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Information, education and health care work: Beyond evidence, collective intelligence[1]

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Abstract

Information has been considered a key input for the management, teaching and coordination of care practices and for public (or collective) health, and it is expected to work as a true tool to guide decision-making and the production of valid knowledge. In the present essay, we question the role of information in the management and teaching of participatory management concepts and critical-participatory teaching-learning processes. Considering concepts from the collective health field, information science and Brazil's national information policy, we analyze the challenge of an evaluation culture to strengthen management systems, particularly with respect to the development of skills among health care workers. Without disregarding the technical nature of information processing, we propose a shift in the concept of information from a tool to guide decision-making and the production of valid knowledge to a tool used to mobilize the development of capacity of local institutions. The concept of the data/collective information-intelligence cycle, which was developed in previous research, points to the analytical power of soft technologies and approaches to professional education, following a theoretical construct that has already been proposed in the National Policy on Health Information and Computing. This concept highlights the challenge for health information to be more than an input for learning in everyday management, care and training.

Introduction

Information has been considered a key input for management and education and is usually expected to act as a tool to guide decision-making and the production of valid knowledge. Information of different natures and from different sources is the main building block for these processes, leaving managers to analyze information and thus identify evidence within the research material itself. In the present essay, we question the role of information in management and education in the context of participatory management concepts and critical-participatory teaching-learning processes.

The first research initiatives attempted to problematize the tradition of fragmented and specialized information under the central management of the Brazilian health system. Considering concepts from public health, information science and Brazil's national policy of health information, these research initiatives challenge the culture of using evaluation to strengthen management, particularly with respect to the development of professional skills among health care workers.

Subsequently, the reflexive path searches for a link between the concepts of the public health field, specifically within its micro-policies, to propose a new relationship between information and work processes. The concept of the data/collective information-intelligence cycle, which has been built upon previous studies (FERLA, 2009), rescues the analytical power of soft technologies (MERHY, 2002) and approaches for continuing education, following a theoretical construct that has already been proposed in the National Policy on Health Information and Computing.

The context of information and its challenges

Databases and National Health Information Systems are important tools for the evaluation of health policies, services, networks and systems. Until the 1970s and 1980s, Brazil's databases and information systems were managed at the federal level, and the technology to process data was based on mainframe computers. Even in the mid-1990s, data storage servers were commonly located in central agencies, such as the Brazilian Census Bureau (IBGE) and the Ministry of Health. Between the 1980s and 1990s, with the expansion of information systems tracking morbidity, mortality and births, and the decentralization of assisting care services, especially primary care, it was possible to obtain data at the municipal level under the coordination of the Federation Units. Although processed locally, the data and configuration of the health information systems were traditionally the responsibility of federal and state managers. However, since then, gaps in coverage have been observed, especially in the North and Northeast regions, generating indicators that do not always depict the true picture of the health situation of these areas. In addition, problems with data fragmentation have led to questions about the way information is produced and the competence of those managing this information (MORAES *et al.*, 1998; 2009).

Even the existing innovations that make data available in online local databases (e.g., the DATASUS and State Health Department sites, the IBGE Multidimensional Database and the

IBGE Automatic Data Recovery System [Sistema de Recuperação Automática de Dados – SIDRA], among others) are unable to respond to the demands of users and managers at all levels (federal, state and municipal) with regard to the planning, monitoring, evaluation and regulation of the health system, or the strengthening of social control. The data displayed are, in most cases, raw data with various levels of aggregation that do not generate data that are useful for statistical analysis or information that may produce evidence for local decision-making or enhance the process of constructing meanings for these decisions and the necessary interventions. An example of this situation is as follows: although the demographic census performed by IBGE uses census sector micro-areas defined by the Family Health Strategy, the professional staff and even the public administrator ignore these micro-areas (either because they do not know about them or because of the absolute lack of data integration). Therefore, the ability to use these data to generate important information that could help in the planning of health actions is lost, particularly on a municipal level. In addition, the use of micro-areas as data units is not a skill that is developed during academic training or professional development, except in specific training courses and specializations for public health workers.

Recently, the Oswaldo Cruz Foundation (Fundação Oswaldo Cruz – Fiocruz) has developed specialized courses in the field of data collection for the students of *lato-sensu* graduate programs and for technicians. The courses were offered in the city of Rio de Janeiro and, later, in Porto Alegre, Manaus and Brasília (FERLA *et al.*, 2005), but coverage remains limited. These educational activities have served as laboratories for the construction of new meanings and new possibilities for the use of information in health care, particularly with regard to using data to meet local demands. It is worth noting that since 2002, and particularly since the beginning of the Reuni projects in 2008, most new public health graduate programs make use of information for management, namely for the "analysis of policies and health and systems services", as a pedagogical challenge for training professionals (CECCIM *et al.,* 2012). The formation of skills to effectively use information is expected on a larger scale at the local level from these initiatives for the development of professional skills that, while focusing on the techniques and technologies of the national systems, also strengthen local competence for the creative and innovative use of information.

In this context, in 2003, the Ministry of Health, in conjunction with the Pan American Health Organization (Organização Pan-Americana da Saúde – Opas) and the National Health Council (Conselho Nacional de Saúde – CNS), conducted a workshop on health information and social control. The workshop approach, which was summarized in its Final Report (BRAZIL, 2003), points directly to an influential notion that guides actions in the information and computing fields (placing a visibility status that is very unique to the computing infrastructure in the evaluation of the accessibility of information and useful knowledge for inclusion in the Unified Health System – SUS), the policy character of information and knowledge that comes from its domain, the fragmentation of databases and information and the deficits in the link between information and computers, and communication and education. As a main point of action, workshop participants developed suggestions to strengthen the development of a comprehensive, creative and innovative policy for this area, recognizing the potential of information to build new levels of the health care system and to influence the different actors in health care. The emphasis on social control at the workshop and subsequently points to the need for a dialogue about the knowledge needed for data interpretation and the expansion of access to and dissemination of health information so that this information is not trapped in the

technical domain. The needs of the different actors are not limited to the development of specialized explanations but also include the construction of explanatory models of reality derived from local knowledge.

Thus, in 2004, following an intense discussion that culminated with the deliberations of the 12th National Conference on Health, the Ministry of Health added to the National Policy for Information and Computing of SUS (Política Nacional de Informação e Informática do SUS – PNIIS), whose purpose is:

> To promote the innovative, creative and transformative use of information technology, to improve the health work processes, resulting in an articulated National Health Information System that produces information for citizens, management, professional practice, generation of knowledge and social control, ensuring efficiency gains and measurable quality through increased access, equity, integration and humanization of services, and thus contributing to improving the health status of the population (BRAZIL, 2004:15).

This definition is consistent with international standards, highlights the possibility of changes in institutional management models and confirms that health information is an important area that requires further consideration (BRENDER *et al.*, 2000) with regard to the configuration of health care systems in countries and regions. Information in this context not only operates as an instrument or tool with a hard technology configuration (MERHY, 2002) but acts as a device to mobilize local networks and encourages the sharing of knowledge about the reality under study. More than content to be learned, it raises the articulation of significant learning (CECCIM *et al.*, 2008) in everyday management, participation, care and training, mobilizing a new capacity to produce meanings from everyday work.

The structure of the National Health Information System is strengthened, according to PNIIS (BRAZIL, 2004), by the creation and monitoring of the following two integrated National Databases: (i) the National Identification Database (Base Nacional de Identificação – BNAI), which uses data from users, professionals and health care facilities, and (ii) the National Health Care Database (Base Nacional de Atenção à Saúde – BNAS), which uses data from assistance, health surveillance, rehabilitation and health promotion efforts. These two databases include health information from various sources. However, a problem that has already been identified is the difficulty in distilling the broader health concepts that form the foundation of the Brazilian health care system, according to the system's constitutional definition, from information and objective indicators (BRAZIL, 2004). Therefore, we must consider how the current system can take local realities into account.

The monitoring of these two large national databases allows for the integration of the system with the current databases, which have different ways of encoding the same variables. A large proportion of the >300 subsystems of information that exist in DATASUS can also be integrated, which would make the analysis process and use of information in local contexts much more accessible.

Under the SUS, several examples of local initiatives for the computerization of the data generated from health work activities are succeeding, which has resulted in an increase in the quality of health services. For example, Curitiba, Ipatinga, Sobral, Aracaju and Campo Grande are cited as municipalities in which the basic health care network is computerized, which leads to several advantages for the population, health professionals and managers. As part of health

surveillance, a health system component that traditionally uses data treatment as a work approach, Drumonnd Júnior (2003) has shown local creative effort to be a basic and necessary condition for the innovative use of epidemiological information in some selected municipalities. More than training for the regular maintenance of the Health Information Systems (Sistemas de Informação em Saúde – SIS) flow, this approach proposes institutional development for the use of information.

Since 2011, several institutional initiatives of the Ministry of Health have expanded the scope and use of strategies for the monitoring and evaluation of the information used in federal management actions. To cite two examples, the National Program for Improving Access and Quality of Primary Care (Programa Nacional de Melhoria do Acesso e da Qualidade da Atenção Básica – PMAQ) and the SUS Performance Index (Índice de Desempenho do SUS – IDSUS) were released and are now in effect, creating a consensus, more or less, around the methodological and operational aspects of data management. The policy definition adds to the definition of resources and priorities for the Brazilian health care system. The dissent around these strategies, in general, comes from a technical dispute about the reliability of data used and the ability to translate the Brazilian reality, which in itself is a positive marker of the initiatives because it places the information in the scope of the uses made for it and, in a way, denatures the instrumental look that is usually used for the treatment of data for management. Nevertheless, the data-information range must be evaluated in a way that takes into account the interests of the actors who use the data.

Health care information and evaluation

The interpretation or meaning of data constitutes what we call information. From the articulation and combination of a dataset, it is possible to generate information that allows us to infer the truth. This interpretation, in the words of Ferreira (1998: 73-74), "can be understood as an **evaluation** (which comes from **value**, that is, **to give value**)" to form a judgment about a particular situation or context. The author continues: "Necessarily, this judgment incorporates our views, our assumptions, and the references that underlie our worldview" (FERREIRA, 1998, p. 74).

Information can therefore be defined as follows:

> "the product obtained from a given combination of data and evaluation and the judgment we make about a given situation; it serves to support the decision-making process, implementation and evaluation of triggered [health] actions." (FERREIRA, 1998, p.74)

In the health field, it is important to specify which health concept is being explored because this will determine the type of data to be collected and, in turn, the information that will support the management of health care systems and their planning, execution, monitoring and evaluation (Ferla *et al.,* 2002a). We affirm that the existence of comprehensive, reliable and quality databases is not sufficient to develop institutional capacity to mobilize these data or to ensure the availability of technologies for data analysis. In addition, other capacities that result in the following equation should be developed: "available information" + "health care managers and/or students" equals "health management for the implementation of the policies of the current health care system".

As observed, there is a tendency to associate, in a very direct way, information and decision-making processes, in which assessment would be the most relevant cognitive process. Even without attempting to generate a broad theory on this subject, we prefer the idea of evaluation as a movement device, or the production of new knowledge that leads to change. Contandriopoulos (2006), to strengthen health assessment, proposes actions to develop and implement an *evaluation culture*, which assists in understanding the concepts presented in the current essay. According to Contandriopoulos,

> "To make the evaluation be at the core of the strategies for transforming the healthcare system, we suggest creating conditions for a truly critical assessment judgment by implementing strategies that enhance the training and learning, the debate, the reflection and opening of new intervention fronts. Institutionalizing assessment implies first of all to question the assessment ability to produce the information and the judgment needed to help decision-makers to improve the SUS performance." (CONTANDRIOPOULOS, 2006, p. 705)

Thus, the evaluation would involve learning processes in everyday life and learning the ability to critically analyze the interaction between the treatment of information and its context. In fact, neither decision-making processes nor health management exist in ideal conditions. To Contandriopoulos, this perspective of assessment requires the implementation of strategies to encourage "training and learning, allowing all actors to acquire new intellectual models to understand the complexity of the evaluation and the healthcare system". However, this process is not – and cannot be – purely instrumental because "the same information [can] have different meanings for persons in different positions and judgment fields" (CONTANDRIOPOULOS, 2006, p. 710-711).

The abovementioned perspective allows us to consider one of the central ideas developed in the theoretical construction presented herein: the most adequate understanding cycle for the informational process is no longer restricted to the data-information interval, or even data-knowledge, as is commonly put forth in the literature. Furthermore, the scope of intervention is no longer focused on information science or planning theories. The interval for a more adequate understanding, from the perspective of health care management and its different actors (managers, workers, the participatory network and the training network), is data/collective information-intelligence. In other words, to move beyond the character of information as a technical variable in the decision-making process, we must shift to a concept of information as a device, reflecting our understanding of the concepts of the actor-network (LATOUR, 1996), the trees of knowledge (LÉVY, 2004), the mediations of knowledge production (SILVA, 2009), the use of experience and local truth networks (SOUZA SANTOS, 2000) and representations of territoriality (de Santos, 1994). It is this approximation that we want to explore in the present essay, a set of reflections that associates everyday health care work with knowledge production, thereby activating an intelligence that comes later (not an illustration of access to information, but changing the ways of knowing and learning). The next topic approaches this association.

Information and health care: aspects of micro-policies

A few years ago, the analysis of health contexts was expanded with several theoretical approaches. Among other initiatives, the social Latin-American epidemiological approach (DRUMOND JÚNIOR, 2003) allowed for a critical understanding of the relationship between

morbimortality indicators and the modes of production of society, expanding the breadth of information and indicators for diseases and disorders. In addition, it also required a renewed capacity to understand the contexts in which the indicators were produced in society, i.e., work processes in general, as well as the ways in which the production of information and indicators affect the construction of meanings. In addition, the capacity to analyze the work and its interface with health care systems was leveraged in the context of public health in recent years. We refer specifically to several analyses of the micro-policies of health care, based primarily on the work of Merhy (2002).

The study of health care system organization models or, as we prefer to say, techno-care modeling, which highlight these aspects, is important to reflect upon because it allows us to think about two relevant issues for the analysis that is currently being considered: the interaction between the different health care system actors and the relationship that they establish with information. It is worth noting that with some frequency, both aspects can translate into an understanding of these relationships through quite similar technological dimensions. First, there is equipment and structured knowledge (regarding the biomedical clinic, disciplinary fields of health care professions and/or others that act in the health care scene, such as administration, accounting, etc.). Second, there are normative procedures (either from the legal standpoint or scientific evidence). In the second case, technological solutions, structured knowledge (regarding epidemiology, statistics, computing, etc.) and methodological definitions aim to unveil the essence of data and information.

In the first case, we return to the work of Merhy (2002), who speaks about the distinct nature of the technologies that are used in care and management. For example, equipment (*hard technology*) and structured knowledge (*soft-hard technologies*) assist with technologies that are produced in the act and that materialize in the relationship between different subjects and with different resources. It is the *soft technologies* that, according to Merhy, must be considered to be such – because they are – but they should also lead to the management of health care that is intended to be integral. The instrumental character of equipment and biomedical knowledge should be substituted with work of a creative nature, in which structured knowledge and technological equipment are used to meet the care and management needs identified in the caring relationship between professionals and clients. In other words, the proposed shift is not for a return to the world of nature in a pure state but for a review of the power and determination of disciplinary knowledge and technological equipment in the hegemonic imagination of the actors that compose the care scene and its management. This operation includes the negotiation of knowledge and interests and the shared construction of work projects. In our understanding, the comprehension of information as a device for these processes of negotiation, change and the production of new meanings for performance in the workplace is not only possible but also contributes to these shifts in working practices.

To analyze the relationship between information and health care work, we propose the following concept: instead of being a systemic and instrumental character, information should be used as a device to reorder knowledge and practices. In an exquisite text on the subject of information, Merhy *et al*. (1997, p. 123) propose "information as an interrogatory tool of sense and meanings of the actions in health care, in the possibility to search new ethical-political references that are presented as noise in its interior". The authors mentioned above proposed that, instead of seeking a fixed and established meaning, information should be treated in a

way that brings attention to inconsistencies and tensions (*noise*) in the processes of work and the flow of care and management. The possibility of analysis from the noise would constitute "openings for more public processes, shareable among everyday operators", in which they could, by means "of a certain technology, act conforming new directions for the service" and as "a certain institutional arena" in which different interests are at stake (MERHY *et al.,* 1997, p. 118). Information, instead of being a "carrier" of universal knowledge (with the pretense of truth), would be a carrier of analytical capacity, of real and potential noises in the organization of work as a process of the cognitive treatment of reality. The figure below illustrates this idea.

FIGURE 1 – Conceptual diagram of information according to uses and potential for management
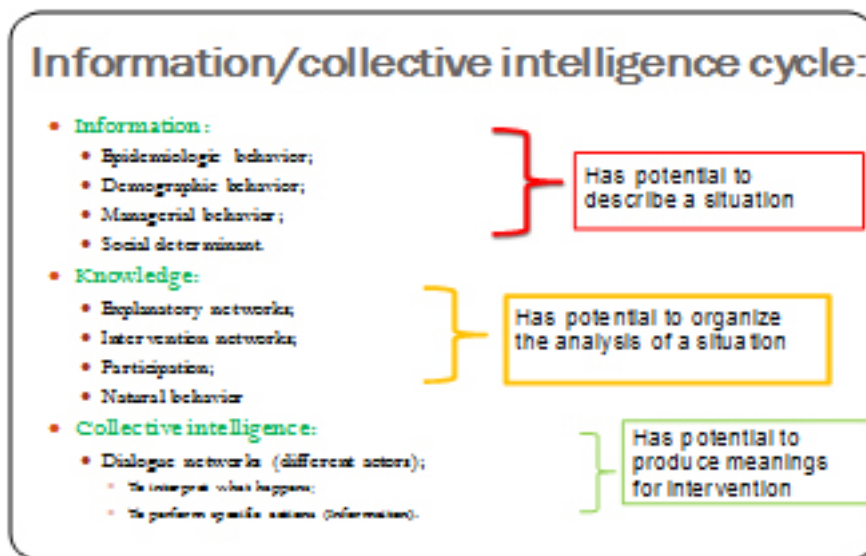
SOURCE: Adapted from Ferla & Cols, 2009.

The figure above represents the ideas that are inherent in the construction of the axis information/collective (or institutional) intelligence presented in a previous work (FERLA, 2009). In the conceptual diagram, the information plan is associated with the ability to describe epidemiological behaviors, managerial behaviors, demographic behaviors and social determinants. The data handled by assessment processes predominantly have descriptive potential. Subsequently, with new treatment processes, information could generate knowledge that is capable of organizing the analysis of a health situation for a defined set of actors in certain epistemic communities. What we aim to highlight is a third plane, in which information and knowledge are circulated to build local production networks, thereby leading to the development of new interventions. These interaction (dialogue) networks have the ability to mobilize local resources for intervention. This process does not exist under the pretense of the universal meaning of the produced knowledge but of a significant knowledge (CECCIM *et al.*, 2008) that is generated through daily work and leads towards changes in practices.

In this context, we find the definitions of the national policy of professional education in health care, which highlights the need for a new positive alliance between the operators of the health care system and the work itself. The new alliance is indeed a relationship between the actors and the evidence of reality (as opposed to scientific evidence, which has been the basis of creating health care processes for several decades), establishing falsification patterns in which knowledge potentially emerges and giving a new meaning to the work itself. Education is thus

a permanent feature of health care through intellectual openness, creation potential and ethical claim and potentially – and necessarily – is being produced in the relationship between individuals and work. The challenge in this case is to not naturalize the work processes or their organization or to put them "outside" of concrete work (knowledge and technological equipment) as they are capable of acting as sufficient mediators (CECCIM *et al.*, 2008).

These formulations bring us once more to Brazil's health information and computing policy (BRAZIL, 2004). Under this policy, the guidelines clearly point to the idea of the flow of information and knowledge[2], with regard to local realities and needs[3], to build definitions in an ascending manner and to encourage the exchange of experiences, thereby increasing the amount of learning occurring in everyday work. At this point, we most likely find the greatest operational innovation that the concept of the data/collective information-intelligence (institutional) cycle reaches: to provide opportunity for those concepts and guidelines of the listed policies and, furthermore, to strengthen the context in which the new alliance between the world of health care work and its agents is possible. This is a relevant challenge for management practices, care coordination and health care education.

Conclusion: health information, management and care

We sought, in the present essay, to discuss the role of information in the processes of health management, care and education. In the case of management, the role of information is to bring about the production of truths to illuminate the decision-making processes of managers. According to the literature, cognitive models based on ideal conditions tend to be unfeasible re because they are usually not applicable to daily work (PINHEIRO *et al.*, 2007). In the argument presented here, the concept of evaluation as a device for decision-making processes approaches the concept of "evaluative research" used by some authors to refer to a set of cognitive processes performed in a rational and systematic way that lead to the construction of judgments used for decision-making processes (CONTANDRIOPOULOS, 2006). This is not an evaluation that is based only on the application of criteria and standards (normative evaluation) or the simple production of knowledge for a better understanding of reality (research). It is, rather, an evaluation to produce knowledge based on methodologies of analysis of a certain reality, which generates useful judgments for the decision-making process in the development of interventions. The concept discussed in the present essay is not that the knowledge and judgments constitute the decision but that they subsidize it in the sense of displacing the current way of thinking. Moreover, the current essay proposes that knowledge acquired in daily work, in combination with local knowledge, can inform the knowledge built by the network of actors involved in these issues.

This argument questions not only the methodological considerations for evaluation research but also its policies, in that the conditions of different natures provide feasibility to management decisions. These different conditions and the knowledge that supports them

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[2] As verified in guideline number 06: "To establish mechanisms for sharing of data of interest for healthcare and to expand the production and dissemination of health information to meet both the needs of users, professionals, managers, service providers and social control, as to the exchange with education and research institutions, other sectors of government and society and international institutions" (p. 17).

[3] As verified in guideline number 09: "To encourage local initiatives for development of information systems, considering its potential to better address the diversity and complexity of health care services, respecting the regional characteristics and strengthening the development of a culture of information and computing in health" (p. 17-18).

render them relevant mediators for evaluation research. The role of information in these processes is shifted. In an article discussing the interactions between researchers and managers in health care, Hernández-Bello *et al.* (2006) identified that the full use of knowledge generated by the analysis of reality is achieved when the research process includes areas of intense interaction between the different subjects. We consider it possible, by analogy, to state that the best judgment of reality (defining that this judgment has greater potential to induce changes based on what is considered appropriate by the actors involved) is that built with intense mediation processes from different subjects, with their knowledge, practices and capacity for interaction. This statement takes us back to our introduction, which highlights the assortment of relationships (the soft technologies, in Merhy's words) that manage the cognitive processes in the data/collective information-intelligence cycle. This concept is analogous to what Alazraqui *et al*. (2006) termed open and complex health care information systems, or in the case of the use of information and communication technology, the resources of the communities of practice (TAVARES *et al.*, 2011).

We recognize that the indicators have a technical dimension, which is very relevant to the idea that the available knowledge allows us to prevent avoidable errors in analysis and decision-making, but we highlight that this dimension is not complete and needs to incorporate a policy dimension. Therefore, this dimension emphasizes the information resources (hard technologies) and structured knowledge (in the case of health information, statistics, epidemiology, demography, etc.) or soft-hard technologies. However, the association between the indicators and the decision-making process, including the construction of meaning for the evaluation, is placed almost fully within the soft technologies. Again, we refer to the theory of the actor-network or even intelligence technologies to show that the challenge is not the ability to theoretically and methodologically define the indicator but to view the indicator as a device for thinking and communication, thereby demonstrating its capacity to link (trigger networks) different actors and to build new shared meanings (trigger thoughts). This concept is a challenge of large dimensions for public health education.

One aspect of mediation in information is related to the interdisciplinary character of its production and use. If the condition of multiprofessionality is easily visible by the diverse education of operators and information, overcoming disciplinary logic must be sought in different theoretical perspectives; in the diversity of fields in which concepts and methodological approaches are pursued; and in the various links between computing and education, computing and management, information and computing, information and communication, health and sociology of work, health care and education, and information management and care coordination. Finally, the construction of network production assumes a production based on heterogeneous thoughts that, on one hand, challenges management and education in an intense way but, on the other hand, motivates through the always renewed potential of the creation and production of new thinking planes (live and act work).

The data/collective information/intelligence cycle is built based on the mapping of heterogeneous practices and is capable of reciprocal falsification due to links with everyday life (FERLA, 2009). Thus, this concept is currently defined as a distributed knowledge network, which is coordinated in real time and mobilized by mutual enrichment and growth, as described by Lévy (1998). Nevertheless, this concept is also an expression of the ethical

implication of individuals and the collective with the invention of new possibilities for health care and a plan for these possibilities (CECCIM *et al.*, 2009).

For the production and use of information and for the production of technological resources for management, care and learning support, there is more to propose than the explicit continuities of information, which are highlighted in studies of evidence and protocols. It is necessary to link the subject and its context, subsequently constructing networks of meaning. After all, information as collective intelligence can be used to produce movement and changes in the look, feel and actions of health care work. Health care should produce practices of care, management, and training that are more committed to quality of life using the advances of public policies built to protect life and health and strengthen citizenship.

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