A Novel Report Generation Approach for Medical Applications: The SISDS Methodology

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Tıbbi Uygulamalar İçin Yeni Bir Rapor Oluşturma Yaklaşıımı: SISDS Metodu

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Öz

Abstract

There has been an increasing demand for high quality medical data that are in a standard electronic format and easily shared. Therefore, there has been an increasing pressure on health care professionals to record qualified data which can be beneficial in many respects. Although a great amount of money has been invested to ease the process, an effective solution has yet to be found. There must be some powerful and cost effective methods that enable professionals to manage high quality electronic patient records. In this study, we propose a new medical reporting method which is an EPSS (Electronic Performance Support System) as well: The method that we named as “Structured, Interactive, Standardized, and Decision Supporting (SISDS) Method” enables professionals to produce multilingual medical reports much more efficiently than the existing approaches in a novel way. We first provide an evaluation and analysis of existing medical reporting methods; then, we present the conceptual approach of the SISDS reporting method, followed by the design and implementation details of a Web-based prototype.
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1 Introduction

Medical reports are the primary means of communication between laboratory professionals and referring physicians. A medical report can be defined as the results of a medical examination of a patient or a written document describing the findings of a patient to provide physicians with a better diagnostic decision supporting ability and consequently guide physicians to provide a better health care service for a patient.

Originally, health care professionals recorded medical reports themselves on paper with specific authentication methods such as signatures in black ink. With emerging technologies and ever increasing need for accessibility and ease of use, the process of producing and distributing medical reports started to be computerized; medical departments have made an effort to achieve a goal of collecting data in a structured format. Some of the earliest attempts focused on developing custom computer terminals at which professionals could produce coded reports themselves. The difficulty of reproducing or acquiring the information capture technology for widespread use is hampered by cost considerations, the lack of standardization [31] and cognitive overload [25, 8, 4]. Bell et al. indicate that one major obstacle to the success of computer systems is that physicians have difficulty in entering data [1]. With time, the features that allowed professionals to produce reports based on coded input were used less and less.

Medical reports are usually in free-text format and “natural language processing (NLP)” is not successful to turn free text into structured format because of equivocal abbreviations, large vocabulary, ungrammatical writing styles, many different codes, complex medical terms and details that are often left out [30]. The doctors acknowledged that there is no need for completeness, as colleagues would be able to fill in the gaps via an inferential process in medical reports; medical records are recognized as imperfect, even for their primary purpose of assisting in patient care [19]. Consequently, details are often left out because they are assumed to be common knowledge.

These difficulties force the usage of new structured data collecting and dissemination methods, but, not resulting in inefficiency and cognitive overload. Medical reports constitute one of the main sources of medical knowledge for a better health care service; however, they are in general difficult to find, read, and apply to the care of patients [24]: reasons for these difficulties include the lack of a common, standardized and structured approach for medical reports. In many cases, laboratory professionals and referring physicians need to come together to establish an unequivocal communication for optimal outcomes [25] because of current reporting methods which are insufficient in providing a through communication. However, personal collaboration is not often possible in crowded and sometimes chaotic atmosphere of hospitals. A common complaint by laboratory professionals is that of inadequate information from clinicians requesting studies [26, 6, 10]. Clinicians, on the other hand, express concerns that interpretations in medical reports are often not relevant to the clinical questions they seek to answer [26, 25]. Unfortunately, current reporting methods are insufficient in establishing the required communication medium [25], and this leads to avoidable medical errors which cost both human life and substantial amount of money [3, 12]. A recent report by the Institute of Medicine also lists inadequate methods for generating and relaying information as one of several potential causes of medical errors [12]. It is therefore evident that there is a need to improve the clarity of communication among laboratory professionals and referring physicians, and to improve the quality of laboratory professionals’ interpretations; new methods of generating medical reports are

\[\text{Only in USA, more than 100,000 people die each year from medical errors, including inadequate methods for generating and relaying information -- this lead to an estimated cost of } 2\times10^{10} \text{ USD between 2000 and 2002 [3].}\]
required to avoid errors, decrease variations, enable research, support decisions, decrease technological diseases and provide high quality health services for patients by managing high quality electronic patient records to provide a basis for better care.

The primary objective of the present study is to develop an alternative methodology for the capturing and the processing of medical data in the field of medical reporting. Providing a better electronic data collection method and decision supporting ability while optimizing reporting process has been a main goal seeking to replace traditional methods, especially dictation supported mostly by transcriptionists. In this study we have developed and proposed a new medical reporting method named "Structured, Interactive, Standardized, Decision Supporting" (SISDS) reporting method. This method is superior by combining most of the favorable features of previous medical reporting methods by giving experts a means to produce reports more quickly and efficiently at no more cost than those currently in widespread use; as well as, it removes the deficiencies of current methods, introduces and promises new advantages. The interactivity with a versatile, user- and problem-driven, scalable and dynamic reporting understanding is the proposed solution to avoid inefficiency and cognitive overload. Moreover, SISDS is an electronic performance-support system (EPSS); it revolutionize and improve the process of the poor performance during medical reporting while providing decision supporting and just-in-time learning abilities to users; an apprentice performs at an expert’s level effectively and properly with minimal cognitive effort, support and intervention by others. We have applied a testbed of SISDS method to several radiology departments to reveal what utilities are needed in an effective medical reporting system. The feedbacks that we received from the users who evaluated SISDS alongside with other existing methods by the help of a questionnaire in Appendix A.3 show that the proposed method is more effective in many respects, mainly helping health care professionals practice better medicine as well.

2 Related Work

In this section, various existing medical reporting methodologies are evaluated. Their strengths and deficiencies are revealed to shed light on how to establish an ideal medical reporting scheme. Interested reader can directly skip to Section 3 for the discussion of the proposed reporting method. Some early attempts in medical reporting are presented in Appendix A.1.

“Handwriting”, “Telephone Access” (TA), “Transcriptionist Oriented System” (TOS – recorded speech files to be dictated later by medical transcriptionists), “Real Time Transcriptionist Oriented Systems” (RTTOS – recording in real-time using medical transcriptionists), “Dictation by Speech Recognition” (DSR) and “All Structured Data Collected in a Screen” (ASDCIAS) are the six common data collecting methods in medical reporting recently.

Handwriting Handwriting is usually in free text, but templates are increasingly used and handwritten reports are signed by authors when recorded. Handwriting is often illegible, and varying terminologies represent different meanings to different practitioners and lack of a universal structure of patient information makes it difficult to find relevant information in a record created with a free text. Manual methods are persecution to the patients and also to physicians since reports are illegible and not detailed enough. Research and establishing DSS for further use is the most common drawback of handwriting.

Telephone Access An interesting supplement to a computerized reporting system is
the automated voice recording system known as RTAS \cite{13}: In its original form, described by Kolodny in 1974, the system was composed of several reel-to-reel audiotapes, each one of which was accessed by dialing an individual code number from a touch-tone telephone. Thus, the laboratory personal would dictate a report, the dictation would be recorded in analog form, and a specific dictation could then be accessed by any physician using a standard telephone. Since its original development, the system has been redesigned so that the voice information is now stored digitally, and in this form, the system has been installed successfully in a number of departments. The obvious benefit of such a system is that it can provide rapid access to reports, but it does not obviate the need for a more traditional computer reporting system to capture, store, and distribute the report in machine-readable form.

**Transcriptionist-Oriented Systems** The process of dictation was born as doctors dictated to secretaries or other assistants, and ultimately to medical transcriptionists, who captured the spoken text with shorthand to be transcribed later; in the second half of the 20th century, dictation devices were introduced, thus replacing the human interface in the dictation process \cite{31}. By far the most prevalent technique for entering radiology reports into a computer involves the use of transcriptionists. These systems allow the professionals to dictate a report in the usual way, using standard dictation equipment. Sometime later, a transcriptionist transcribes the report but uses a computer terminal instead of a standard typewriter to prepare the report. The editing of reports is, of course, a simpler task, because with word-processing techniques, it is possible to correct a mistake without retyping the entire report.

While recording voice to be transferred into the free-text machine readable form by transcriptionist later, an expert’s eyes never leave images or patients and his/her hands are free to manipulate image display controls or examine patients. Although TOS is generally well received and well accepted in most laboratory departments and look-away problem in this way is removed, it carries many drawbacks. It can often take a long time for a patient to receive his medical report. Once the report has been completed and diagnosis has been made, the report still has to be dictated and then typed up by transcriptionists. One of the drawbacks is that all recording process often has to be repeated if any update is needed in recorded sound for the sake of completeness. Another drawback is that reports still must be submitted to the laboratory professionals for approval and signature even if it is dictated into text by transcriptionist. Once a report has been approved, it is then necessary to go back to the computer and indicate that the report has been finalized. Thus, the signature cycle remains a problem that must be addressed. Moreover, because a professional’s review of the report documents, prior to signature, happens hours to days after the dictation, specific details of each case might not be fully remembered. This could result in errors. The remedy for this problem requires rework to review images or findings, a process that can be cumbersome and time-consuming even in a soft copy reading environment. Furthermore, patients are becoming increasingly anxious about the privacy of their medical records, one concern where transcriptionists dictate medical reports. On the other hand, economically, some healthcare providers show substantial savings as transcription is diminished or eliminated while some of the return on investment (ROI) could be quite impressive (i.e., considering that 400,000 transcriptionist are needed in the USA alone) \cite{21}. In all sectors, technological diseases, a cause for concern where transcriptionists dictate huge number of medical reports using keyboard in reporting phase, cost approximately 100 billion
Real Time Transcriptionist-Oriented System  RTTOS has been preferred to address the signature cycle although it carries most of the other drawbacks that TOS has. Real Time reports are not returned to the professionals for formal signature but are distributed immediately, thus eliminating the signature cycle and reexamining images or patients. However, a medical transcriptionist is required in real time during reporting process, a state which is very costly and necessitates a thorough communication between laboratory professionals and transcriptionists. Generally all dictated report has to be reexamined by professionals before signature and dissemination for the sake of truthfulness, which means doubling the efforts.

Dictation by Speech Recognition  The development of a conversational computer has been an elusive goal for many years [9]. New technologies, such as speech recognition and structured reporting systems, have been developed to address many shortcomings mentioned previous data collecting methods [26]. A study suggested that health care providers might use medical applications more often if speech, rather than conventional input techniques, were the interface modality [22]. Although several studies have analyzed the speech-driven approach to facilitate the collection of data in medical area as radiology, pathology, dental examination [7], anesthesia [27], Pediatric Gastroenterology [28], Orthopedic Surgery [29], we haven’t encountered a study which both uses a speech-driven approach and analyzes the method of data collection in a bilateral interactive, dynamic and structured (controlled vocabulary) understanding in the literature. Current medical applications in which a speech interface modality has been integrated have generally used free-text data collecting methods unilaterally, user-to-computer (either recorded speech-to-text by a transcriptionist or speech-to-text simultaneously). While dictating reports into the free text machine readable form in real-time using the speech interface, users are necessary to return computer to test what is dictated and to correct mistakes with facing a real look-away problem. Slow report turnaround, suboptimal report quality and accuracy, and the unsuitability of report information for quality improvement and research are some of the limitations of these applications. NLP (natural language processing) functionality in medical area has still been recognized as a promising research area to turn free text into structured data as it is detailed by addressing many shortcomings in one other study [21]. The current generation of continuous speech recognition systems claims to offer high accuracy (greater than 95 percent) SR at natural speech rates (150 words per minute) [34]. But, providing an accuracy rate greater than 95 percent is not an easy issue to handle in a natural rhythm and in the noisy environment of hospitals: the accuracy rate is strictly dependent on many factors as teaching grammar, well-trained speech files for specific users and vocabulary size. Speech recognition holds promise for medical reporting.

All Structured Data Collected in a Screen  Unlike conventional "free-text" reports, structured reports incorporate a standardized set of concepts in a predefined format [32]; a practical goal of structured reporting applications is to capture most of the information in structured format and allow free-text comments as needed; the major advantages of this approach include reduced transcription cost and turn-around times, increase report completeness, greater usefulness of cases for teaching and research, and improved quality assurance, utilization review. Efforts to apply structured reporting to laboratory date from the 1960s [32] and have included the UltraSTAR (Ultrasound Structured Attribute Reporting) system at the Brigham
and Women’s Hospital and chest radiography reporting system at John Hopkins Medical Institution [32]: Ultra-STAR grew out of the difficulties encountered in reporting a large volume of pelvic ultrasound studies that often show similar findings: sonographers write notes for a study on a paper form; these notes go to the referring physician as a preliminary report and serve as the basis for the radiologist’s dictation of a final report; it captures initial notes in a standardized format that is easily edited to produce a final report; it obviates the need for dictation and stores standardized patient data for retrospective study. Many windows may remain open simultaneously having radio buttons, combo boxes, buttons and checkboxes to select concepts and in its use of multiple small windows, a cause for cognitive overload. In structured text, the documentation process is guided through the use of titles and templates [31]. Templates are guides used to create standardized health information documentation. The purpose is to produce data of more consistent quality, make information more usable for decision support, make information more complete and more easily retrievable and templates may also present data for the physician to choose from menus, lists, or forms [31]. Cognitive overload and dependence to computer experts for updates for the architecture of report formats have been the most effecting factor for these kinds of systems to be used less and less, thought, they have many advantages.

3 The SISDS Method

According to some studies in cognitive psychology and sociology, free-text communication is the most effective way for coordinating a complex medical task [25] [8] [4], and consequently, it is not surprising that medical reports are usually in free-text format. However, this also poses difficulties as converting them into electronic form and then extracting semantics become challenging tasks.

Transcriptionist based approaches and automatic optical character or speech recognition are some of the well-known data collection methods in free-text medical reporting. Although those systems that allow transcriptionists to enter reports in free text are currently the most prevalent[2], the time between dictation and report availability is long on average [25]. The overall process is also not cost effective [24]. On the other hand, automatic methods fail to turn free text into structured format at a satisfactory level, due to several factors such as equivocal abbreviations, large vocabulary, ungrammatical writing styles, many different codes and complex medical terms. Furthermore, reports are almost always incomplete since details are assumed to be common knowledge and left out [30]. The doctors acknowledged that there is no need for completeness, as colleagues would be able to fill in the gaps via an inferential process [19], which of course doesn’t apply to current computer systems.

In order to remove the deficiencies of free-text recording, structured data entry has been proposed as an alternative approach by different groups, but has not yet gained widespread acceptance primarily because of additional, and sometimes excessive, cognitive overload [15] [14]. Some of the earliest computer medical reporting attempts focused on developing specialized computer terminals at which professionals could produce reports themselves with predefined coded policies to reduce errors and increase health care services. Jost lists some early uses of computers in structured medical reporting based on coded input [13][3]. With time, the features that allowed professionals to produce reports based on

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2Surprisingly, second to handwriting [31].
3See Appendix A.1 for more information.
Figure 1: The hierarchical structure. Boxes correspond to data entries and line labels indicate possible answers. The dashed box groups a set of data entries that are activated when there is narrowness. The normal values are shown with thick edges.

coded input were used less and less because of cognitive overload, cost consideration and lack of a common standardization. According to Sistrom, although the concept of using a sophisticated menu-driven interface with predefined report shells that provide consistent structure to the report is quite attractive, the very sophistication of the concept causes the interface to be rather complex both cognitively and visually [25]. Overly structured data can lead to loss of cognitive focus by professionals, both during input and review [19]. Most clinicians note that they have less time available than in the past, because of increased patient volumes, greater demands for documentation, and the increasing complexity of modern practice [11]. Now, as medical data sets become increasingly large and complex, much of the professional’s time and cognitive effort must be devoted to manipulating the display and post processing controls of workstations for medical reporting in the current structured understanding. This can cause clinicians to experience a loss of overview about any case when they have to deal with data from different fields, sometimes on different screens [20] [2].

These difficulties, as highlighted by the results of several studies that have shown that professionals frequently declare the need for improvements in medical report quality at their institutions [3] [17] [20], indicate a necessity for new methods that are both effective and with less cognitive pressure – in between free-text reporting and sophisticated menu-driven structured approaches, which would provide a through communication among professionals, and also facilitate high level operations, such as population based inferences and diagnosis/decision support. In this section, we will first discuss some essential characteristics of such a method, and then formally describe a particular solution that provides them; a Web-based implementation of the proposed solution is presented in the next section.

Cognitive load and hierarchical structure. As already mentioned in the previous paragraphs, reducing the cognitive overload is of utmost importance in medical reporting. There exists a direct relationship between the amount and complexity of information that need to be entered/processed by users and the cognitive load; hence, reducing the amount and complexity of information would also reduce the cognitive load. Let us consider a typical esophagus radiology report which would, among other things, contain observations
about the shape of the mucosal relief, the section, length and the site of the narrowness of the esophagus etc. However, in a particular case only a subset of this information is actually relevant. For example, one of the questions to be answered in this report would be the following: “Is there any narrowness without a clear expansion in the esophagus during the transition of the contrast media?”. Usually, the answer to this question is no, and in this case the mucosal relief should be entered, which can be either regular or irregular; if the mucosal relief is irregular then the shape of the irregularity should also be specified. In case there is a narrowness, mucosal relief is not important and a completely different set of information should be entered including and depending on the properties of the narrowness, such as its section, length and site. Note that, this inherently leads to a nested and hierarchical structure shown in Figure 1, in which data entered at a certain point determines the information flow, and consequently, the related data that should be entered. Although the total number of possible realizations may be large, by interactively walking on the necessary steps while completing the report, the number of data entries can be reduced considerably (ex. it is unnecessary to ask for/display anything related to narrowness unless the user explicitly indicates that it exists). This hierarchical structure is not specific to this particular example, and emerges as a common feature of almost all kinds of medical reports. Furthermore, as several sources point out, in most cases medical reports belong to normal cases in which there are only few fields with abnormal values depending on the case under examination. Ideally, much less time has to be spent to record normality, and for the sake of cognitive simplicity the user should not receive data entries related to abnormal situations; this can simply be achieved by conducting an initial simulated walk on the necessary steps using the default values for the normal cases (i.e. no narrowness and regular mucosal relief in our example above).

Abstraction. In medical reporting, we can identify two main goals: (i) to make medical reports easily accessible, complete and comprehensible by all users, and (ii) to be able to extract medical data out of them for further analysis. In order to accomplish these goals, abstraction at several layers seems essential.

Data level The data fields, or variables, that constitute a report must be consistent and well defined. A typical medical report contains many nominal and numerical values with different measurement units (such as, temperature, length, weight, volume, date, etc.), and without specific data-types for them it is unavoidable to lose some information when working directly with the data afterwards. Specific data-types also enable unit conversion, which facilitates information sharing. The ability to assign default values to data fields and to define constraints over them, such as a permissible value range, are other useful features that would reduce the cognitive overload and prevent erroneous input by guiding the user during data entry.

Logic level A data entry can encapsulate multiple data fields. For example, in our sample esophagus radiology report, the size of the first ulcerated lesion may be defined in an interval by specifying its lower and upper bounds. Furthermore, as discussed above there may exist dependencies and relations between data entries that trigger their activation; here, the trigger conditions are defined in terms of boolean expressions that refer to the data fields, and hence require an abstraction above the data level.

Presentation level Data and logic level can be regarded as the backend that defines the structure of the report; presentation level, on the other hand, is the frontend that

\[\text{The dependencies between data fields may be more complex, i.e. the condition of requesting a certain information may depend on the values of various other data fields that may or may not be dependent on each other.}\]
defines how the report is rendered for data collection and viewing. The separation of presentation from data and logic would enable to generate different views of the same data based on user requirements (for example, in tabular form or in a natural free-text like style as described in the next section); this also brings support for report generation in multiple languages without requiring natural language processing methods, which are not reliable and liable to medical errors.

We would like to point out that several existing design patterns, most notably model-view-controller architecture fits well to this layering. Now, starting from the data level we will describe the SISDS method and discuss how it possesses the features listed so far.

The building block in SISDS is a data field defined by a tuple \( \langle \text{var}, \text{type}, \text{val}, \text{opts} \rangle \) where \( \text{var} \) is the name of the data field, or variable, \( \text{type} \) is the type of the variable, \( \text{val} \) is its initial value, and \( \text{opt} \) is a list of options which may be empty. \( \text{type} \) is either one of pre-defined types\(^5\) or if it is a nominal variable it is a set of possible values, ex. \{yes, no\}. For measurement data types, such as length, the initial value should also contain the unit of measurement, ex. \(1.2cm\). \( \text{opts} \) is a set of pairs of the form \( \{\langle \text{name}_i, \text{val}_i \rangle, \ldots \} \) where \( \text{name}_i \) denotes the name of the \( i \)th option and \( \text{val}_i \) is its value; typical options include the minimum, maximum and normal values of a variable.

A data entry is a unit of data request and encapsulates one or more variables; it is defined by a tuple \( \langle \text{label}, \text{vars}, \text{defs}, \text{triggers} \rangle \) where \( \text{label} \) is a unique identifier denoting the data entry, \( \text{vars} \) is a set of variable definitions, \( \text{defs} \) is a set of data request/view definitions (DRVDs) and \( \text{triggers} \) is a set of triggers that activate related data entries. Each trigger in \( \text{triggers} \) is a pair of the form \( \langle \text{cond}, \text{action} \rangle \) where \( \text{cond} \) is a boolean expression with embedded variable references and \( \text{action} \) specifies an action to be executed when the condition holds, i.e. boolean expression evaluates to true. The boolean expression may include arithmetic and logic operators, function calls, constants and variables references. The variable references in the boolean expression are of the form \( \langle \text{label}, \text{var} \rangle \) where \( \text{var} \) is the name of the variable, \( \text{label} \) is the identifier of the data entry that the variable belongs to or \( \emptyset \) if it belongs to the current data entry. While evaluating the boolean expression, the variable references are replaced with the current value (default or that entered by the user) of the corresponding variables. Note that, the values of the variables with measurement data types must be normalized, i.e. converted into a common unit, before evaluation since the unit of such variables may be altered by the user. This can be done by calling a unit conversion function within the condition expression. An \( \text{action} \) can be a set of labels that denote the data entries to be activated, a message to be displayed, or a diagnosis prediction; it is important to note that cyclic activations are not allowed, that is a descendant of a data entry cannot re-activate it. Each DRVD is a tuple of the form \( \langle \text{type}, \text{lang}, \text{def} \rangle \) where \( \text{type} \) denotes the type of the DRVD, \( \text{lang} \) denotes the language of the definition, and \( \text{def} \) is the body of the definition. The body of the definition is an arbitrary string with embedded variable references of the form \( \langle \text{label}, \text{var}, \text{vals}, \text{opts} \rangle \) where \( \text{label} \) and \( \text{var} \) are defined as above, \( \text{vals} \) is a set of mappings for nominal variables to map possible values of the variable to string counterparts, and \( \text{opts} \) is a set of options as in the definition of variables. Typical options include format specifiers to determine the rendering of the variable. DRVDs are used by the presentation layer to render data entry forms or reports based on their \( \text{type} \); this gives rise to a unified view in which data collection and viewing are handled similarly.

Finally, a report is tuple \( \langle E, M, \text{triggers} \rangle \) where \( E \) is a set of consistent data entries, that is all data entries referred in the trigger conditions of these data entries exists in

\(^5\)For the sake of simplicity, we opted to use \{integer, float, string, date, length, weight, volume\}; other types are also possible.
the report (i.e. are in $E$), $M$ is an ordered list of data entry identifiers denoting the main data entries, and triggers is a set of report-wide triggers; for each identifier in $M$ there must be a corresponding data entry in $E$. The main data entries constitute the initial skeleton of the report. The report-wide triggers enable to provide diagnosis and other suggestions to the user based on the entered data. From a conceptual point of view, our structured design with interactivity looks like a tree with branches growing from a stem such that the branches collapse and expand as needed, main data entries being the initially expanded branches. A dynamic hierarchy of sections is built as related data entries logically follow-up depending on the defined conditions. This effectively enables the user to focus on problematic parts and record them in more detail while eliminating other parts to save time, thus avoiding inefficiency and cognitive overload. The overall architecture of esophagus report on which the SISDS methodology has been applied is depicted in Appendix A.2. The Esophagus Report Format has been prepared by consulting 12 radiologists working in radiology departments, five of whom are the chiefs in their departments, in 6 different hospitals. It wasn’t an easy task to reach a consensus. However, most important parameters which indicate possible diagnoses are included in the report in a way with minimum data set, but with most important conditions mainly based on Weissleder’s book [33].

4 Design and Implementation of the Prototype

In order to verify the eligibility of the proposed approach, we implemented a Web-based prototype based on the client-server architecture. Using the definitions and collected data stored in a relational database, the web server renders the report for data entry or viewing, which is then displayed to the user by the web browser; the user interacts with the web browser (via Dynamic HTML and AJAX) and his feedback (data entry or update, if any) is sent back to the web server for processing (Figure 2). A backend allows privileged users to easily define and edit reports and their structure, as well as export collected data for analysis purposes. In realizing the abstract variable and data entry definitions given in the previous section, we opted to use a human-readable textual notation with a simple syntax; the syntax of this notation is presented in Table 1 together with some examples. The trigger conditions are also defined using this notation.

The main novelty of this particular implementation is a free-text like data entry facility with inline editing. As we mentioned in the previous section, free-text is the most natural way for data entry where the entered data directly corresponds to the content of the final product (i.e. report). One way to ensure this in structure data entry is to let the user see the resulting report while still entering data. Although this can be accomplished by following a split view approach, i.e. having separate data entry and report views and
Figure 3: The ER Diagram of The SISDS Methodology.
segment_length = length : 2cm ; min = 0cm, max = 10cm

What is the length of the narrow segment? [segment_length]
The length of the narrow segment is [segment_length].
Dar segment genişliği [segment_length]'dir. (in Turkish)
defect = smooth,regular,circular : smooth ; normal = regular

The filling defect is in the shape of [defect:smooth=smooth linear structure,
circular=circular modular,regular=regular linear structure].

([q1.segment_length] > 5 and [segment_length] < 7) or [defect] = “circular”

Table 1: The syntax of variable, data entry/view definitions and trigger conditions in modified BNF notation and some examples. Entities within curly brackets are optional. In the first example, note the change in the position of the variable in the Turkish version.

Figure 4: Inline data entry in free-text format. (top) Initial state. Abnormal values are highlighted in red, and the field yet to be entered has a gray background. (middle) When the user clicks on the link inline editing is activated. (bottom) The new value “There is” triggers another set of data entries.
Figure 5: Two different views of the same report. Free-text (top) and enumerated (bottom).

updating the second one as the user makes modifications in the first one, it is not cognitively appealing as the user has to go back and forth between different views, increasing cognitive load. The solution that we offer is to use inline editing, that is to present the report in a single view but allow the users to directly manipulate the data on the screen simply by clicking on data fields which are displayed as hyperlinks (Figure 4). As the user changes the values of variables, the contents of the report is also rearranged automatically (and notifications are displayed) according to defined trigger conditions. This not only prevents the cognitive overload, but also unifies the data entry and viewing phases.

According to some studies about visual cognition, under normal viewing conditions only a minor part of the environment is encoded in detail [18]: Although the factors that determine which features of a scene are encoded remain unknown, it seems likely that attention plays a major role. Sometimes professionals could not see other pertinent details while concentrating on a specific subject. In order to prevent this, in our implementation the presentation layer is enriched with visual clues; data fields having abnormal values or yet to be entered are automatically highlighted in different ways to warn the user and draw his attention to those sections of the report (Figure 4). We also enabled the user to temporarily hide data entries that are not directly related with a selected data entry (i.e. show only selected data entry together with its descendants and those that are involved in the activation of this data entry). The feedback that we received from initial deployment of the system to four different hospitals suggests that users find both features effective and useful in terms of the questionnaire in Appendix A.3 which has been prepared to test the effectiveness and acceptance of the SISDS in a way using a comparison to other most common data collecting methods. In addition to testing the effectiveness and the acceptance, the questionnaire is aimed to measure how much the SISDS covers the criteria of EPSS and the learning organizations. In first place, the questionnaire has been applied to 20 experts, 12 of which are radiologists, 8 of which are clinicians.

Aside free-text like data entry, by taking advantage of the separation of data from its representation the prototype also supports data entry in the form of an enumerated list (Figure 5) and additional formats can be added with ease. These are just different representations of the same data, albeit with different cognitive properties, and it is possible to switch from one to another online during editing; even though the first one is more natural, the enumerated list may be more convenient and preferable in certain cases –
especially when one is interested in seeing the hierarchical structure.

A prompt version of any generated report is transformed into another language in terms of the syntax mentioned in Table 1 when an authorized user, whose language setting is set to another language different from the person who generated the report at the very first time using his own language set in the user’s profile. For instance, an esophagus report generated in Turkish language is depicted in English in Figure 6 as free text.

A demo version of the prototype is available online at the following address for hands-on experience: http://www.gata.edu.tr/mebs/sisds

5 Discussion and Conclusion

Information systems should enable the capturing of more complete, accurate, specific and timely medical information in an even more cost-effective manner in the future. On the other hand, common language is the foundation of communication, learning, and understanding. Shared concepts and standard definitions are necessary foundations for the field of patient safety, whether for research or for operations of health care providers. Differences in definitions can make inferences across studies impossible, and can make communication across operating departments difficult. Within this context, an effective data collection and reporting system is a key element to success.

There is a need for international standardization of terminology in definition, common methods for measurement, and compatible reporting of adverse events. Standardization would enable comparison of research findings, better benchmarking across healthcare organizations, and the development of reliable reporting. Conclusions drawn from national and international data would therefore provide a broader and more meaningful picture of individual and population health.

In this study we propose a new methodology which adopts a systematic approach to improve medical processes by reducing variability and minimizing errors. More specifically, we focus on the process of data entry and report generation. The interactivity with the user in our study, “interactive walk on necessary steps”, has many advantages that allow information to be captured at the point of care and eliminate the need for a transcriptionist or auxiliary procedures to write reports. In particular, the end report is automatically generated while structured fields are filled interactively in a natural form which is similar to the final report; it also provides

1. a high degree of timeliness and accuracy, reducing errors,

2. multifunctional capabilities such as drawing the attention of practitioner to important sections of the report, alerting him about a diagnosis or giving advises at the time of entry, and

3. an easy way for domain experts to define reports in a textual form without extensive computer knowledge.

Data collection constitutes the first and necessary step for analysis and advanced applications, such as diagnosis and decision support. The initial feedback that we received from the users of the prototype implementation indicates that the proposed method is a promising approach for achieving the aim of effective data collection and reporting. Further studies will concentrate on a wide-scale deployment of the system, and development and integration of a medical decision support system based on the collected data.
Figure 6: Two different views of the same report in free text form. In Turkish (left) and in English (right).

**Esophagus (Özafagus)**

The position of the patient is erect left oblique. The contrast media used in oral way is barium. **There is extravasations of contrast media out of the lumen.** The section of the extravasation is **distal 1/3 esophagus.** The transition of the contrast media from the esophagus to stomach **happens after a level occurred and after a while.** The level is **1/3 lower esophagus.** The feature of the peristalsis wave during the transition of the contrast media is **tertury.** The section in which peristalsic waves are observed is **as a shape of diffusive spasm (corkscrew esophagus) through all esophagus.** There is **narrowness without a clear expansion in the esophagus during the transition of the contrast media.** The section in which there isn’t a clear expansion during the transition of the contrast media is **proximal + middle 1/3 esophagus.** The length of the narrow segment is **2.5 cm.** The settlement of the narrow segment is **asymmetrical.** The narrow esophagus segment is **irregular.** **There is a filling defect in the esophagus.** The number of the filling defects is **multiple.** The level of the smallest filling defect is **distal 1/3 esophagus.** The size of the smallest filling defect is in the shape of **irregular polipoid without stippled.** The size of the smallest filling defect is **2.5 cm.** The level of the largest filling defect is **proximal 1/3 esophagus.** The largest filling defect is in the shape of **irregular polipoid without stippled.** The size of the largest filling defect is **2.5 cm.** **There is ulcerated lesion in the mucosal membrane of the esophagus.** The number of the ulcerated lesions is **1.** The size of the first ulcerated lesion is **2.5 cm.** The shape of the first ulcerated lesion is **small superficial ulcer.** There isn’t a discrete filling defect in the esophagus. **There is significant abnormal dilatation in esophagus during the transition of contrast media.** **The significant abnormal dilatation in esophagus is proximal 1/3 esophagus.** There isn’t a surgical operation in the esophagus. There isn’t herna in the distal esophagus. There isn’t a gastro-esophagus reflux.
References


[29] Svanfeldt, G. A speech interface demonstrator for pre-operative planning within orthopaedic surgery. master degree project in speech communication.


A Appendix

A.1 Some Early Attempts in Medical Reporting

As described by Jost [13], some early uses of computer systems in medical reporting were MARS, CLIP, CGR and RAPORT: The Missouri Automated Radiology System (MARS) was one of the very first systems designed to produce radiology reports using a computer. It was developed initially in 1965 as a prototype system requiring punched card input on an IBM 1620 computer. Later, the system was rewritten in the MUMPS language and installed on a Digital PDP-15 time-sharing system. In order to produce a report, a radiologist was asked to enter coded symbols at a standard computer terminal. The code “P4” might stand for the sentence, “There has been essentially no change in findings since the previous examination.” If the proper code could not be remembered, simply typing a “P” would cause a list of possibilities to be presented from which the radiologist would choose. A concatenation of these symbols would eventually lead to the production of a complete report. The final report was presented to the radiologist on the CRT screen for his or her approval and “signature”. If a report required terms that could not be expressed in coded language, free text could be appended to the report by typing it directly into the terminal. Later, in the early 1970s, the Coded Language Information Processing (CLIP) system was developed at the Beth Israel Hospital. The CLIP reporting system embodies a philosophy of medical classification and that divides the description of disease into anatomic, descriptive, and etiologic components, the computed displays sets of pre-entered statements. The radiologists then select by letter or number the desired statements, which can be modified by appropriate adjectival or adverbial insertions. The core of this system is an array of about 5800 frames on which the pre-entered statements are organized. Each frame can carry 35 items, which are identified by the numbers or letters on the keyboard. The string of statements selected for inclusion in the report is displayed on the terminal for review as it’s is composed. The radiologist then works his or her way through a report, selecting from the items presented on the screen. This unique system was undergone steady evolution at Beth Israel Hospital. It seemed to lend itself particularly well to certain types of reports, such as computed tomography (CT) of the head and spine, for which, at Beth Israel Hospital, direct-entry reporting of this type was used for nearly 90 per cent of reports. One of the major advantages of this approach is that reports can be reviewed and “signed” at the time of report generation, thus eliminating the signature cycle, and reports can therefore be printed and distributed immediately. Furthermore, because reports are frequently entered in coded form, it is easier to retrieve reports later according to diagnostic codes. Nevertheless, except for a very few medical centers, CRT terminals were seldom used by radiologists to type at a CRT terminal remains a major obstacle in most departments.

From the early days of computerized reporting there has been an interest in developing a better interface between laboratory professionals and the computer to allow a professional to compose a report more easily. One solution has been the development of touch-sensitive terminals on which diagnostic possibilities are projected on a touch-sensitive screen and a radiologist is able to compose a report simply by touching the desired items. The first use of touch-sensitive screens was described by Inger Brolin using a Saab terminal in Sweden in 1967. CGR was also an early innovator of this type of technology and introduced a French-made terminal at the International Congress of Radiology in 1973. Subsequent versions of this terminal were evaluated in this country. Some of the most influential work in this area emerged at Johns Hopkins University, where the touch-sensitive IBM 3760 terminal was introduced in the radiology department in 1972. This system was nurtured
in the early 1970s and became a predominant influence in the development of the Siemens SIREP system, a microcomputer-based, stand-alone, touch-screen, computer-based reporting system (Figure 7). The Siemens system provided a rapid method for optically projecting a number of diagnostic choices on a touch-sensitive panel. Each examination type had a main frame of information with enough pathology and anatomy to report most cases, and a radiologist could easily flip from one frame to another. To assist the user, diagnostic terms were arranged around simple anatomic diagrams, and to create a report, items could be probed in any desired order. This type of terminal seems to work best in high-volume areas of the department where there is a high percentage of normal studies. In this environment, proponents of this type of system believe that computer reporting using a touch-screen terminal is only slightly slower than traditional transcribing methods, and because reports are available immediately for printing and distribution, the overall report turn-around time can be reduced considerably, one of the major limitations of the SIREP system was the high cost of each station. The system did not find a wide enough market, and it was discontinued. Another system was RAPORT. Mark sense technology has provided a unique method for entering radiology reports into a computer. A radiologist indicates a diagnosis by marking in pencil on specially prepared machine-readable forms. The computer then translates these marks into standard text. This approach to radiology reporting was introduced by General Electric with the RAPORT system in 1970. General Electric no longer markets this system. Each diagnostic form contains terms and anatomic diagrams pertinent to a specific topic, such as the hand and wrist or the foot and ankle. In many cases, the radiologist can compose the entire report on the machine-readable form; however, dictation can be appended if necessary. An important advantage of this approach is that a radiologist need not be located at a computer terminal in order to generate a report. In the event of a computer failure, the radiologist can continue to interpret studies using the mark sense forms, and only the printing of the reports is delayed. It is well received in some departments and less well received in others.
A.2 Radiology Esophagus Report Format Applied to SISDS Methodology


Hastanın pozisyonu [position]dir. The position of the patient is [position]prone oblique, erect left oblique, erect left lateral, erect right lateral, semi-erect, supin, trandelenburg, lie-down and erect.


Oral yoldan kullanılan kontrast madde [contrast]dir. The contrast media used in oral way is [contrast]barium, contrast media dissolving in water, contrast media through vein.


Kontrast maddenin lümen dışına kaçışı [extravasating]. The leakage of contrast media out of the lumen is [extravasating].

Condition 1: [extravasating] == “vardır”


Kaçağın olduğu özafagus bölgesi [section]tur. The section of the extravasating is [section]1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.

4. Kontrast maddenin özafagusdan mideye geçişi nasıldır? = [transition]bekleden normal hızla olmuştır, beklemeden olmadan, beklemeden belirli seviye oluşturulan sonra olmuştur, olmadan: beklemeden normal hızla olmuştur; normal=beklemeden normal hızla olmuştur. How is the transition of the contrast media from the esophagus to stomach? = [transition]as normal without delay, delayed transition, happens after a level occurred and with delay, doesn’t happen.

Kontrast maddenin özafagusdan mideye geçişi [transition]. The transition of the contrast media from the esophagus to stomach is [transition]as normal without delay, delayed transition, happens after a level occurred and with delay, doesn’t happen.

Condition 1: [transition] == “bekleyerek belirli seviye oluşturulan sonra olmuştur”

- Görülen seviye nasılır? = [level]1/3 üst özafagus, 1/3 orta özafagus, 1/3 alt özafagus, tüm özafagus boyunca: 1/3 üst özafagus; normal=yok/dir.
5. What is the site of the level? = \{level\} \(1/3\) upper esophagus, \(1/3\) lower esophagus, whole esophagus.

Görülen seviye \(\text{level}\) tadir.
The site of the level is \(\text{level}\) \(1/3\) upper esophagus, \(1/3\) middle esophagus, \(1/3\) lower esophagus, whole esophagus.

What is the feature of the peristalsis wave during the transition of the contrast media? = \{peristalsis\} \{wave\} primary, \{peristalsis\} \{wave\} secondary, primary secondary tertiary, \{peristalsis\} \{wave\} not observed specifically, decreased, tertiary.

Kontast madde geçişi sırasında görülen peristaltik dalganın \{peristalsis\} \{wave\}dir.
The feature of the peristalsis wave during the transition of the contrast media is \{peristalsis\} \{wave\} primary, \{peristalsis\} \{wave\} secondary, \{peristalsis\} \{wave\} tertiary, \{peristalsis\} \{wave\} not observed specifically, decreased, tertiary.

Condition 1: \{peristalsis\} \{wave\} == “primary secondary tertiary” || \{peristalsis\} \{wave\} == “tertiary”

- Tersiyer peristaltik dalgaların saaptandiği özafagus seviyesi neredir? = \{level\} \{proximal\} \(1/3\) özafagus, orta \(1/3\) özafagus, distal \(1/3\) özafagus, tüm özafagus böümlerinde diffüz spazm (tirbüşon özafagus) görüntüsünde, orta distal: \{proximal\} \(1/3\) özafagus; normal=yok.

In which section pristalsis waves are observed? = \{level\} \(1/3\) esophagus, middle \(1/3\) esophagus, distal \(1/3\) esophagus, as a shape of diffusesive spasm (corkscrew esophagus) whole esophagus, middle distal.

Tersiyer peristaltik dalgaların saaptandiği özafagus seviyesi \{level\}dir.
The section in which pristalsis waves are observed is \{level\} \(1/3\) esophagus, middle \(1/3\) esophagus, distal \(1/3\) esophagus, as a shape of diffusesive spasm (corkscrew esophagus) whole esophagus, middle distal.

Condition 2: \{peristalsis\} \{wave\} == “belirgin olarak izlenmemiş”

- Peristaltik dalganın belirgin olarak izlenmediği bölge neresidir? = \{section\} \{proximal\} \(1/3\) özafagus, orta \(1/3\) özafagus, distal \(1/3\) özafagus, tüm özafagus: \{proximal\} \(1/3\) özafagus; normal=yok.

In which section pristalsis wave is not observed specifically? =\{section\} \{proximal\} \(1/3\) esophagus, middle \(1/3\) esophagus, distal \(1/3\) esophagus, whole esophagus.

Peristaltik dalganın belirgin olarak izlenmediği bölge \{section\}dir.
\{section\} \{proximal\} \(1/3\) esophagus, middle \(1/3\) esophagus, distal \(1/3\) esophagus, whole is the section in which pristalsis wave not observed specifically.

6. Is there any narrowness without a clear expansion in the esophagus during the transition of the contrast media? = \{narrowness\} \{yes\}, \{narrowness\} \{no\}; normal=yok.

Is there any narrowness without a clear expansion in the esophagus during the transition of the contrast media? = \{narrowness\} \{There isn’t\}, \{narrowness\} \{There is\}.
Kontrast madde geçişi sırasında özafagusla belirgin genişleme göstermeyen, dar (13 mm den daha az) bölüm var mı? = \{narrowness\} \{yes\}, \{narrowness\} \{no\}; normal=yok.

Is there any narrowness without a clear expansion in the esophagus during the transition of the contrast media? = \{narrowness\} \{There isn’t\}, \{narrowness\} \{There is\}.

Condition 1: \{narrowness\} == “var”
Özafagusun belirgin genişleme olmayan bölgesi hangi seviyededir? = [section]proksimal 1/3 özafagus, orta 1/3 özafagus, distal 1/3 özafagus, tüm özafagus, proksimal + orta 1/3 özafagus, proksimal + distal 1/3 özafagus, orta + distal 1/3 özafagus: proksimal 1/3 özafagus; normal=yok|tur.
In which section there isn’t a clear expansion during the transition of the contrast media? = [section]proksimal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, proximal + middle 1/3 esophagus, proximal + distal 1/3 esophagus, middle + distal 1/3 esophagus.
Özafagusun belirgin genişleme olmayan bölgesinin seviyesi [section]tur.
The section in which there isn’t a clear expansion during the transition of the contrast media is [section]proksimal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, proximal + middle 1/3 esophagus, proximal + distal 1/3 esophagus, middle + distal 1/3 esophagus.

Condition 1: [section] != “ ”

(a) Dar segment uzunluğu ne kadarır? = [length]length: 2 cm; min=0 cm, max=0 cm| dir.
What is the length of the narrow segment? = [length].
Dar segment uzunluğu [length] dir.
The length of the narrow segment is [length].

Condition 1: CU([length], ‘cm’) > 0
What is the site of the narrow segment? = [settlement]symmetrical, asymmetrical.
Dar segmentin yerleşimi [settlement]tir.
The site of the narrow segment is [settlement]symmetrical, asymmetrical.

Condition 1: [settlement] != “ ”

How is the narrow esophagus segment? = [segment]regular, irregular.
Dar özafagus segmenti [segment]dir.
The narrow esophagus segment is [segment]regular, irregular.

Condition 2: [narrowness] == “yok”

Özafagusta mukozal rölefed nasıldır? = [relief]normal, normal değil: normal; normal=normal|dir.
How is the mucosal relief of the esophagus? = [relief]normal, not normal.
Özafagusta mukozal röleved [relief]dir.
The mucosal relief of the esophagus is [relief]normal, not normal.

Condition 1: [relief] == “normal değil”

(a) Özafagusta normal olmayan röleved nasıldır? = [topography]Kalınlaşma mukozal kurşunlar görünnümde, retüküler mukozal patern görünümünde, mukozal nodüler görünümünde, ince transvers mukozal çizgiler (feline özafagus) görünümünde: kalınlaşma mukozal kurşunlar görünümünde; normal=yok|dir.
How is the abnormal relief of the esophagus? = [topography|thickened mucosal folds, reticular mucosal pattern, nodular mucosal pattern, thin transverse mucosal folds(feline ozafagus)].

Ozafagusta normal olmayan rolüyef [topography]dir.
The abnormal relief of the esophagus is in the shape of [topography|thickened mucosal folds, reticular mucosal pattern, nodular mucosal pattern, thin transverse mucosal folds(feline ozafagus)].

**Condition 2:** [relief] == “normal değil”

(a) Normal olmayan rolüyef hangi seviyededir? = [relief_level|proksimal 1/3 ozafagus, orta 1/3 ozafagus, distal 1/3 ozafagus, tüm ozafagus, proksimal + orta 1/3 ozafagus, proksimal + distal 1/3 ozafagus, orta + distal 1/3 ozafagus: proksimal 1/3 ozafagus; normal=yok] tur.

In which section there is an abnormal relief? = [relief_level]proksimal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, proximal + middle 1/3 esophagus, proximal + distal 1/3 esophagus, middle + distal 1/3 esophagus].

The level of abnormal relief is [relief_level]proksimal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, proximal + middle 1/3 esophagus, proximal + distal 1/3 esophagus, middle + distal 1/3 esophagus].

7. Ozafagusta dolum defekti var mıdır? = [defect|yoktur, vardır: yoktur; normal=yoktur].

Is there a filling defect in the esophagus? = [defect|There isn’t, There is].

Ozafagusta dolum defekti [defect].

[defect]There isn’t, There is/ a filling defect in the esophagus.

**Condition 1:** [defect] == “vardır”

- Dolum defekti kaç tanedir? = [defectNumber|1, 2, 3, multiple: 1; normal=yok] tanedir.

What is the number of the filling defects? = [defectNumber|1, 2, 3, multiple]

Dolum defekti [defectNumber] tanedir.
The number of the filling defects is [defectNumber|1, 2, 3, multiple].

**Condition 1:** [defectNumber] > 0 && [defectNumber] < 4

(a) İlk dolum defekti hangi seviyededir? = [level|proksimal 1/3 ozafagus, orta 1/3 ozafagus, distal 1/3 ozafagus, tüm ozafagus, ozafagus mide birtəşmə düzəldir, ozafagusgastrik bələşdirə: proksimal 1/3 ozafagus; normal=yok].

What is level of the first filling defect? = [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, level of the esophagogastric junction, esophagogastric junction].

İlk dolum defektinin seviyesi [level]tur.
The level of the first filling defect is [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, level of the esophagogastric junction, esophagogastric junction].

**Condition 1:** [level] != “”

- İlk dolum defekti nasıldır? = [defect|düzgün çizgisel yapış, düzensiz polipoid saplı, düzensiz polipoid sapsız, düzensiz polipoid ülser, yılanvari kırıntılı dolum, çizgili plaklar, nodüler: düzgün çizgili yapış; normal=yok] şeklindedir.
How is the shape of the first filling defect? = [defect|regular linear structure, irregular polipoid pedunculated, irregular polipoid without pedunculated, irregular polipoid ulcerated, snakelike curly filled, linear discs, circular noduler].

İlk dolum defektin [defect] şeklindedir.

The first filling defect is in the shape of [defect|regular linear structure, irregular polipoid pedunculated, irregular polipoid without pedunculated, irregular polipoid ulcerated, snakelike curly filled, linear discs, circular noduler].

**Condition 1:** [defect] != ""  
i. İlk dolum defektinin boyutu ne kadardır? = [size]length: 2.5 cm ; min=0 cm, max=0 cm/ dir.  
What is the size of the first filling defect? = [size].  
İlk dolum defektinin boyutu ne kadardır [size]/dir.  
The size of the first filling defect is [size].

**Condition 2:** [defectNumber] > 1 && [defectNumber] < 4  
(a) İkinci dolum defekti hangi seviyededir? = [level|proksimal 1/3 özafagustur, orta 1/3 özafagustur, distal 1/3 özafagustur, tüm özafagustur, özafagus mide birleşim düzeyidir, özafagusgastrik bileşkedir; proksimal 1/3 özafagustur; normal=yok].  
What is level of the second filling defect? = [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, level of the esophagogastric junction, esophagogastric junction].  
İkinci dolum defektinin seviyesi [level].  
The level of the second filling defect is [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus, level of the esophagogastric junction, esophagogastric junction].

**Condition 1:** [level] != ""  
How is the shape of the second filling defect? = [defect|regular linear structure, irregular polipoid pedunculated, irregular polipoid without pedunculated, irregular polipoid ulcerated, snakelike curly filled, linear discs, circular noduler].  
İkinci dolum defektin [defect] şeklindedir.  
The second filling defect is in the shape of [defect|regular linear structure, irregular polipoid pedunculated, irregular polipoid without pedunculated, irregular polipoid ulcerated, snakelike curly filled, linear discs, circular noduler].

**Condition 1:** [defect] != ""  
i. İkinci dolum defektinin boyutu ne kadardır? = [size]length: 2.5 cm ; min=0 cm, max=0 cm/ dir.  
What is the size of the second filling defect? = [size].  
İkinci dolum defektinin boyutu ne kadardır [size]/dir.  
The size of the second filling defect is [size].

**Condition 3:** [defectNumber] > 2 && [defectNumber] < 4  
(a) Üçüncü dolum defekti hangi seviyededir? = [level|proksimal 1/3 özafagustur, orta 1/3 özafagustur, distal 1/3 özafagustur, tüm özafagustur, özafagus mide birleşim düzeyidir, özafagusgastrik bileşkedir; proksimal 1/3 özafagustur; normal=yok].
What is level of the third filling defect? = level \{ proximal \, 1/3 \, esophagus, middle \, 1/3 \, esophagus, distal \, 1/3 \, esophagus, whole \, esophagus, level \, of \, the \, esophagogastric \, junction, esophagogastric \, junction \}.

The level of the third filling defect is level \{ proximal \, 1/3 \, esophagus, middle \, 1/3 \, esophagus, distal \, 1/3 \, esophagus, whole \, esophagus, level \, of \, the \, esophagogastric \, junction \}.

Condition 1: level \(!= ""\)
- Üçüncü dolum defektin seviyesi level tur.

The third filling defect is in the shape of regular linear structure, irregular polipoid pedunculated, irregular polipoid without pedunculated, irregular polipoid ulcerated, snakelike curly filled, linear discs, circular noduler.

Condition 1: level \(!= ""\)

What is the size of largest the filling defect? = size \{ length: 2.5 cm ; min=0 cm, max=0 cm \}.

The size of the largest filling defect is size.

Condition 4: defectNumber \("\text{"\text{multiple}"

(a) En küçük dolum defektin boyutu ne kadardı? = size \{ length: 2.5 cm ; min=0 cm, max=0 cm \}.

The size of the largest filling defect is size.

Condition 1: defect \(!= "\)

- En küçük dolum defektin seviyesi level tur.

The level of the smallest filling defect is level \{ proximal \, 1/3 \, esophagus, middle \, 1/3 \, esophagus, distal \, 1/3 \, esophagus, whole \, esophagus, level \, of \, the \, esophagogastric \, junction, esophagogastric \, junction \}.

Condition 1: level \(!= "\)

- En küçük dolum defektin seviyesi level tur.

The smallest filling defect is in the shape of regular linear structure, irregular polipoid pedunculated, irregular polipoid without pedunculated, irregular polipoid ulcerated, snakelike curly filled, linear discs, circular noduler.
**Condition 1**: \(\text{[defect]} \neq \text{""} \)

i. What is the size of the smallest filling defect? = \(\text{[size]} \) dir.

En küçük dolum defektinin boyutu ne kadardır? = \(\text{[size]} \) dir.

The size of the smallest filling defect is \(\text{[size]} \).

**Condition 5**: \(\text{[defectNumber]} == \text{“multiple”} \)

(a) What is level of the largest filling defect? = \(\text{[level]} \)

En büyük dolum defektinin seviyesi \(\text{[level]} \) tur.

The level of the largest filling defect is \(\text{[level]} \).

**Condition 1**: \(\text{[defect]} \neq \text{""} \)

i. What is the size of the largest filling defect? = \(\text{[size]} \) dir.

En büyük dolum defektinin boyutu ne kadardır? = \(\text{[size]} \) dir.

The size of the largest filling defect is \(\text{[size]} \).

8. Is there ulcerated lesion in the mucosa of the esophagus? = \(\text{[ulcero_lezyon]} \)

Is there ulcerated lesion in the mucosa of the esophagus? = \(\text{[ulcero_lezyon]} \)

Özafagus mukozasında ılsere lezyon var mıdır? = \(\text{[ulcero_lezyon]} \)

How many ulcerated lesions are there? = \(\text{[lesionNumber]} \)

- Ulcere lezyonum kaç tanedir? = \(\text{[lesionNumber]} \)

How many ulcerated lesions are there? = \(\text{[lesionNumber]} \).
Ülserle lezyon \([\text{lesionNumber}]\) tanedir.
The number of the ulcerated lesions is \([\text{lesionNumber}]\) 1, 2, 3, multiple.

**Condition 1:** \([\text{lesionNumber}] > 0 \&\& \ [\text{lesionNumber}] < 4\)

(a) İlk ülserle lezyonun boyutu ne kadardır? = \([\text{size}]\) \(\text{length: } 2.5 \text{ cm} ; \text{min=0 cm, max=0 cm}\) dir.
What is the size of the first ulcerated lesion? = \([\text{size}]\).
İlk ülserle lezyonun boyutu \([\text{size}]\) dir.
The size of the first ulcerated lesion is \([\text{size}]\).

**Condition 1:** \(\text{CU}([\text{size}], 'cm') > 0\)
- İlk ülserle lezyonun şekli nasıldır? = \([\text{shape}_\text{UlceroLesion}]\) küçük yüzeyel ülserler, dev elmas (diamond shape), düzensiz sınırlı: küçük yüzeyel ülserler; normal=yok/ şeklindedir.
what is the shape of the first ulcerated lesion? = \([\text{shape}_\text{UlceroLesion}]\) small superficial ulcers, giant diamond ulcer, irregular restrictive.
İlk ülserle lezyonun \([\text{shape}_\text{UlceroLesion}]\) şeklindedir.
The shape of the first ulcerated lesion is \([\text{shape}_\text{UlceroLesion}]\) small superficial ulcers, giant diamond ulcer, irregular restrictive.

**Condition 2:** \([\text{lesionNumber}] > 1 \&\& \ [\text{lesionNumber}] < 4\)

(a) İkinci ülserle lezyonun boyutu ne kadardır? = \([\text{size}]\) \(\text{length: } 2.5 \text{ cm} ; \text{min=0 cm, max=0 cm}\) dir.
What is the size of the second ulcerated lesion? = \([\text{size}]\).
İkinci ülserle lezyonun boyutu \([\text{size}]\) dir.
The size of the second ulcerated lesion is \([\text{size}]\).

**Condition 1:** \(\text{CU}([\text{size}], 'cm') > 0\)
- İkinci ülserle lezyonun şekli nasıldır? = \([\text{shape}_\text{UlceroLesion}]\) küçük yüzeyel ülserler, dev elmas (diamond shape), düzensiz sınırlı: küçük yüzeyel ülserler; normal=yok/ şeklindedir.
what is the shape of the second ulcerated lesion? = \([\text{shape}_\text{UlceroLesion}]\) small superficial ulcers, giant diamond ulcer, irregular restrictive.
İkinci ülserle lezyonun \([\text{shape}_\text{UlceroLesion}]\) şeklindedir.
The shape of the second ulcerated lesion is \([\text{shape}_\text{UlceroLesion}]\) small superficial ulcers, giant diamond ulcer, irregular restrictive.

**Condition 3:** \([\text{lesionNumber}] > 2 \&\& \ [\text{lesionNumber}] < 4\)

(a) Üçüncü ülserle lezyonun boyutu ne kadardır? = \([\text{size}]\) \(\text{length: } 2.5 \text{ cm} ; \text{min=0 cm, max=0 cm}\) dir.
What is the size of the third ulcerated lesion? = \([\text{size}]\).
Üçüncü ülserle lezyonun boyutu \([\text{size}]\) dir.
The size of the third ulcerated lesion is \([\text{size}]\).

**Condition 1:** \(\text{CU}([\text{size}], 'cm') > 0\)
- Üçüncü ülserle lezyonun şekli nasıldır? = \([\text{shape}_\text{UlceroLesion}]\) küçük yüzeyel ülserler, dev elmas (diamond shape), düzensiz sınırlı: küçük yüzeyel ülserler; normal=yok/ şeklindedir.
what is the shape of the third ulcerated lesion? = \text{[shape\_UlceroLesion|small superficial ulcers, giant diamond ulcer, irregular restrictive]}. 

The shape of the third ulcerated lesion is \text{[shape\_UlceroLesion|small superficial ulcers, giant diamond ulcer, irregular restrictive]}. 

\textbf{Condition 4:} \text{[lesionNumber] == “multiple”} 

(a) En küçük ılsere lezyonun boyutu ne kadardır? = \text{[size|length: 0.5 cm ; min=0 cm, max=0 cm]}. 

\text{What is the size of the smallest ulcerated lesion? = \text{[size]}.} 

\text{En küçük ılsere lezyonun boyutu \text{[size]}.} 

The size of the smallest ulcerated lesion is \text{[size]}.

\textbf{Condition 1:} \text{CU([size], ‘cm’) > 0} 

- \text{En küçük ılsere lezyonun şekli nasıldır? = \text{[shape\_UlceroLesion|küçük yüzeyel ülseler, dev elmas (diamond shape), düzensiz sınırlı: küçük yüzeyel ülseler; normal=yok]}.} 

\text{what is the shape of the smallest ulcerated lesion? = \text{[shape\_UlceroLesion|small superficial ulcers, giant diamond ulcer, irregular restrictive]}.} 

\text{En küçük ılsere lezyonun \text{[shape\_UlceroLesion]}.} 

The shape of the first ulcerated lesion is \text{[shape\_UlceroLesion|small superficial ulcers, giant diamond ulcer, irregular restrictive]}. 

\textbf{Condition 5:} \text{[lesionNumber] == “multiple”} 

(a) En büyük ılsere lezyonun boyutu ne kadardır? = \text{[size|length: 2.5 cm ; min=0 cm, max=0 cm]}. 

\text{What is the size of the largest ulcerated lesion? = \text{[size]}.} 

\text{En büyük ılsere lezyonun boyutu \text{[size]}.} 

The size of the largest ulcerated lesion is \text{[size]}.

\textbf{Condition 1:} \text{CU([size], ‘cm’) > 0} 

- \text{En büyük ılsere lezyonun şekli nasıldır? = \text{[shape\_UlceroLesion|küçük yüzeyel ülseler, dev elmas (diamond shape), düzensiz sınırlı: küçük yüzeyel ülseler; normal=yok]}.} 

\text{what is the shape of the largest ulcerated lesion? = \text{[shape\_UlceroLesion|small superficial ulcers, giant diamond ulcer, irregular restrictive]}.} 

\text{En büyük ılsere lezyonun \text{[shape\_UlceroLesion]}.} 

The shape of the largest ulcerated lesion is \text{[shape\_UlceroLesion|small superficial ulcers, giant diamond ulcer, irregular restrictive]}. 

9. Özafagusta dolum fazlalığı var mıdır? = \text{[filling\_diverticular|yoktur, vardır: yoktur; normal=yoktur]}. 

Is there an outpouching in the esophagus? = \text{[filling\_diverticular|There isn’t, There is].} 

Özafagusta dolum fazlalığı \text{[filling\_diverticular]}.

\text{[filling\_diverticular|There isn’t, There is] an outpouching in the esophagus.} 

\textbf{Condition 1:} \text{[filling\_diverticular] == “vardır”}
- Dolum fazlalığı kaç tanedir? = [number_diverducular|1, 2, 3, multiple: 1; normal=yok] tanedir.
  How many outpouchings are there? = [number_diverducular|1, 2, 3, multiple].
  Dolum fazlalığı [number_diverducular] tanedir.

The number of outpouchings is [number_diverducular|1, 2, 3, multiple].

Condition 1: [number_diverducular] > 0 && [number_diverducular] < 4

(a) İlk dolum fazlalığı seviyesi nedir? = [level|proksimal 1/3 özafagus, orta 1/3 özafagus, distal 1/3 özafagus, tüm özafagus: proksimal 1/3 özafagus; normal=yok] tur.
  What is the level of the first outpouching? = [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus].
  İlk dolum fazlalığı seviyesi [level] tur.

The level of the first outpouching is [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus].

Condition 1: [level] != ""
  – İlk dolum fazlalığı nerededir? = [place_fillingDiverducular|orta hattadır, arkadadır, lateraldedir: orta hattadır; normal=yok].
    where is the outpouching filling? = [place_fillingDiverducular|middle outline, back, lateral].

  İlk dolum fazlalığı [place_fillingDiverducular].

The first outpouching is in [place_fillingDiverducular|middle outline, back, lateral].

Condition 1: [place_fillingDiverducular] != ""
  i. İlk dolum fazlalığı boyutu ne kadardır? = [size|length: 1.5 cm; min=0 cm, max=0 cm] dir.
    What is the size of the first outpouching? = [size].

  İlk dolum fazlalığı boyutu [size] dir.

The size of the outpouching is [size].

Condition 2: [number_diverducular] > 1 && [number_diverducular] < 4

(a) İkinci dolum fazlalığı seviyesi nedir? = [level|proksimal 1/3 oesophagus, orta 1/3 oesophagus, distal 1/3 oesophagus, tüm oesophagus: proksimal 1/3 oesophagus; normal=yok] tur.
  What is the level of the second outpouching? = [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus].
  İkinci dolum fazlalığı seviyesi [level] tur.

The level of the second outpouching is [level|proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus].

Condition 1: [level] != ""
  – İkinci dolum fazlalığı nerededir? = [place_fillingDiverducular|orta hattadır, arkadadır, lateraldedir: orta hattadır; normal=yok].
    where is the second outpouching ? = [place_fillingDiverducular|middle outline, back, lateral].

  İkinci dolum fazlalığı [place_fillingDiverducular].

The second outpouching is in [place_fillingDiverducular|middle outline, back, lateral].

Condition 1: [place_fillingDiverducular] != ""
  i. İkinci dolum fazlalığı boyutu ne kadardır? = [size|length: 1.5 cm; min=0 cm, max=0 cm] dir.
    What is the size of the second outpouching ? = [size].
İkinci dolum fazlalığının boyutu [size] dir.
The size of the second outpouching is [size].

Condition 3: [number_diverducular] > 2 & & [number_diverducular] < 4

(a) Üçüncü dolum fazlalığı seviyesi nedir? = [level]proximal 1/3 özafagus, orta 1/3 özafagus, distal 1/3 özafagus, tüm özafagus: proksimal 1/3 özafagus; normal=yok/tur.
What is the level of the third outpouching? = [level]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.
Üçüncü dolum fazlalığı seviyesi [level]/tur.
The level of the third outpouching is [level]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.

Condition 1: [level] != “”
– Üçüncü dolum fazlalığını nerededir? = [place_fillingDiverducular]orta hattadır, arkadadır, lateraledir: orta hattadır; normal=yok].
where is the third outpouching? = [place_fillingDiverducular]middle outline, back, lateral].
Üçüncü dolum fazlalığı [place_fillingDiverducular].
The third outpouching is in [place_fillingDiverducular]middle outline, back, lateral].

Condition 1: [place_fillingDiverducular] != “”

i. Üçüncü dolum fazlalığının boyutu ne kadardır? = [size]length: 1.5 cm; min=0 cm, max=0 cm] dir.
What is the size of the third outpouching? = [size].
Üçüncü dolum fazlalığının boyutu [size]/dir.
The size of the third outpouching is [size].

Condition 4: [number_diverducular] == “multiple”

(a) En küçük dolum fazlalığı seviyesi nedir? = [level]proximal 1/3 özafagus, orta 1/3 özafagus, distal 1/3 özafagus, tüm özafagus: proksimal 1/3 özafagus; normal=yok/tur.
What is the level of the smallest outpouching? = [level]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.
En küçük dolum fazlalığı seviyesi [level]/tur.
The level of the smallest outpouching is [level]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.

Condition 1: [level] != “”
– En küçük dolum fazlalığı nerededir? = [place_fillingDiverducular]orta hattadır, arkadadır, lateraledir: orta hattadır; normal=yok].
where is the smallest outpouching? = [place_fillingDiverducular]middle outline, back, lateral].
En küçük dolum fazlalığı [place_fillingDiverducular].
The smallest outpouching is in [place_fillingDiverducular]middle outline, back, lateral].

Condition 1: [place_fillingDiverducular] != “”

i. En küçük dolum fazlalığının boyutu ne kadardır? = [size]length: 1.5 cm; min=0 cm, max=0 cm] dir.
What is the size of the smallest outpouching? = [size].
Condition 5: [number_diverducular] == “multiple”

(a) En büyük dolum fazlalığı seviyesi nedir? = [level]proksimal 1/3 özafagus, orta 1/3 özafagus, distal 1/3 özafagus, tüm özafagus: proksimal 1/3 özafagus; normal=yok[tur].

What is the level of the largest outpouching? = [level]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.

En büyük dolum fazlalığı seviyesi [level]tur.
The level of the largest outpouching is [level]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.

Condition 1: [level] != ""

- En büyük dolum fazlalığını nerededir? = [place_fillingDiverducular]orta hattadır, arkadaşır, lateraldedir: orta hattadır; normal=yok[.]

where is the largest outpouching? = [place_fillingDiverducular]middle outline, back, lateral.

En büyük dolum fazlalığı [place_fillingDiverducular].
The largest outpouching is in [place_fillingDiverducular]middle outline, back, lateral.

Condition 1: [place_fillingDiverducular] != ""

i. En büyük dolum fazlalığının boyutu ne kadardır? = [size]length: 1.5 cm; min=0 cm, max=0 cm [dir].

What is the size of the largest outpouching? = [size].

En büyük dolum fazlalığının boyutu [size] dir.
The size of the largest outpouching is [size].


Is there any significant abnormal dilatation in esophagus during the transition of contrast media? = [dilatation]There isn’t, There is[.]

Kontrast maddenin geçişi sırasında özafagusta normal dış belirgin genişleme [dilatation].

[dilatation]There isn’t, There is/ significant abnormal dilatation in esophagus during the transition of contrast media.

Condition 1: [dilatation] == “vardır”

- Normal dış belirgin genişleme özafagusun neresindedir? = [dilatation_place]proksimal 1/3 özafagus, orta 1/3 özafagus, distal 1/3 özafagus, tüm özafagus: proksimal 1/3 özafagus; normal=yok[.]

Where is the significant abnormal dilatation in esophagus? = [dilatation_place]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus.

Normal dış belirgin genişleme [dilatation_place].
The significant abnormal dilatation in esophagus is [dilatation_place]proximal 1/3 esophagus, middle 1/3 esophagus, distal 1/3 esophagus, whole esophagus[.]

11. Özafagusta geçirilmiş cerrahi müdahale var mı? = [operation]yoktur, vardır: yoktur; normal=yoktur[.]

Is there any surgical operation in the esophagus? = [operation]There isn’t, There is[.]

Özafagusta geçirilmiş cerrahi müdahale [operation].

**Condition 1:** [operation] == “vardır”

- Anastomoz hattı genişliği nasıldır? = [Anas_line] normaldir, dardır: normaldir; normal=normaldir].
  How is the wideness of anastomoses line? = [Anas_line] normal, narrow].
  Anastomoz hattı genişliği [Anas_line].
  The wideness of anastomoses line is [Anas_line] normal, narrow].

    Is there hernia in the distal esophagus? = [hernia] There isn’t, There is].
    Distal özafagusta herni [hernia].
    [hernia] There isn’t, There is] hernia in the distal esophagus.

**Condition 1:** [hernia] == “vardır”

  What is the type of hernia?= [hernia_type] sliding, paraesophag, mixed, short esophagus]
  Herni [hernia_type] tipindedir.
  The type of esophagus is [hernia_type] sliding, paroesophag, mixed, short esophagus]

    Is there a gastro-esophagus reflux?= [reflux] There isn’t, There is, Not tested].
    Gastroözafagiel reflü [reflux].
    [reflux] There isn’t, There is, Not tested] a gastro-esophagus reflux.
A.3 A Questionnaire to Test the Acceptance and the Efficiency of SISDS Methodology

The most common data collecting methods itemized below including SISDS in medical reporting are compared to each other by the questionnaire in terms of the questions enumerated below. All questions are close ended and have multiple options. The options are depicted above the questions. The option character written at the end of each question in parenthesis indicate which options itemized above the questions are taken into consideration for the current question. Each question is asked to users and evaluated for every method one by one as depicted(Figure 8).

1. Do you agree that a targeted and desired quality of care can be delivered through uniform work practices with the current model?

<table>
<thead>
<tr>
<th>METHOD</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>HANDWRITING</td>
<td>Totally Agree</td>
</tr>
<tr>
<td>TOS</td>
<td>Totally Agree</td>
</tr>
<tr>
<td>RTTOS</td>
<td>Totally Agree</td>
</tr>
<tr>
<td>TELEPHONE</td>
<td>Totally Agree</td>
</tr>
<tr>
<td>DBSR</td>
<td>Totally Agree</td>
</tr>
<tr>
<td>ASDCIAS</td>
<td>Totally Agree</td>
</tr>
<tr>
<td>SISDS</td>
<td>Totally Agree</td>
</tr>
</tbody>
</table>

Figure 8: An example for the questionnaire

METHODS EVALUATED IN THE QUESTIONNAIRE:

- HANDWRITING
- TOS (TRANSCRIPTIONIST-ORIENTED SYSTEMS (Recorded speech files to be dictated later by medical transcriptionists))
- RTTOS (REAL TIME TRANSCRIPTIONIST-ORIENTED SYSTEMS (Recording in real-time using medical transcriptionists))
- TELEPHONE (TELEPHONE ACCESS (automated voice recording system))
- DBSR (DICTATION BY SPEECH RECOGNITION)
- ASDCIAS (ALL STRUCTURED DATA COLLECTED IN A SCREEN)
- SISDS (Structured, Interactive, Standardized, Decision Supporting Methodology)
Options for the questions in the questionnaire in English:

(a) Totally Agree, Agree, Neither Agree Nor Disagree, Disagree, Totally Disagree
(b) Totally Prefer, Prefer, No Idea, Not Prefer, Totally Not Prefer
(c) Totally Recommend, Partially Recommend, No Idea, Partially Not Recommend, Totally Not Recommend
(d) Totally Think, Think, No Idea, Not Think, Totally Not Think
(e) Totally Believe, Believe, No Idea, Not Believe, Totally Not Believe
(f) About an Hour, 1-3 Hours, 3-9 Hours, About a day, 1-6 Days, About a Week, More Than a Week
(g) Still Using, Used Partially, Never used

Questions

1. Do you agree that a targeted and desired quality of care can be delivered through uniform work practices with the current model? (a)

2. Do you agree that users are guided thoroughly through details to analyze correctly with the current model? (a)

3. Do you agree that the current model provides an educational/training support? (a)

4. Do you agree that the current model is user-friendly? (a)

5. Do you agree that the current model will sure increase the overall level of job performance and provide faster response to physician’s clinical orders? (a)

6. Do you agree that recruits will be oriented faster with the current model? (a)

7. Do you agree that the current model will increase employee autonomy, enhancing employee empowerment, improving individual competence and tailorable? (a)

8. Do you agree that the training cost of recruits will be reduced with the current model? (a)

9. Do you agree that the current model will provide same medical reporting quality for every case in terms of the differences between inexperienced and experienced? (a)

10. Do you agree that the current model will standardize the working processes better? (a)

11. Do you believe that the current model will increase healthcare professionals’ productivity? (e)

12. Do you agree that your unit will get a continuous improvement of complex and changing tasks in your learning organization? (a)

13. Do you agree that knowledge capture and capitalization, management of knowledge systematically and institutionalizing best practice will be provided well with the current model? (a)
14. Do you agree that the current model is providing a data/information base or ideal domain, content management, consistent content while medical reporting? (a)

15. Do you agree that the current model will store more quality structured data for further analysis and research? (a)

16. Do you agree that the current model is better in terms of reducing medical error and improving patient safety? (a)

17. Do you agree that the current model will reduce the cost of transcriptionist usage? (a)

18. Do you agree that the current method will preserve the privacy and confidentiality between experts and patients? (a)

19. Do you agree that the current model will preserve the hygienic working environment while medical reporting (anjio, ultrasound etc)? (a)

20. Do you agree that the current model will support examining physicians while diagnosing process through examining data in prepared medical reports? (a)

21. Do you agree that the current model will provide an advisory diagnosis itself in view of the previous prepared reports including their diagnoses? (a)

22. Do you agree that the current model will prevent the lesion blindness during reporting process? (a)

23. Do you agree that the current model will increase patients’ satisfaction? (a)

24. Do you prefer to use the current model while medical reporting? (b)

25. Do you recommend the current model to health professionals to use while medical reporting? (c)

26. Do you think that the current model will increase healthcare professionals’ job satisfaction? (d)

27. Do you agree that you will focus the processes better while reporting with the current model? (a)

28. Do you think that the current model is overall cost-efficient? (d)

29. Do you think that the current model will decrease system maintenance and support cost? (d)

30. Do you think that the current model can meet the overall desired benefits in terms of its all functions? (d)

31. How long does it take you to learn the current model with all its functions to form an ideal medical report? (f)

32. Which model have you used up to now and which model are you still using right now? (g)
Options for the questions in the questionnaire in Turkish:

(a) Kesinlikle Katılıyorum, Katılıyorum, Ne Katılıyorum ne de Katılmıyorum,Katılmıyorum, Kesinlikle Katılmıyorum
(b) Kesinlikle Tercih Ederim, Tercih Ederim, Fikrim Yok, Tercih Etmem,Kesinlikle Tercih Etmem
(c) Kesinlikle Öneririm, Kismen Öneririm, Fikrim Yok, Kismen Önermem, Kesinlikle Önermem
(d) Kesinlikle Düşünüyorum, Düşünüyorum, Fikrim Yok, Düşünmüyorum, Kesinlikle Düşünmüyorum
(e) Kesinlikle İnanıyorum, İnanıyorum, Fikrim Yok, İnanmıyorum, Kesinlikle İnanmıyorum
(f) Bir Saat, 1-3 Saat, 3-9 Saat, Bir Gün, 1-6 Gün, Bir Hafta, Bir Haftadan Fazla
(g) Halen kullanmaktayım, Kismen Kullandım, Hiç kullanmadım

**Questions**

1. İlgili yöntemle, farklı uzmanlar tarafından, her seferinde, hedeflenen ve arzulanan kalitede hizmet verilebileceğine katılıyorsunuz? (a)
2. İlgili yöntemle, yapılan değerlendirmenin, doğru ve tam olarak yapılabilmesi için, kullanıcıların doğru olarak yönlendirilebileceğine katılıyorsunuz? (a)
3. İlgili yöntemün öğretici ve eğitici olduğunu katılıyorsunuz? (a)
4. İlgili yöntemin kullanıcı dostu olduğunu katılıyorsunuz? (a)
5. İlgili yöntem, iş performansını artıracakına, tubbi rapor oluştururken, raporu kullanıma sunum açısından performans etkin olacağını katılıyorsunuz? (a)
6. İlgili yöntemle, işe yeni başlayanpersonelin daha cabuk oriente olabileceğine katılıyorsunuz? (a)
7. İlgili yöntem, kullanıcıya daha bağımsız(başka birine ihtiyaç duymadan) bir çalışma ortamı sağlayacağını katılıyorsunuz? (a)
8. İlgili yöntem, işe yeni başlayanpersonelin eğitilmesini maliyetlerini düşüreceğine katılıyorsunuz? (a)
9. İlgili yöntemin, en uzman ve en acemi arasında, kullanım esnasında aynı kalitede raporlama hizmeti sunabileceği katılıyorsunuz? (a)
10. İlgili yöntemin, yapılan işi daha standart bir hale getireceğine katılıyorsunuz? (a)
11. İlgili yöntemle çalışmanın verimliliğinin artacağına inanıyor musunuz? (e)
12. İlgili yöntemi kullanarak, biriminizin, belirli politikalara uygulanarak devamlı bir gelişme içerisinde olabileceğine katılıyorsunuz? (a)
13. İlgili yöntemi kullanarak, üstbilginin(knowledge) daha iyi yönetilebileceğine katılıyorsunuz? (a)
14. İlgili yöntemin, raporun ideal bir şekilde doldurulması maddi ile yeterli bilgiye ulaşım desteği sağladığına katılıyorsunuz? (a)
15. İlgili yöntem, ileride araştırma yapacaklar için daha kaliteli yapış veri oluşturulabileceğine katlıyor musunuz? (a)

16. İlgili yöntem, hasta sağlığı ve tıbbi hataların azaltılması açısından, daha sağlıklı olduğunu katlıyor musunuz? (a)

17. İlgili yöntem, tıbbi sekreter kullanımını azaltacağına katlıyor musunuz? (a)

18. İlgili yöntem, tıbbi raporlama esnasında, uzmanla arasındaki mahremiyeti koruyabileceğine katlıyor musunuz? (a)

19. İlgili yöntem, anjio, ultrasound vb raporların oluşturulması esnasında hijyenik çalışma ortamlarını koruyabileceğini düşünüyor musunuz? (d)

20. İlgili yöntem kullanılmazsa, raporu değerlendirirecek uzmanların açısından baktığınızda, oluşturulmuş olan rapordaki verilerin değerlendirilmesinde, koyulacak olan tanımm daha doğru olmasına katkı sağlayacağına katlıyor musunuz? (a)

21. İlgili yöntem, önceki benzer raporlar ışığında, kendiliğinden öğrenek, doğru karara yönelik tavsıye niteliğinde tanı koyabileceğine katlıyor musunuz? (a)

22. İlgili yöntem, raporlama esnasında lezyon körlüğünü öneleyebileceğine katlıyor musunuz? (a)

23. İlgili yöntem kullanılmazsa, hizmet alan hasta memnuniyetinin artacağına katlıyor musunuz? (a)

24. İlgili yöntem, tıbbi raporlarımızı oluştururken kullanmayı tercih eder misiniz? (b)

25. İlgili yöntem, uzmanların raporlarını oluştururken, kullanımlarını önerir misiniz? (c)

26. İlgili yöntem iş tatminini artıracak düşündüğünüz musunuz? (d)

27. İlgili yöntem, rapor oluştururken, yapılan işe daha fazla odaklanma sağlayacağına katlıyor musunuz? (a)

28. İlgili yöntem oldukça maliyet etkin olduğunu düşündüğünüz musunuz? (d)

29. İlgili yöntemle, sistem bakım ve geliştirme maliyetlerinin daha az olabileceğini düşünüyor musunuz? (d)

30. İlgili yöntem, tüm parametreleri ile bir değerlendirme yaptığınızda, elde edilmiş istenen tüm faydaları karşılayabileceğini düşünüyor musunuz? (d)

31. İlgili yöntemle, ideal rapor oluşturulma açısından baktığınızda tüm fonksiyonları ile ne kadar zamanda öğrenebildiniz?

32. Siz şimdiye kadar hangi yöntemi kullanırdınız ve haliyle kullanmakta oltuğunuz yöntem hangisidir? (g)