



# A multiprofessional information model for Brazilian primary care: Defining a consensus model towards an interoperable electronic health record



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## ABSTRACT

**Objective:** To develop a multiprofessional information model to be used in the decision-making process in primary care in Brazil.

**Methods:** This was an observational study with a descriptive and exploratory approach, using action research associated with the Delphi method. A group of 13 health professionals made up a panel of experts that, through individual and group meetings, drew up a preliminary health information records model. The questionnaire used to validate this model included four questions based on a Likert scale. These questions evaluated the completeness and relevance of information on each of the four pillars that composed the model. The changes suggested in each round of evaluation were included when accepted by the majority ( $\geq 50\%$ ). This process was repeated as many times as necessary to obtain the desirable and recommended consensus level ( $> 50\%$ ), and the final version became the consensus model.

**Results:** Multidisciplinary health training of the panel of experts allowed a consensus model to be obtained based on four categories of health information, called pillars: Data Collection, Diagnosis, Care Plan and Evaluation.

**Conclusion:** The obtained consensus model was considered valid by the experts and can contribute to the collection and recording of multidisciplinary information in primary care, as well as the identification of relevant concepts for defining electronic health records at this level of complexity in health care.

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## 1. Introduction

Brazil's Unified Health System (UHS) has no standardisation of health information yet, which leads to great variability in the format of documents and information, there being possibly as many variations as the thousands of health centres distributed throughout the country [1,2]. This variability makes standardisation and commu-

nication between different health professionals difficult. It also has a negative effect on health care as a whole [3]. The development of a model that incorporates a set of essential health information is justified by the need to meet a number of requirements that guide the principles of the UHS [4,5]. These requirements include:

- multidisciplinary care as a comprehensive view of individual health, which is the main source of all information required in different health service settings, as well as in research and health education;
- interaction between the different health professionals working at the primary-care level of complexity; and

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- (c) preserving the individual's longitudinal record, for better communication between health teams and security of the information that is collected, stored and retrieved, as well as its quality [6,7].

The purpose of this study was to develop a multiprofessional information model to be used in the decision-making process in primary care in Brazil.

## 2. Background

Brazil's UHS is structured on three levels of health care complexity: primary (gateway to the UHS), secondary (medium complexity) and tertiary (high complexity) [4]. This order of classification does not mean that primary health care has a lower level of complexity than the others since it is also complex, being the principal means of solving the health problems that affect the population most frequently [8]. Primary care should be an initial filter resolving most user health needs, approximately 85% [9], and channelling the demand for more complex services, organising the flow of treatment continuity or treatment at other health care levels [10,11].

It is known that, inevitably, each individual's health information is collected in various care settings and stored in heterogeneous repositories. Integrating this broad set of information is a challenge [12]. According to the last census published in 2011, Brazil has approximately 43,000 basic health units [1]. Establishing effective communication between them, so that data can be interpreted electronically, suggests that information cannot be "isolated" [3], but should be accessible beyond the context that generated it, meaning that service points should share longitudinal health record information. In this way, both the health care professional and the individual seeking assistance will have a full view of the generated health history, respecting ethical and legal issues.

This heterogeneity of care in Brazil, whether in the public, supplementary or private sector, highlights the need to maintain communication at different health care levels. The absence of electronic health records leads to the duplication of documents, tests, prescriptions and medication errors and increases the delay to the right clinical decision-making [1,3]. Furthermore, longitudinal electronic health records can improve the quality and safety of individual care, providing knowledge required to improve health service efficiency [12]. To achieve this, standards for content, structure, representation, security and communication are necessary to develop semantically interoperable technological solutions, some of which are being used in Brazil [13,14].

Considering the need of information availability, the simple standardisation of terminology and tools, for example, is not enough to make an impact on health care quality. Multiple parallel actions need to be undertaken and an important one is the health information storage location (repository) so that it can be analysed or exchanged with other health institutions.

Thus, based on the guidelines and principles of Brazilian UHS [14], which calls for the collectivity and a quality care to the individual, this study is justified as another initiative being undertaken with a view to building an information architecture, centred on the individual and specific for health care at a level of complexity where the largest number of affections in health can be solved.

Studies have been recommending that patient-centeredness should be one of the main concepts to redesign and implement new health technologies in primary care [15]. To reach this goal, a starting point would be the definition of the core set of information that needs to be standardised. Countries that have made large investments in personal health records—PHR (Meaningful Use) have shown that the speed to develop these PHR has gen-

erated a large number of islands, hindering progress to the high level of interoperability [16].

The development of a health record information model through a multidisciplinary collaboration that includes experts in the subject from their different angles, increases the chance of identifying the essential information for this health record [17]. In addition, it addresses the needs of a service with a broader concept of health, instead of that fragmented and centred on each health profession or speciality [3,15].

## 3. Methods

### 3.1. Study design

This was an applied observational study, with a descriptive and exploratory approach, using action research with the Delphi method. This approach comprised an investigation in the context of real clinical practice, oriented towards future perspectives [18]. The Delphi method was chosen since it allows a consensual analysis by a group of experts in the research problem and clinical practice. The method comprised three stages: (a) selection the panel of experts, (b) development of the preliminary model and (c) content validation using Delphi method.

#### 3.1.1. Selecting the panel of experts

The panel was composed of faculty and staff who had taught principles of health information collection and/or worked in primary health care (Table 1). These professionals came from four Brazilian institutions of higher education, with a representative from each of the following health professions, officially regulated by Brazil's National Health Council (Physical Education, Nursing, Pharmacy, Physiotherapy, Speech Therapy, Medicine, Nutrition, Dentistry, Psychology, Occupational Therapy), one health profession unregulated (Music Therapy) and Computer Science. The following inclusion criteria were considered:

- (a) Health professionals, formally recognised in their speciality;
- (b) Health professionals with experience (clinical practice, teaching or research) in symptomatology and/or primary care;
- (c) Professionals in the area of computing with experience in health informatics.

The snowball technique was also adopted to select experts in some health professions. This technique takes suggestions from the already-included experts for new participants who were not previously considered [19].

#### 3.1.2. Development of preliminary health information record model

To develop the preliminary model, the expert panel received no initial proposal. The professionals were explained about the purpose of the desired information model, based on four main factors: focus (individual), scope (primary care), information type (the common health information needed among the different health professions) and the guiding questions of the study.

The essential information of the general health of an individual were identified by panel members, through discussions (brainstorm) performed in a sequence of collective and individual regular meetings.

At the end, the result was a mind map, which contained all the essential information identified and their connections. These informations were grouped according to their similar characteristics in four sets called pillars: Data Collection, Diagnosis, Management, Therapy and Assessment. The preliminary model was then used to search the Delphi consensus.

**Table 1**  
Panel experts' profile and participation in the steps of the research.

Professional	Health profession	Years of practice	Professional profile	Development phase	Consensual phase		
				Preliminary Meetings <sup>a</sup>	Delphi Method		
					1st round	2st round	3st round
1	Dentistry	20 years	<ul style="list-style-type: none"> <li>• DDS, PhD, Professor in higher education (dentistry education)</li> <li>• Specialist in Oral Medicine and Dentomaxillofacial Radiology</li> <li>• Fields of teaching and research: oral diagnosis; semiology; oral cancer; imaging diagnosis; diagnosis/treatment of diseases and chronic pain of dentomaxillofacial region</li> <li>• Part of the professional team of local public health system</li> </ul>	Yes	Yes	No	Yes
2	Medicine	56 years	<ul style="list-style-type: none"> <li>• MD, PhD, Professor in higher education (medical education)</li> <li>• Specialization: Cardiology, Tropical Medicine, Medical Clinic and Medical Education</li> <li>• Fields of teaching and research: semiology; medical clinic; cardiology and tropical medicine</li> <li>• Part of the professional team of local public health system</li> </ul>	Yes	No	No	Yes
3	Music Therapy	20 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education (Music Education)</li> <li>• Fields of teaching and research: music therapy; creativity, cognitive processes and interdisciplinarity</li> </ul>	Yes	No	Yes	Yes
4	Nursing	28 years	<ul style="list-style-type: none"> <li>• BN, PhD, Professor in higher education (Nursing Education)</li> <li>• Fields of teaching and research: semiology; theoretical foundation and technology development on knowledge production in health care and nursing; comprehensive care in health and nursing; Nurse-patient communication</li> <li>• Part of the professional team of local public health system</li> </ul>	Yes	No	No	Yes
5	Nursing	8 years	<ul style="list-style-type: none"> <li>• BN, MSc, public health worker, focused in nursing surveillance; communication and information in health; nursing informatics; systematization of nursing care; patient safety health.</li> <li>• Fields of teaching and research: analysis of epidemiological data</li> </ul>	Yes	Yes	Yes	No
6	Nutrition	10 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Fields of teaching and research: Nutrition in Public Health with emphasis on Maternal and Child Nutrition.</li> </ul>	Yes	Yes	Yes	Yes
7	Occupational Therapy	28 years	<ul style="list-style-type: none"> <li>• OT, PhD, Professor in higher education</li> <li>• Fields of teaching and research: children's playful behaviour; occupational performance of children with cerebral palsy</li> </ul>	No	Yes	Yes	Yes

8	Pharmacy	24 ears	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Fields of teaching and research: right to health; pharmaceutical care; pharmaceutical services</li> </ul>	Yes	Yes	Yes	No
9	Physical Education	9 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Fields of teaching and research: pedagogical and socio-cultural aspects of physical education in health; sociology of the professions and the role of physical education in public health</li> </ul>	Yes	Yes	Yes	Yes
10	Physiotherapy	16 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Clinical practice in Physiotherapy</li> <li>• Fields of teaching and research: quality of life of patients with spinal cord injuries; theories, methods and process of care in health</li> </ul>	Yes	No	No	Yes
11	Psychology	25 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Fields of teaching and research: mental health and prevention in psychology; clinical and cultural psychology; health information technology</li> </ul>	Yes	Yes	Yes	No
12	Psychology	27 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Fields of teaching and research: school and educational psychology; training in social-psychomotricity</li> </ul>	No	No	Yes	Yes
13	Speech Therapy	18 years	<ul style="list-style-type: none"> <li>• PhD, Professor in higher education</li> <li>• Fields of teaching and research: clinical and occupational audiology; newborn hearing screening; deafness and epidemiology</li> </ul>	Yes	No	No	Yes

Source: The authors.

<sup>a</sup> The number of preliminary meetings varied from one profession to the others, according to their time availability and extension of the subject discussion.

### 3.2. Delphi consensus

The Delphi consensus was performed by the same panel of experts that conducted the preliminary phase of the study, plus two new members of psychology and occupational therapy fields.

Based on the preliminary model, each expert panel member received a link to an evaluation questionnaire by email (Google® Forms). The professionals had, in each round, a week-interval to answer questionnaire. During this period, two reminders were sent to non-respondents using Google Calendar tool and email.

The questionnaire was structured as four questions that aimed to evaluate aspects of completeness and relevance of the information contained in the pillars and to allow experts to suggest additions or modifications to that information. The response options for each of the first three questions were presented as a Likert scale (strongly agree, slightly disagree, moderately disagree, strongly disagree and totally disagree). In the disagree options, the expert had the opportunity to explain his/her choice. The fourth question was included to assess whether each pillar of the obtained model could be adapted to focus on the family as the unit of care, as the Family Health Strategy has been considered as a treatment model for primary care in the Brazilian UHS [20]. This evaluation format allowed the experts, individually and without the panel's influence, to analyse the model and suggest modifications or agree with information contained therein, preserving anonymity [21,22].

The suggested changes were included in the model by the researchers, and a new round of evaluation was performed. Each round was based upon the previous round's responses [23]. The criterion used to keep, add or remove experts' suggestions for each pillar in different rounds was a simple majority ( $\geq 50\%$ ) [24].

This process was repeated as many times as necessary to achieve the desired and recommended consensus level [25], which was established as  $>50\%$ . The version thus obtained was considered the consensus model to be proposed so that in the future a broader validation could be performed within the public health service units of a Brazilian state.

Three rounds were needed to reach the desirable consensus (Table 1). After the completion of each round, feedback on the number of responses and suggestions received was provided to the experts. Each subsequent round contained the image of the updated health information records model, using the mind map concept [26]. Items included and accepted by most experts were highlighted in green, while those in red represented the new suggestions to be analysed by the experts regarding inclusion and/or appropriateness in its particular pillar or subsection.

### 3.3. Ethical aspects

The research project was reviewed and approved by the Research Ethics Committee of the Federal University of Goiás under protocol number 118/2012. All experts participating in the study signed informed consent forms.

## 4. Results and discussion

The main contribution of this study was the definition of a dataset considered essential for health information records—a consensus model, identified by professionals from different fields, who make up the teams working in primary health care.

The definition of health information records that most closely reflect the needs of primary care is important because this model is considered one of the first steps towards electronic representation of such information in an interoperable electronic health record (EHR) system [7,27–29]. In addition, the definition of this model means an information architecture that meets the expecta-

tions of the target audience. The model was drawn up by experts involved in the process of identifying information [30] and using such information—not just by a team of computer professionals based on other models and/or built in the context of other problems [17,31].

The panel with thirteen experts participated in all steps of the research defining the consensus model. They had multidisciplinary training and worked in teaching, research and/or clinical practice at different levels of health care (Table 1). The age of participants ranged from thirty to seventy-eight years old and their years of practice from eight to fifty-six years. Of the 14 health professions regulated by the Brazilian National Board of Health [32], only four were not represented (Social Assistance, Biology, Biomedicine and Veterinary Medicine). Nursing and Psychology had two representatives each. Table 1 describes the panel experts' profile and their contribution with the steps of the research.

Nine group meetings (expert panel) were held, totalling more than eighteen hours. Several individual meetings were carried out with professionals that had no availability to participate in some group meetings, totalling, approximately sixteen hours.

The presence of a multidisciplinary team, with representatives of all recognised health areas, is a precondition for the effectiveness of primary care as an UHS gateway. However, this still is not the reality in Brazil, where primary care still faces many obstacles in playing its role of system organiser and health care coordinator [20].

Therefore, when defining an EHR system, it must be structured according to an ideal model of primary care, considering comprehensive health, as it can be an important tool for one of UHS's greatest challenges—to integrate primary care with other more complex levels of health care, ensuring integrity and providing appropriate responses to the needs of UHS users [20]. In this context, the model presented here is a differential one, as it contains information identified as essential by a consensus of representatives of most health professions.

Although studies emphasize the importance of the health information be individually collected [15], it is important to note that depending on the context that this individual is being assisted, this information collection should be expanded. In the context of Brazilian UHS, a developing continental country, where the primary attention was not being effective, many deficiencies in education, access to basic sanitation services and health care for the majority of population, a new perspective of informational model needs to be thought to improve primary care. The investigation of individual problems should be expanded to his surroundings – family and community.

So, the family health strategy was implemented in Brazilian UHS in the 90s, being the base of primary care, to reorient the health care model, aiming that the organization of the communities could better exercise social control over the actions in health and services, articulating strategic sectors. Considering that, it is important to highlight an ongoing research, as a second step of this study, which aims to expand the consensual model here presented to include family and community information. Also, to validate the consensual model by other health professionals that work in the public primary care service. We considered that an important step to eliminate any consensus bias of the consensual model, since most professionals who developed the preliminary version, also held the consensual one.

### 4.1. Delphi consensus

The desired consensus was reached in the third round for the vast majority of questions in each pillar (Table 2).

In the first round, seven experts answered the questionnaire, for a response rate of 53% (7/13), while in the second, eight responses

**Table 2**  
Level of consensus by pillar of the model, obtained in each round of the Delphi method.

Pillar	Round	Question 1 (Complete?)	Question 2 (Relevant?)	Question 3 (Add/Modify item?)	Question 4 (Family as care unit)
Data Collection	1	57%	43%	43%	42%
	2	63%	63%	63%	57%
	3	80%	80%	87%	77%
Diagnosis	1	43%	57%	14%	57%
	2	38%	63%	38%	71%
	3	80%	60%	90%	55%
Treatment Approach (this pillar's name was changed to Care Plan in the consensus model)	1	43%	57%	29%	57%
	2	63%	25%	38%	57%
	3	90%	80%	70%	77%
Evaluation	1	71%	71%	71%	71%
	2	88%	88%	63%	57%
	3	90%	90%	90%	88%

Source: The authors.

were obtained (61%; 8/13), and in the third, ten (76%; 10/13). This percentage of respondents ( $\geq 50\%$  of the number of participating experts) was considered adequate [25].

The consensus nearest to 100% in the four questions was obtained in the Evaluation pillar. The lowest level of consensus occurred in the Diagnosis pillar, regarding the relevance of the information in that pillar (question 2) and changes to the pillar's information to consider the family as the care unit instead of the individual (question 4). However, a consensus above 50% was obtained in all the pillars at the end of the third round of consultation with the experts (Table 2).

The answers to the questions investigating the appropriateness of each pillar to having the family as the care unit revealed in all rounds that “the obtained model should not only be adjusted, it would have to be reconsidered in full. . . . Some experts noted that: ‘The whole set should be reconsidered in a connected way’, ‘in this case, the whole model should focus on family/household and not on the individual. . . .’ ‘it is another epistemology, another information architecture. It is not just adding something else, it is doing things differently. Therefore, the suggestions obtained were not included because the whole-model structure (pillars and sub-items) would have to be rethought comprehensively from the perspective of the individual, family and community (territory) rather than the individual alone [20,33].

The Delphi method is a tool for obtaining, comparing and directing a judgement and for promoting the convergence of views. However, even when using this kind of tool, it is not always possible to achieve 100% consensus, especially when dealing with a theme with a broad and complex scope, such as health information records in primary care [24]. The use of an online tool (Google Forms) when applying the Delphi method provided some advantages, in particular the optimisation of the participation of experts residing in other Brazilian cities and states, as well as agility in data analysis, as it automatically compiled the data [34]. The development of the Delphi method in the context of action research, which is a collective methodology, encouraged discussion and cooperative production of specific knowledge about lived reality, based on the perspective of a continued, systematic, empirically based attempt to improve [35,36].

#### 4.2. Health information records consensus model

The dataset that formed the consensus model was represented by the mind map, illustrated in Fig. 1. The content highlighted in green corresponds to changes to the preliminary model, generated by means of the Delphi consensus, which resulted in the consensus model. To make easier interpretation of this map, information

located on the first level of detail of each pillar will be termed “item”, and those located at lower detail levels as “sub-item”. The main changes and/or exclusions of information from different pillars are presented in Table 3. The full version of the consensus model is available at [goo.gl/mp2015](http://goo.gl/mp2015).

In the first pillar, “Data Collection”, nine items were included regard demographic, anamnestic and specific clinical evaluation informations from the different health professions. The second pillar, “Diagnosis”, included four items comprising clinical hypotheses, complementary examinations and their results, as well as partial or final diagnoses of health. The items in the third pillar, “Care Plan” were divided according to three groups of procedures: invasive, non-invasive, complementary and integrative practices. The fourth and last pillar, “Evaluation”, was destined to the follow up or health history evaluation, under the perspective of the health professional and the one from the user (Fig. 1).

This information model is consistent with the methodology proposed by openEHR, one of the most reputable standards, at present, for the design of an interoperable electronic health record. OpenEHR dual model approach provides a separation between structure and semantic concerns, in which semantic should be developed by professionals from the clinical domain. In this way, there is an increased chance to provide high quality information or concepts (archetypes) to be translated later into computer language, by computer professionals [43].

The differential of this information model is that, it has been produced by professionals from clinical domain, increasing the chance to achieve effectiveness of two steps on building an EHR with high level of interoperability: archetype building and terminology and classification standards mapping (i.e. Systematized Nomenclature of Medicine–Clinical Terms–SNOMED-CT; International Classification of Diseases–ICD) [16]. These steps should also be under the responsibility of health professionals.

In many situations, computer professionals have appropriated of the health problem scope and taking the responsibility not only for the technical aspects, but also to build archetypes, which may compromise the results in attending the needs of health care services.

The main contributions of this consensus model are in the context of the following perspectives:

- Health management: to provide support for the identification of requirements for building an electronic health records information architecture (what data need to be registered?);
- Health professional: identification of several key concepts necessary for the development of archetypes, i.e., the next step for

**Table 3**

Changes and exclusions of information in the preliminary model of health information record in primary care, performed by experts to establish the consensus model.

Pillar of the model	Changes/exclusions
<b>Data Collection</b>	<p>In the item “health institution providing treatment, the nomenclature of health facilities was standardised to that used by the Brazilian Ministry of Health – Basic Health Unit, as a great variety of terms and acronyms were adopted for the different structural complexities of health care units [37].</p> <p>In the item “General health evaluation”:</p> <ul style="list-style-type: none"> <li>• The sub-item “Disability/Special Needs Carrier” was replaced by “Disability/Person with Special Needs”, and the subdivisions of this were inserted in accordance with the Brazilian Institute of Geography and Statistics, which classifies disability as visual, auditory, motor or mental (or intellectual) [38].</li> <li>• In the sub-items “Alcoholic drinks” and “Illicit drug use”, “Frequency” was modified to meet the standards of alcohol consumption adopted by the Brazilian Ministry of Justice, including the classifications: “Use, abuse and dependence” [39].</li> <li>• In the sub-item “Socioeconomic and Cultural Aspects”, in the evaluation of “Housing conditions – basic sanitation”, electricity was excluded because it is not included in the definition of basic sanitation [40].</li> <li>• In the item “Specific evaluation” the main change occurred in the sub-item “Anthropometric Evaluation”, in which four new pieces of information were added (Body Mass Index – BMI, BMI classification, waist circumference and waist circumference classification), as weight and height do not include essential information for meeting the demands of the represented health professions, particularly Nutrition, Physical Education and Nursing. The term “abdominal circumference” was replaced by “waist circumference”.</li> </ul>
<b>Diagnosis</b>	<p>In the item “Exams”, four pieces of information were included in sub-item “Tools/evaluation protocols” to include the needs of other professions (nutritional, pharmaceutical, behavioural/effective and profession specific).</p> <p>In the item “Diagnostics” two sub-items were included (specific and interdisciplinary) to consider the specifics of all professions, as well as the relationship between them. In addition, the International Classification of Functioning (ICF) [41] was suggested by the experts because according to them, “the ICF would be like a paradigm, as a way to make the diagnosis usable for any profession, taking into consideration the changed structures and functions and limited activities and participation”.</p>
<b>Care Plan</b>	<p>The name of this pillar, previously called “Treatment Approach” in the preliminary model was modified to “Care Plan”. The rationale for this change was the fact that in primary care the approach established by health professionals is not always treatment. “Care Plans”, on the other hand, reflects a broader concept of health and is more rooted in the context of quality of life.</p> <p>In the item “non-invasive procedures, the sub-items ‘treatment groups’ and “Laser therapy” were removed from the item “complementary and comprehensive practices” because they are not comprehensive/complementary and are not officially recognised practices according to the Brazilian Ministry of Health, respectively [42] and thus were transferred to the non-invasive procedures group.</p>
<b>Evaluation</b>	<p>Two new items were created, “Professional evaluation” and “User evaluation”. The former included the sub-items “Procedural evaluation” and “Final evaluation” of the individual who sought for care. The latter, “User evaluation”, was included to represent the evaluation of the care received by the individual who sought it.</p> <p>In the preliminary model, this pillar was subdivided only into Procedural evaluation and Final evaluation, so the evaluation made by the user was not considered.</p> <p>In the sub-item “Final evaluation” the information “In follow-up/monitoring” was included to contemplate continuity of care or simply longitudinality. This is one of the essential attributes of primary care [20], which includes the monitoring of the individual over time and by all health professionals at this level of complexity [6]. In this way, the individual would not be discharged from primary care, targeting continuity of the bond, since sickness in this following up is considered an event.</p>

Source: The authors.

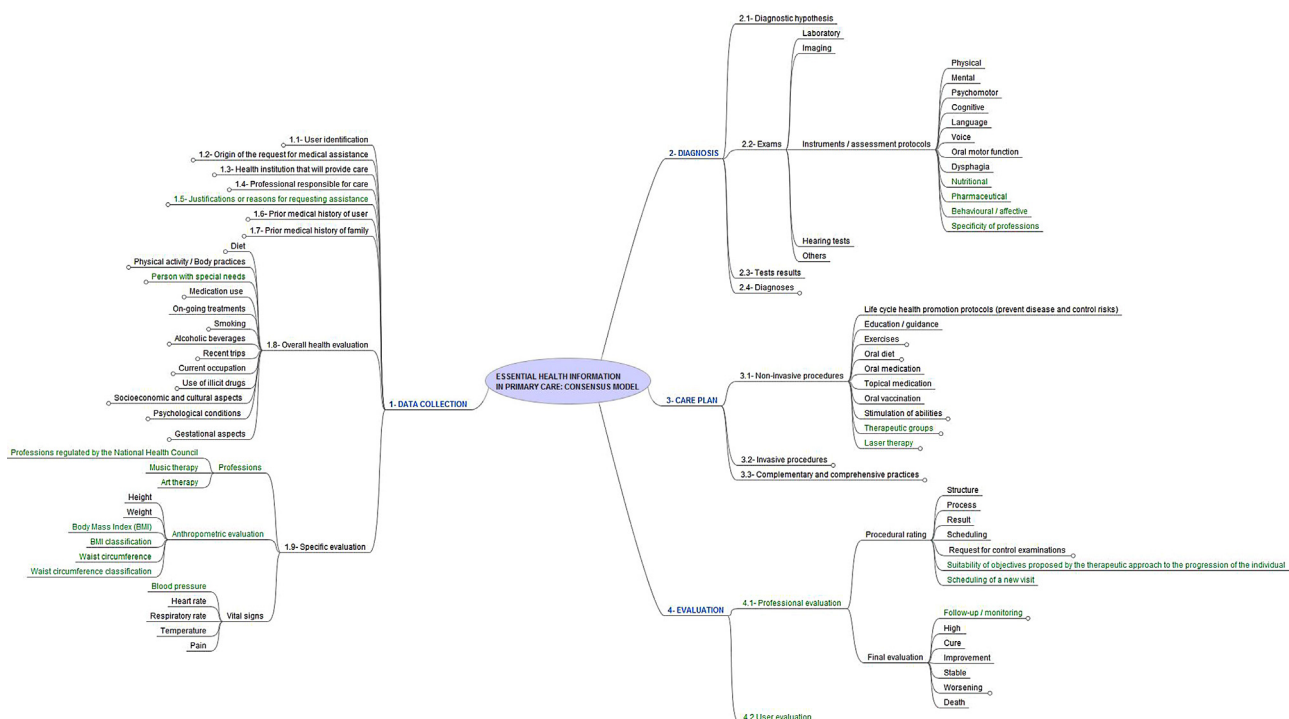


Fig. 1. Consensus model of health information record in primary care, focusing on individuals (mind map).

the construction of semantically interoperable electronic health records;

- IT Professional: identification of the requirements for the development of the electronic health records product (business modelling);
- For e-Health: establishment of a proposal for an electronic health records information architecture where conceptual and contextual modelling were performed. A future step is to ensure the identification of essential information at a sufficient level of detail for primary care, noting institutional specifics;
- Improving health care quality: advancement of the reduction of deficiency in communication between health professionals, which has a direct impact on the quality of care provided.

## 5. Conclusion

Interaction between all the health professions who comprised the panel of experts was essential to validate the model's content and to generate individual reflection. This is fundamental to the translation of knowledge into clinical practice in a broader context of health rather than in an individual and fragmented way. The consensus model included more than 300 concepts across all pillars, in the context of multidisciplinary health care at a level of complexity in which the majority of health complaints are resolved.

If there was no participation of nursing, psychology and pharmacy, for example, the medical concept of "chief complaint" in the Data Collection pillar would not have been rethought. The individual can seek the primary care looking for guidance on how to take a medication or to participate in therapeutic groups (pregnant; hypertensive or health promotion actions). The participation of physiotherapy, physical education, occupational therapy and speech therapy professionals was fundamental to design the third pillar as "Care Plan" and not as "Therapeutic Approach" which resulted in the inclusion of procedures and activities to physical and mental stimulation as well as language abilities. Another important attended demand was nursing, physical education and nutrition, with the inclusion of other items on anthropometric eval-

uation, other than weight and height. These are few examples of the importance of this multiprofessional interaction.

The consensus model generated was centred on the individual and can form the basis of a model for a family health strategy. We believe this is a first step in identifying the concepts or data that will be required to meet the needs of health professionals in future electronic primary health care records.

Among some limitations to be pointed in this study, three of them are highlighted: the lack of the same level of detail of the information from each item comprising in the four pillars of the model; the lack of family and community information that the individual belongs; the need of model validation in the daily practices of health care units". These limitations are already the target of a new study in progress to improve the presented model.

As future research, detailing model information items and mapping with terminologies and classifications recognised internationally are recommended. Also, the validation of the model as well as evaluation consensus in another countries would be important.

As this investigation is one of the first and few that aimed identifying at the source (the individual), the essential health information to be collected to primary care in health, rather than only those needed to health managing or of interest of an specific specialty, we believe that the results presented here can be widely exploited by those who develop initiatives towards interoperable and longitudinal EHR.

## Author contributions

Renata Dutra Braga

- Study conception and design.
- Acquisition of data.
- Analysis and interpretation of data.
- Drafting of manuscript.



## Panel of Specialists in Health

- Analysis and interpretation of data.
- Participation in achieving model consensus by Delphi method.

### Fábio Nogueira de Lucena

- Study conception and design.
- Analysis and interpretation of data.
- Drafting of manuscript.
- Critical revision.

### Rejane Faria Ribeiro-Rotta

- Study conception and design.
- Analysis and interpretation of data.
- Drafting of manuscript.
- Critical revision.

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## Appendix A.

The members of the Panel of Specialists in Health (and their affiliations) are as follows:

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## Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.ijmedinf.2016.03.004>.

## Summary points

What is already known on this topic:

- It is known that, inevitably, each individual's health information is collected in various care settings and stored in heterogeneous repositories. Integrating this broad set of information is a challenge;
- Longitudinal electronic health records can improve the quality and safety of individual care, providing knowledge required to improve health service efficiency;
- Most health information systems are not designed based on a broad and integrated mapping of processes, being limited to analysis focused on isolated and specific problems;
- Brazil's Unified Health System (UHS) has no standardisation of health information yet, which leads to great variability in the format of documents and information and has a negative effect on health care as a whole.
- There is a wealth of work already done around EHR information architecture. However, the level of their detailing is very specific to each health profession, or even only include the data required for the generation of health indicators (health managing).

What this study adds:

The main contributions of this consensus model are in the context of the following perspectives:

- Health management: to provide support for the identification of requirements for building an electronic health records information architecture based on a multiprofessional integrated mapping of processes (what data need to be registered?);
- Health professional: identification of several key concepts necessary for the development of archetypes, i.e., the next step for the construction of semantically interoperable electronic health records;
- IT professional: identification of the requirements for the development of the electronic health records product (business modelling);
- For e-Health: establishment of a proposal for an electronic health records information architecture where conceptual and contextual modelling were performed. A future step is to ensure the identification of essential information at a sufficient level of detail for primary care, noting institutional specifics;
- Improving health care quality: advancement of the reduction of deficiency in communication between health professionals, which has a direct impact on the quality of care provided.

As this investigation is one of the first and few that aimed identifying at the source (the individual), the essential health information to be collected to primary care in health, we believe that the results presented here can be widely exploited by those who develop initiatives towards interoperable and longitudinal EHR.

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