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Determination of Minimum Data Set (MSD) in Echocardiography Reporting System to Exchange with Iran's Electronic Health Record (EHR) System

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ABSTRACT

Background: Determination of minimum data set (MDS) in echocardiography reports is necessary for documentation and putting information in a standard way, and leads to the enhancement of electrocardiographic studies through having access to precise and perfect reports and also to the development of a standard database for electrocardiographic reports. **Aim:** to determine the minimum data set of echocardiography reporting system to exchange with Iran's electronic health record (EHR) system. **Methods:** First, a list of minimum data set was prepared after reviewing texts and studying cardiac patients' records. Then, to determine the content validity of the prepared MDS, the expert views of 10 cardiologists and 10 health information management (HIM) specialists were obtained; to estimate the reliability of the set, test-retest method was employed. Finally, the data were analyzed using SPSS software. **Results:** The highest degree of consensus was found for the following MDSs: patient's name and family name (5), accepting doctor's name and family name, familial death records due to cardiac disorders, the image identification code, mitral valve, aortic valve, tricuspid valve, pulmonary valve, left ventricle, hole, atrium valve, Doppler examination of ventricular and atrial movement models and diagnoses with an average of. **Conclusions:** To prepare a model of echocardiography reporting system to exchange with EHR system, creation a standard data set is the vital point. Therefore, based on the research findings, the minimum reporting system data to exchange with Iran's electronic health record system include information on entity, management, medical record, carried-out acts, and the main content of the echocardiography report, which the planners of reporting system should consider.
Key words: Minimum Data Set (MDS), Data Elements, Echocardiography Report, Electronic Health Record System, Reporting System.

1. INTRODUCTION

Electronic health systems (EHS), as a system to make data available, can help enhance accessibility to patient's information (1). Electronic health record (EHR) is the most important instrument to provide high-quality health care through sharing health information (2). International research indicates that electronic health advantages increase when EHR information is accessible and can be used by all those involved in the patient's care (3). In recent years, the term electronic health record (EHR) is widely used. In this record, patients play an active role in their treatment (4).

The EHR system indicates a set of software performed in a suitable platform and making EHR realization possible. The aim of this system is the integration of this structure. The electronic health records system (SEPAAS) plan in Iran makes that goal possible as well (5). SEPAAS, as the country's greatest health information technology (HIT) project, must have considered all dimensions of hardware, software, communications system infrastructure, standards, rules and regulations, training, culture-building, basic, developmental and applied research, and development of bioinformatics and medical informatics centers (6).

One of the problems leading to EHR definition in Iran is the lack of integrated health information. In different fields (hygiene, treatment, insurance) of the existing health system, either health information does not exist in a focused way or , if it does, it exists in a scattered and non-focused, and probably different, way in various departments (7). Since the aim of establishing the EHR

system in Iran is to integrate the structure of local information systems, due to the scatteredness of these softwares, it is not possible to analyze these bits of information and exchange them with electronic health records system (SEPAAS) (8). The ability to interact in healthcare systems can be divided into the two dimensions of performance interaction ability and meaning interaction ability. Meaning interaction ability becomes possible through standardization of data together with the creation of certain protocols and exchange standards (9). Determination and application of standard data set, as has proven in minimum data set study of nursing, can facilitate the use of these scattered information systems. Defining the minimum data set in clinical domains, where the needed information and care processes are not completely transparent, can improve and support clinical care (10).

One of the essential wards in hospitals is the cardiovascular ward. In an optimal attitude, cardiovascular information system should be integrated into larger information systems (11). Cardiovascular wards are faced with an increasing pressure to improve the patient's health and his condition (12). For these wards, different reporting and information systems have been designed, among which one can refer to echocardiography results system (11). These systems benefit from a database to facilitate care; therefore, they should enjoy a flexible and suitable data architecture so that obtaining, manipulation, and production of echocardiography and cardiology reports becomes possible (13). That is why, an echocardiography report should have a systematic approach with a logical structure on data and terminology; making use of such an approach is quite necessary for doctors and specialists to avoid confusion. Digital structured report is considered a superior technology for giving reports in the domain of echocardiography reporting, which results in customers' satisfaction and enhancement of care efficiency (14). Structured reports are obtained from defined and structured databases (15). Therefore, the definition of changing minimum data set (MDS) is considered a little necessary for storage, and publication and exchange of structured echocardiography reports among laboratory systems (16). Echocardiogram reporting is one of the subsystems of cardiovascular information systems, and due to the requirements of launching and benefiting from SEPAAS exchange standards, databases and exchange messages between these sections and subsections should be standardized with defined data which are obtained through studies, so that the ability of interaction and integration among systems and departments become available. So, the present research aims to determine the minimum data set of echocardiography reporting system for the country's electronic health record (EHR) system, and present it to those responsible for it.

2. METHODS

This is a cross-sectional descriptive study conducted in 2013/2014. To determine the data elements of echocardiography reporting system, first a review of studies was done and then the views of 20 specialists were asked. In this study, purposive random sampling method was applied. Ten HIM experts and 10 cardiologists were selected. These cardiologists had at least three years of work experience in echocardiography centers of Shahid Rajaie Cardiovascular, Medical and Research Center (4 people) and Tehran Heart Center (6

people), among the most equipped cardiac centers of diagnosis and treatment in the region.

The ten faculty members with assistant and associate degrees were also active in medical records, or health information management, departments. To collect data, a researcher-made questionnaire was used in this study. The questionnaire - including all information elements introduced in this set of data - was constructed after searching different published sets of data and considering the related articles on the elements of echocardiography reporting system data and related researches in the field of information exchange with electronic health record and data elements existing in this field. The questionnaire includes such parts as patient's identity (demographic information), medical records data, administrative data, echocardiography report data, and performed measures, with a 5-level Likert scale: the most important element was given a 5 and the least important got a 1. Prior to the completion of the questionnaire by the cardiologists, the researcher briefly described for them the importance of structured reports as an important part of electronic health record. In the prepared questionnaire, the questions related to patient's demographic information and administrative data were answered by health information management (HIM) experts and those about medical records data, echocardiography report, and performed measures were replied by the hospitals' cardiologists.

The completed questionnaires were analyzed using IBM SPSS Statistics software (version 21) and descriptive statistics techniques. In this questionnaire, items with a less-than-the-mean importance were omitted; those with an importance above the mean and up to 3 were sent for repeated survey; and the ones with an average above 3 were accepted in the pattern. To measure the validity of the questionnaire, content validity method was used and the questionnaires were given to 4 cardiologists and HIM experts. To estimate reliability, test-retest method was applied; in this way, 7 people were chosen from a peer group outside the research population and were asked to fill out the questionnaire. Such a task was done twice with a 10-day time interval; finally, the correlation coefficient turned out to be 87 percent; therefore, the reliability of the questionnaire was confirmed. After determining the data elements of echocardiography reporting system, the second questionnaire was designed to determine the minimum data set of echocardiography reporting system and was given to experts. At this stage, the research sample and population together with the methods of validity computation and reliability estimation of the questionnaire were similar to those of the first stage: again, to measure the validity of the questionnaire, content validity method was used and the questionnaires were given to 4 cardiologists and HIM experts. To estimate reliability, test-retest method was applied; in this way, 7 people were chosen from a peer group outside the research population and were asked to fill out the questionnaire. Such a task was done twice with a 10-day time interval; finally, the correlation coefficient turned out to be 86 percent; therefore, the reliability of the questionnaire was confirmed. The completed questionnaires were analyzed using IBM SPSS Statistics software (version 21) and descriptive statistics techniques. In this questionnaire, like the previous stage, cases with a less-than-the-mean importance were

omitted; those with an importance above the mean and up to 3 were sent for repeated survey; and the ones with an average above 3 were accepted in the pattern and were considered as the minimum data set of electrocardiography reporting system to exchange with electronic health record system.

3. RESULTS

Frequency distribution and percentage of demographic features of the research sample are presented in Table 1. Based on Table 1, of all sample members, 4 were male (20%) and 16 were female (80%). Only two sample members (10%) were in age group of 31-40 and 15 (75%) in age group of 41-50; the others were in 51-60 age group.

Proposed minimum data set of echocardiography reporting system for Iran by specialists are presented in Table 2.

In the proposed minimum data set in Table 2, in the part on patient's identity, the highest mean was related to first and last names (5) and the lowest pertained insurance payers (3. 1); in the part on management data, the highest mean concerned the accepting doctor's (Specialist's) first and last names (4. 9) and the lowest was related to the referral physician's specialty (3); in the part on medical records, the highest mean pertained familial history of death due to cardiac malfunctions (4. 7) and the lowest concerned the patient's history of chemotherapy with cardiotoxic elements and his/her diabetes history (3. 2); in the part on performed measures, the highest mean concerned radiogram ph identification code (4. 9) and the lowest was related to measure performing technique (3. 6); and in the part on echocardiography report content, the highest means pertained Mitral valve, aortic valve, tricuspid valve, pulmonary valve, left ventricle, hole, atrial valves, Doppler examination of ventricular and atrial movement models, and diagnoses (5) and the lowest was related to ductus venosus (3. 2).

4. DISCUSSION

Based on the findings of the study from the users' viewpoint, the most important set of data elements and echocardiography reporting system's minimum data set to exchange with Iran's electronic health record (EHR) system consist of five sets of data on patient's Identity, management, medical records, performed measures and main echocardiography report data/content, which should be considered in designing the echocardiography reporting system.

The country's EHR system aims to create a single, coherent, integrated, and complete source of patients' healthcare data;

Research Sample		Cardiologists		HIM Experts		Total	
Demographic Features		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Sex	Male	2	10	2	10	4	20
	Female	8	40	8	40	16	80
Age Group	31-40	2	10	0	0	2	10
	41-50	8	40	7	35	15	75
	51-60	1	5	2	10	3	15

Table 1. Frequency distribution and percentage of demographic features of the research sample.

Category	Subcategory
Demographic Information	Sex, birthdate, care period, insurance payers, type of rendering care facilities, first and last names, father's name, post-referral condition, height, weight, national ID number, The patient's home phone number, patient 's cell phone number.
Administrative data	Name of institute, institute code, referring physician's first and last names, his/her code (Medical Council No.), his/her specialty, accepting doctor's (specialist's) first and last names, service renderer's/giver's (specialist's) name, service giver's code, admission date, time of admission, date of giving service, time of giving service, informed consent
Medical records data	Patient's smoking background, alcohol intake, his/her diabetes history and treatment plans, blood pressure, history of breast radiography, history of chemotherapy with cardiotoxic materials, familial history of death due to cardiac malfunctions
Performed measures	Date of performed measures, time of performed measures, name of the measure, radiography measure code based on CPT, measure performing technique, radiographic image identification code , patient's confirmation and the measures related to him/her.
Echocardiography report content	Mitral valve, aortic valve, tricuspid valve, pulmonary valve, left ventricle, pressure volume analysis, left and right atriums, Left ventricular posterior wall, pericardium, pressure gradient, shunt and flow, hole, walls, chamber, inferior vena cava, pulmonary vessels, ductus venosus, foramen ovale, atrial valves, arch valves, transverse aortic arch, atrial valve diameter, semilunar valve diameter, main pulmonary artery, ascending aorta, descending aorta, pulmonary artery branch, dimensions of ventricular short axis, , dimensions of ventricular short axis, atrial and ventricular wall movements, Doppler examination of ventricular and atrial movement models, diagnoses, remedial suggestions, signature and confirmation

Table 2. Proposed minimum data set of echocardiography reporting system for Iran.

therefore, in line with the integration of information system software to exchange with EHR system, the guide related to the exchange of data related to myocardial infarction and death in Tir and Mordad, 1390 (around mid-June to mid-July, 2011) and the guide related to the exchange of data pertaining influenza in Esfand 1389 (around mid-March, 2011) have so far been registered, and the guide related to the exchange of laboratory test results is being reviewed and completed. Based on these guides, certain services are provided, which make possible the exchange of information of these parts with SEPAAS. The guide related to influenza and myocardial infarction includes clinical, administrative and identity data elements, guide related to death consists of the deceased person's identity data elements and the legal registration of death, and guide related to laboratory test results comprises administrative, insurance, and identity data and the results of these tests (17). Considering the performed poll and based on different texts studied in line with the exchange of echocardiography report data with EHR system, structured echocardiography reports should at least have patient's identity data elements, administrative data elements, performed measures, medical record, patient's clinical data and the main content of echocardiography report.

In a research study conducted by American College of Cardiology Foundation and American Heart Association, key

data elements for patient management, results assessment, and doing research were provided. The essential data elements proposed in this study include demographic, administrative and diagnostic data, history and physical examinations, laboratory results, diagnostic and therapeutic procedures, pharmacological therapy and its results. This study matches with present research in that it includes demographic, administrative and diagnostic data, history and physical examinations, laboratory results, diagnostic and therapeutic procedures, pharmacological therapy and its results. In American College of Cardiology Foundation, of course, pharmacological therapy is considered an essential part, which is not considered a necessity in the present study. Also, in this study, in the part on patient's medical records elements, such things as smoking history, alcohol consumption history/background, diabetes history, blood pressure, death records in the family due to cardiac disorders are important; these elements are also necessary in the present study (18).

In a study conducted by the training committee of British Society of Echocardiography, a framework for performing echocardiography through adults' chests was presented. In this study, all key elements used in all standard studies related to adults' chests were discussed. The proposed data elements of this study were presented in three parts of demographic and identity information, echocardiography study (diagnostic and descriptive comments), and computations and measurements. The results of this study do not conform to some extent with the findings of the present study: height and weight in the part of demographic elements and radiographic image identification code in the part of performed measures were essential in the present study, but were mentioned as optional elements in this study. Besides, this study does not include the subsets of managerial data elements and patient's medical records, and in this respect, it does not conform with the present research (19).

In the present study, managerial elements include name of institute, institute code, referring physician's first and last names, his/her code (Medical Council' code), his/her specialty, accepting doctor's (specialist's) first and last names, service renderer's/giver's (specialist's) name, service giver's code, admission date, time of admission, date of giving service, time of giving service, and informed consent. In the guide related to the exchange of laboratory results data with EHR system, Seidi has shown administrative data in four classes of acceptance data, institute's data, service renderer's data, and data related to hospital ward; these items were of importance in the present research and were put into the part on managerial data set. In demographic data part, however Seidi has considered mother's name, marital status, and employment as main elements while such things did not have a priority in the present research (17).

5. CONCLUSION

Considering the findings of the present study and since there is no standard in Iran as to what data elements should be stored in electronic health record (EHR) in echocardiography report and due to the importance of echocardiography data in recognizing the status of patients' hearts, it is necessary to create the minimum data set of echocardiography reporting system for/specific to Iran. In this study, by identifying the

data needs of echocardiography reporting system's users, a standard data set is presented for the exchange of this system with Iran's EHR system. This minimum data set has 5 parts of patient's demographic data, administrative data, medical records, performed measures, and echocardiography report content, which should be considered when developing the echocardiography reporting system. To determine the minimum data set of Iranian echocardiography reporting system, it is suggested that cardiologists and health information management (HIM) specialists - who have a say in cardiology and information management both technically and legally - be in charge of/responsible for preparing the data elements of echocardiography reporting system's minimum data set. It is to be mentioned that insufficient time to collect research data completely and cardiologists' lack of cooperation were among the limitations of the present research study.

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