways of avoiding duplication of effort, to link people working on similar issues and to provide the information for more advanced types of analysis.

It is also important to note that the knowledge translation process is not static and will change over time. It is therefore necessary to ensure that the framework can be applied within a relatively short time to avoid proposing actions that would no longer be relevant at the time of completion. Moreover, because of its dynamic nature, it will be necessary to define the frequency at which the comparisons between the theoretical and the actual representation of the process should take place.

Next steps

This proposed conceptual framework needs to be further tested at the country and local levels, going beyond the few experiences cited in this paper and eventually refining the knowledge mapping processes that are most effective in translating knowledge into better health. Nevertheless this framework does constitute a first step in the direction of generating guidelines and protocols that would allow countries or institutions to apply the knowledge mapping process. This might serve as an advocacy tool and a practical means for more efficient management of scarce resources and leveraging of additional ones as well as for the possible introduction of incentives for improving the quality of outcomes in identified areas. It could also help to prioritize interventions and provide evidence that the entire public health sector (or entire health system) needs to be engaged in the improvement of the knowledge translation process, as piecemeal efforts will not be successful.

Finally, there are some aspects that have not been addressed in this paper, such as the power of mapping on the basis of geography to integrate large amounts of information and data into single pictures. The mapping of district health services in the Tanzania Essential Health Interventions Project (TEHIP) is a good example of such an application and has had a substantial impact on decision-makers.[20] ■

Special Theme – Knowledge Translation in Global Health
S Ebener et al.
Knowledge mapping to support knowledge translation

Résumé

La cartographie des connaissances : une technique facilitant l'application du savoir

Le présent article étudie les possibilités d'intégrer la cartographie des connaissances dans un cadre conceptuel permettant de comprendre les processus multiples et complexes, les ressources et les acteurs intervenant dans un système de santé et d'identifier les éventuelles insuffisances des processus d'application des connaissances afin d'y remédier.

Après avoir défini la notion de cartographie des connaissances, l'article présente divers exemples d'application de ce procédé dans le domaine de la santé, avant d'examiner les mesures nécessaires pour identifier les insuffisances éventuelles, déterminer à quel point ces insuffisances perturbent les processus d'application des connaissances et en établir les causes. Il expose ensuite des propositions d'interventions visant à renforcer le processus global. Enfin, il examine les limites auxquelles pourrait se heurter l'application de ce cadre à l'échelle d'un pays.

Resumen

El mapeo de los conocimientos como técnica de apoyo a la traslación de conocimientos

En este artículo se analiza la posibilidad de integrar el mapeo de conocimientos en un marco conceptual que podría servir de instrumento para comprender los muchos procesos complejos, recursos y personas implicados en un sistema de salud, así como para identificar posibles vacíos en los procesos de traslación de los conocimientos e intentar subsanarlos.

Tras definir el mapeo de conocimientos, se presentan diversos ejemplos de la aplicación de ese proceso en el marco de la salud, para pasar luego a examinar las medidas que es necesario tomar para identificar las posibles lagunas, determinar en qué medida esas deficiencias afectan el proceso de traslación de conocimientos, y establecer el origen de las mismas. Seguidamente se hacen algunas propuestas para implementar intervenciones encaminadas a fortalecer el proceso general. Por último, se abordan las limitaciones potenciales de la aplicación de este marco a nivel de país.

ملخص

رسم خريطة المعارف كوسيلة لدعم ترجمة المعارف إلى واقع ملموس

نستقصي في هذا المقال إمكانية إدراج رسم خريطة المعارف ضمن إطار عمل مفاهيمي يمكن أن تستخدم كأداة لفهم الكثير من التعقيدات في النظام الصحي بالنسبة للأشخاص والمواد والعمليات، وللتعرُّف على الثغرات المحتملة في عمليات ترجمة المعارف إلى واقع ملموس والتصدِّي لها.

وتقدِّم هذه المقالة في البدء تعريفاً لرسم خريطة المعارف، ثم تستعرض أمثلة مختلفة لتطبيقات هذه العملية في مجال الصحة، قبل أن تصف الخطوات التي ينبغي اتباعها للتعرُّف على الثغرات المحتملة وعلى المدى الذي يمكن لهذه الثغرات أن تؤثِّر فيه على عملية ترجمتها إلى واقع ملموس وللتعرُّف على الأسباب. وأخيراً يقدِّم المقال اقتراحات حول التدخُّلات التي تستهدف تعزيز العملية بكاملها قبل أن تختتم بمعالجة أوجه القصور المحتملة في تطبيق إطار عمل مفاهيمي على الصعيد القُطري.

References

1. Pablos-Mendez A, Shademani R. Knowledge translation in global health. *J Contin Educ Health Prof* 2006;26:81-6.
2. Pablos A, Chunharas S, Lansang MA, Shademani R, Tugwell P. Knowledge translation in global health. *Bull World Health Organ*; 2005;83:723.
3. Vail E. *Knowledge mapping, getting started in knowledge management.* Babson Park (MA): Center for Information Management Studies; 1997. CIMS Working Paper Series #97-04.
4. Huijsen W-O, Driessen S, Swaak J. *Knowledge mapping advances, report on the work package "knowledge mapping" of the Metis project 2003.* Amsterdam: Metis; 2004.
5. Burkhard R. *Knowledge visualization — the use of complementary visual representations for the transfer of knowledge. A model, a framework, and four new approaches.* Swiss Federal Institute of Technology (ETH): Zurich; 2005.
6. Scott J, Tallia A, Crosson JC, Orzano AJ, Stroebel C, DiCicco-Bloom B, et al. Social network analysis as an analytic tool for interaction patterns in primary care practices. *Ann Fam Med*, 2005;3:5.
7. Seemann P. A prescription for knowledge management: what Hoffman-La Roche case can teach others. *Managing Organisation Knowledge Center for Business Innovation Journal* 1998; 2003. Available from: http://www.providersedge.com/docs/km_articles/A_Prescription_for_KM.pdf
8. Trochim WMK, Milstein B, Wood BJ, Jackson S, Pressler V. Setting objectives for community and systems change: an application of concept mapping for planning a statewide health improvement initiative. *Health Promot Pract* 2003:1-12
9. Center for Democracy and Governance. *Policy implementation: what USAID has learned.* Washington, DC: Center for Democracy and Governance; 2001. Report no. PN-ACH-306
10. Reich ME. *Political mapping of health policy: a guide for managing the political dimensions of health politics.* Boston: Harvard School of Public Health; 1994.
11. Glassman A, Reich MR, Laserson K, Rojas F. Political analysis of health reform in the Dominican Republic. *Health Policy and Planning* 1999;14:115-6.
12. González Rossetti A, Soberón Acevedo G, Frenk Mora J, Reich MR, Martínez Valle A. *La Dimensión Política en los Procesos de Reforma del Sistema de Salud.* [*The political dimension in the health system reform process.*] Mexico City: Fundación Mexicana para la Salud; 1995.
13. Canadian Institutes of Health Research. Knowledge translation strategy 2004–2009. Ottawa: Canadian Institutes of Health Research; 2000. Available from: http://www.cihr-irsc.gc.ca/e/26574.html#introduction
14. Bridging the "know-do" gap. *Report from the meeting on Knowledge Translation in Global Health.* 10–12 October 2005. Geneva: World Health Organization; 2006.
15. Reich MR. The politics of reforming health policies. *IUHPE - Promotion & Education.* Vol. IX/4. Paris: International Union for Health Promotion and Education; 2002.
16. Huckfeldt RR, Johnson PE, Sprague J. *Political disagreement: the survival of diverse opinions within communication networks.* Cambridge: Cambridge University Press; 2004.

17. Cross R, Liedtka J, Weiss LA. Practical guide to social networks. *Harvard Business Review* 2005;83:124-32.
18. Roberts MJ, Hsiao W, Berman P, Reich MR. *Getting health reform right*. New York: Oxford University Press; 2003.
19. Den Hertog F, Groen M, Weehuizen R. *Mapping health care innovation: tracing walls and ceilings. 2005–2007*. Maastrict: International Institute of Infonomics; 2005. MERIT-Infonomics Research Memorandum Series.
20. De Savigny D, Kasale H, Mbuya C, Munna G, Mgalula L, Mzige A, et al. Tanzania Essential Health Interventions Project (TEHIP). Interventions — an overview. *TEHIP discussion paper no. 2*, 2002. Available from: http://www.idrc.ca/uploads/user-S/10936344521TEHIP_Discussion_Paper_-_Interventions_Catalogue.pdf