EXAMINING MEDICAL RECORD QUALIFICATION CONTROL TOOLS: A REVIEW

Azam Shahbodaghi[1], Farkhondeh Asadi[1], Azamossadat Hosseini[1], Hamid Moghaddasi[1*]

Department of Health Information Technology and Management, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

*Corresponding Author: Hamid Moghaddasi.
Associate professor of Health Information Management & Medical Informatics, Department of Health Information Technology and Management, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences. Darband St., Qods Sq., Tehran, Iran.
Email: moghaddasi@sbmu.ac.ir ,hamidmoghaddasi1969@gmail.com

Abstract
It is essential to control the qualification of medical records given to extensive applications of its data. So far, some researchers have designed different instruments to standardize the medical record qualification control process. In the present study, some of these instruments are identified and introduced upon a review of the literature. Some texts were searched by using the names of the instruments based on the knowledge of the research team. To find more texts, researchers performed searches in different information databases. The research team reviewed the texts and selected the items that introduced an instrument for the quality and quantity control of the medical records or part of them. By reviewing the selected texts, 8 tools were identified. 3 of them for quantity control and 5 of them considered both quality control and quantity control of medical records. None of the instruments enjoyed sufficient comprehensiveness for the qualification control of all medical record data. A review of the examined instruments demonstrated the inconsistency in the use of the terminology denoting the quality attributes of healthcare data and relevant concepts. This incoherence in the expression of quality features requires attention because a common language is a pre-requisite for the development of instruments meeting the needs of medical record qualification control processes at the national/international scale.

Keywords: Medical record; Qualification control, Quantity control, Quality control, Qualification control instruments

INTRODUCTION
A medical record with high-quality data can play a pivotal role in the continuous provision of healthcare services, education, research, legislation and legal issues, public health promotion and monitoring, and supporting small- and large-scale social policy-making in the domain of healthcare. (Green & Bowie, 2011; Institute of Medicine (US) Committee on Data Standards for Patient Safety., 2003; McWay, 1997; Oppenheim, 2012; Sayles, 2013; Skurka, 2017; Wager et al., 2017) As such, it is necessary to monitor the quality of medical record data. The World Health Organization (WHO) has emphasized the quality of medical record data, not only for promoting the quality of healthcare, but also for reducing the heavy costs associated with healthcare services imposed on governments. (World Health Organization, 2006) Accordingly, the necessity of qualification control for data quality enhancement has been emphasized in the process of medical record documentation. According to Skurka, medical record qualification control ensures the completeness, accuracy, timeliness, and legibility of the records, while also evaluating the documentation patterns of doctors and other healthcare team members. (Skurka, 1998). Medical record qualification control can also provide a basis for identification of and learning from errors, thus promoting patient safety. (Mitchell, 2008; World Health Organization, 2016)

Different methods are available for medical record quality assessment, control, monitoring, and auditing. The American Health Information Management Association mentions quantity and quality control systems as well as manual and automatic self-monitoring systems. (American Health Information Management Association (AHIMA), 2014) Huffman notes quantitative, qualitative, and statistical analysis. (Huffman, 1994) Abdelhak mentions quantitative, qualitative, and legal analysis. (Abdelhak et al., 2007) Moreover, Moghaddasi notes three types of control process, namely preventive, detective, and corrective control in collecting and reporting medical record data. (Moghaddasi, 2005)

In general, due to the variety of healthcare data, as well as the diverse goals and policies of healthcare organizations when it comes to medical record data collection, there are highly diverse procedures for qualification control. Despite the availability of different standards, healthcare organizations are in charge of creating their own instruments. (Abdelhak et al., 2007) Thus, many organizations and hospitals have so far developed local checklists for qualification control of medical record data, while efforts have also been made to develop standard instruments for this purpose. In the present study, these instruments are identified and introduced upon a review of the literature.

Background
Due to the increasing benefits of standards and data standardization, many countries have taken major steps towards the development of standards and accreditation requirements(Overview of Programs and Services, 2018; The Joint Commission, 2018), as well as the creation of minimum data sets (MDS) and data dictionaries (World Health Organization, 2003). Still, as noted earlier, due to the variety of

healthcare data, the diverse goals of healthcare organizations when it comes to medical record data collection, as well as diverse data management policies, there are various procedures for qualification control. One such qualification control procedure is the examination of healthcare data based on a checklist (Moghaddasi, 2005). Checklists are organized cognitive aids which pre-determine the criteria for a specific process and guide the users with regard to the precise completion of that process (Hales et al., 2008). In fact, a major application of checklists is in process standardization (Dlugacz, 2017). Checklists are among the most common reminder and evaluation instruments, and can be employed for standardizing the assessment process (Hales et al., 2008). This instrument has also been used for medical record qualification control. Skurka and Davis introduced checklists for medical record qualification control (Moghaddasi, 2005). Long also developed a data qualification control checklist for two main data collecting parties, namely Toronto Emergency Medical Services and Toronto Base Hospital(Long et al., 2004). Moreover, Singh et al. developed a checklist for auditing medical records in a multi-specialty hospital (Madhav M Singh, Saroj Patnaik, 2017). Salem et al. conducted a basic research for auditing medical records in the nursing units of a subspecialty hospital in Riyadh, and developed a checklist based on the internal standard of the mentioned hospital (Salem et al., n.d.). Moreover, in the Joint Commission Big Book of Checklists, a checklist has been proposed for auditing medical records at the point of care ("Point-of-Care Medical Record Checklist," 2016). In addition to local checklists, some organizations and researchers have also developed instruments for standardizing the qualification control process. These instruments are introduced below.

CRABEL Score

CRABEL Score is a protocol created in 2001 by the researchers at the department of surgery, Basildon University Hospital (UK) for calculating the numerical score of the medical record documentation standard. The name of this tool is an acronym of the names of the three researchers who have developed it, i.e. Crawford, Beresford, and Lafferty. The developers state that this instrument has been developed for standardizing, facilitating, and accelerating the medical record auditing process. CRABEL score, which has been developed for evaluating the paper form of medical records, is a retrospective evaluation instrument, i.e. it evaluates the records of a discharged patient. It comprises four evaluation sections, and the total score of the sections is 50. However, to use this instrument, two notes should be randomly selected from the medical records of a discharged patient and evaluated, in which case the total score would equal 100. The first section is initial checking which receives 10 scores. In this section, one score is deducted for each missing data element. The second section, subsequent entries, has six sub-sections and a total score of 30. The sub-sections are: the name and code of the patient being written on top of each page; the date and time of each entry being recorded; an appropriate heading being recorded for each entry; the results of requested examinations, e.g. diagnostic tests, being recorded; legibility of entries as discerned by the auditor; and the signature, name, position, and contact number of the doctor being recorded. The third section deals with consents and receives 5 scores. One score is deducted for each detail missing. These details include: full title of the measure or surgery, without using abbreviations; the risks and complications of the measures explained to the patient; patient's name and admission code; and the signature of the doctor and the patient or his/her representative. The fourth section, initial discharge letter, receives 5 scores. One score is deducted for

missing patient information, which includes patient's name and address; admission and discharge dates; diagnosis and treatment plans; medications at the time of discharge; and treatment follow-up plans (Crawford et al., 2001).

E-CRABEL score

In 2017 and following the movement towards electronic documentation, the CRABEL score was revised by a number of other British researchers for use in busy surgery wards in order to evaluate medical notes. The revised instrument was adapted to electronic note evaluation and introduced as the e-CRABEL score. In this new instrument, in addition to the changes made to the four sections, electronic discharge has replaced discharge letter, and a VTE (venous thromboembolism risk) prophylaxis section has been added, while the evaluation is still based on the criterion of data elements' completeness (Myuran et al., 2017).

Token Score (Trauma & Orthopedics Note-Keeping Score)

This evaluation system was developed in 2015 by Pakistani researchers to evaluate the quality of medical notes for patients with orthopedic injuries/diseases. The instrument is based on CRABEL score, and the developers claim that it comprehensively covers all the important dimensions of data which must be included in the medical notes for patients with orthopedic injuries/diseases. This instrument comprises all the sections of the CRABEL score, in addition to an independent section called legibility. Here, legibility is in fact the dimensions of definition and clearness (Khan et al., 2015).

STAR Score (Surgical Tool for Auditing Records Score)

This instrument was developed by British researchers upon the revision of CRABEL score while emphasizing the quality assessment of surgical note clinical documentation in medical records. Since this instrument evaluates medical records in the surgery ward, in the revisions, two components of operative record and anesthetic record have been added to the CRABEL score, each comprising the relevant data elements. Similar to the CRABEL score, its scoring system is mostly based on quantitative analysis(Tuffaha et al., 2012).

22-Item PDQI Score (The 22-items Physician Documentation Quality Instrument score)

In 2008 and with the support of the National Library of Medicine, American researchers developed a reliable instrument for doctors' documentation quality assessment. Features which indicated doctors' attitude towards high-quality clinical documentation were collected from texts, evaluated by experts, and then converted into a semantic differential scale. By using this semantic differential scale, doctors and nurses scored the importance of the features for describing quality in three types of text (admission, health progress, and discharge). Exploratory factor analysis was performed to assess the construct validity and internal consistency of the instrument based on doctors' and nurses' opinions. As a result, a 22-item instrument was developed to assess the quality of admission, discharge, and health progress notes. The 22 quality features included in this tool are: clear, up to date, complete, legible, accurate, thorough, uncluttered, coherent, useful, correct, brief, current, organized, relevant, comprehensible, concise, structured, non-redundant, succinct, synthesized, focused and consistent (Stetson et al., 2008).

9-Item PDQI Score (The 9-items Physician Documentation Quality Instrument score)
In 2012, the research team revised the 22-Item PDQI and proposed a 9-item doctor documentation scoring instrument. This 9-item instrument also assesses the quality of admission, discharge, and health progress notes. Up to date, accurate, thorough, useful, organized, comprehensible, succinct, synthesized and consistent are the attributes that included in this instrument (Misra-Hebert et al., 2016; Stetson et al., 2012).

QNOTE
This instrument was developed by American researchers for the evaluation of clinical notes. It evaluates 12 clinical elements based on seven quality features. In this instrument, a three-point scale is used for scoring. The quality score of each note is a combination of the scores of quality features related to that note. A list of the elements and qualitative features is provided below.

Chief complaint (sufficient information)

History of present illness (sufficient information, concise, clear, organized)

Problem list (current, ordered, concise, complete)

Past medical history (complete, concise, clear, organized)

Medications (current, complete, concise)

Adverse drug reactions and allergies (current, sufficient information, clear)

Social and family history (current, sufficient information, clear, concise, organized)

Review of systems (complete, clear, concise)

Physical findings (complete, clear, concise)

Assessment (prioritized, sufficient information, clear, concise)

Plan of Care (prioritized, sufficient information, clear, concise)

Follow up information (prioritized, sufficient information, clear, concise) (Burke et al., 2014; Hanson et al., 2012)

RDQA (Routine Data Quality Assessment Tool)
As part of the global attempt to fight AIDS, malaria, and tuberculosis, led by large international organizations, two instruments were developed for the quality assessment of data reporting and management systems as well as healthcare data quality assessment, aiming for amelioration of the burden of diseases worldwide. The first instrument, entitled Data Quality Audit Tool, presents guidelines for the external auditing team to evaluation the capability of a project/program in terms of high-quality data reporting. This instrument aims to confirm the quality of the reported data based on key criteria in the selected centers, and evaluate the capability of data management systems in terms of collecting and reporting high-quality data. This instrument was developed in 2006 and piloted in Tanzania. The RDQA tool, which is a simplified version of DQA, allows a project/program to assess the quality of its data and the power

of its data reporting and management systems. Both instruments aim to specify the quality of data, evaluate the systems producing these data, and provide action plans for improving the data. Accuracy, reliability, precision, completeness, timeliness, integrity and confidentiality are the attributes that included in this tool (MEASURE Evaluation–SIFSA, 2017; U.S. Agency for International Development, 2008; World Health Organization, 2017).

D-Catch
This instrument was developed in 2010 by researchers in Italy, the Netherlands, and Spain in order to document the accuracy of nursing documentation in general hospitals. (Paans et al., 2010) The 6 items included in this tool for measuring accuracy are: nursing documentation structure, nursing assessment of patients on admission, nursing diagnoses, nursing interventions, patient's outcome and legibility of nursing documentation. (D'Agostino et al., 2017) For scoring, quantitative and qualitative criteria are used to evaluate the accuracy of nursing documentation. The qualitative criteria include relevancy, unambiguity, and linguistic correctness. The score ranges from 1 to 4, indicating weak to very good. The quantitative criteria evaluate the level of documentation completeness which receives a score from 1 to 4 (D'Agostino et al., 2017; Paans et al., 2010).

Method
This was a narrative review study in which the articles in credible journals and books were examined in order to find credible texts related to medical record quality assessment instruments. Some texts were searched by using the names of medical record quality assessment instruments based on the previous knowledge of the research team. To find more texts, searches were performed in PubMed, Embase, ScienceDirect, Scopus, and Web of Science databases as well as the Google Scholar search engine. The retrieved articles were examined by the research team, and those articles which introduced an instrument for the quality assessment of medical records or part of the medical records were included. Texts which introduced instruments for the quality assessment of other health information systems were excluded. No limitations as to time or location were included in the search strategies, but the language was restricted to English. Finally, the selected texts were examined to extract the data related to medical record quality assessment instruments.

RESULTS
Upon an examination of the retrieved sources, eight instruments which were used in the auditing process or evaluation of medical records or parts thereof were identified. These instruments included CRABEL score, E-CRABEL sore, STAR, Token score, 22-Item PDQI Score, 9-Item PDQI Score, D-Catch, and QNOTE, which were introduced before. Subsequently, the findings related to the qualitative features of each instrument, its applicability in the type of medical record qualification control, and documents for whose evaluation the instrument has been developed were extracted (Table 1).

Table 1. Characteristics of qualification control tools	
CRABLE Score	Date of publication : 2001 Attributes of quality: Complete Kind of Qualification Control: Quantity control Target notes: Initial clerking, Subsequent entries, Consents, Discharge summary
PDQI 22-Items Score	Date of publication : 2008 Attributes of quality: Clear, Up to date, Complete, Legible, Accurate, Thorough, uncluttered, Coherent, Useful, Correct, Brief, Current, Organized, Relevant, Comprehensible, Concise, Structured, Non-redundant, Succinct, Synthesized, Focused, Consistent Kind of Qualification Control: Quantity and Quality control Target notes: Physician Documentation
D-Catch	Date of publication : 2010 Attributes of quality: complete; Accurate((Relevant) + (completely unambiguous) + (linguistically correct)) Kind of Qualification Control: Quantity and Quality control Target notes: Nursing documentation in general hospital settings
STAR(Surgical Tool for Auditing Records)(STAR) Score	Date of publication : 2012 Attributes of quality: Complete Kind of Qualification Control: Quantity control Target notes: Surgical notes
PDQI 9-Items Score	Date of publication : 2012 Attributes of quality: Up to date, Accurate, Thorough, Useful, Organized, Comprehensible, Succinct, Synthesized, Consistent Kind of Qualification Control: Quantity and Quality control Target notes: Physician Documentation
QNOTE	Date of publication : 2012 Attributes of quality: Sufficient; concise, clear, organized; current; ordered; complete; prioritized, Kind of Qualification Control: Quantity and Quality control Target notes: Outpatient clinical notes
Token Score	Date of publication : 2015 Attributes of quality: Complete, Legible Kind of Qualification Control: Quantity and Quality control Target notes: Trauma & Orthopedic case notes
e-CRABEL Score	Date of publication : 2017 Attributes of quality: Complete Kind of Qualification Control: Quantity control Target notes: Surgical notes

DISCUSSION

Many countries perform qualitative and quantitative analysis for in-patient medical record qualification control (World Health Organization, 2003). Moghaddasi has mentioned quantitative and qualitative analysis as the foundation of health document qualification control (Moghaddasi, 2005). Quantitative analysis refers to the re-examination of patients' medical records in order to ensure the completeness of healthcare data and identify the deficiencies(Abdelhak et al., 2007; Huffman, 1994; Moghaddasi, 2005; Skurka, 1998; World Health Organization, 2003) . In fact, quantitative analysis is based on the completeness of medical records, accuracy of identity- and admission-related data, and presence of date, time, and signature (Moghaddasi, 2005). Accordingly, CRABLE Score, E-CRABLE Score, and STAR Score have been developed solely for quantitative analysis because the only qualitative dimension included in them is the feature of completeness (Crawford et al., 2001; Myuran et al., 2017; Tuffaha et al., 2012)

Huffman regards qualitative analysis as the re-examination of medical record data in order to identify inconsistencies and eliminations which may indicate the inaccuracy and incompleteness of the medical record (Huffman, 1994). According to Skurka, qualitative analysis is a process whereby the content of the medical record is re-examined in order to identity inconsistent and inaccurate documents. According to

him/her, in qualitative analysis, the accuracy of data and adherence to documentation standards and procedures matter more than the presence/absence of forms or signatures (Skurka, 1998). The WHO, citing Huffman, views qualitative analysis as the re-examination of medical record data in terms of accuracy, credibility, and timeliness. According to the WHO, in qualitative analysis, the quality of the healthcare service provided to the patients is measured by the qualification control of their medical records (World Health Organization, 2003).   According to Moghaddasi, accuracy, timeliness, definition, relevancy, and the data representation format are features examined in the qualitative analysis of medical record documents (Moghaddasi, 2005). The American Health Information Management Association notes that qualitative analysis focuses on clinical performance and standards, and attempts to assess the quality of documentation in terms of adherence to clinical performance guidelines, internal consistency in data recording, and adherence to rules and regulations (American Health Information Management Association (AHIMA), 2014). Based on the nature of qualitative analysis and the quality dimensions of D-Catch, 9-Item PDQI, QNOTE and 22-Item PDQI, it is concluded that these instruments have been developed for quantitative and qualitative analysis because they consider a combination of quality dimensions evaluated in both types of analysis (Burke et al., 2014; Hanson et al., 2012; MEASURE Evaluation–SIFSA, 2017;

Misra-Hebert et al., 2016; Stetson et al., 2008, 2012; U.S. Agency for International Development, 2008; World Health Organization, 2017). Although TOKEN score is based on CRABEL score which is a quantitative analysis instrument, TOKEN Score is a hybrid instrument because it includes the legibility dimension in the concept of definition and clearness (Khan et al., 2015). Upon examining the type of documents being evaluated by these instruments, it was found that all the instruments have been designed for evaluation of in-patient medical record notes, except for QNOTE (for outpatient clinical notes) (Burke et al., 2014; Hanson et al., 2012).

CONCLUSION

None of the instruments enjoyed sufficient comprehensiveness for the qualification control of all medical record data. A review of the examined instruments demonstrated an inconsistency in the use of the terminology denoting the quality features of healthcare data and relevant concepts. According to Moghaddasi, in texts related to the quality of healthcare data, 24 features have been discussed for data quality, many of which have overlapping meanings (Moghaddasi & Rahimi, 2016). This incoherence in the expression of quality features requires attention, because a common language is a pre-requisite for the development of instruments meeting the needs of medical record quality control processes at the national/international scale.

Competing interests

The authors declare no conflict of interest

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