On the Use of Vignettes for Eliciting Test-Selection Strategies

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Abstract

Decision-support systems often include a strategy for selecting tests in their field of application. This strategy in essence captures procedural knowledge and serves to provide support for the reasoning processes involved. Generally, a test-selection strategy is offered in which tests are selected sequentially. For our field of application, we noticed that such a strategy would be an oversimplification, and decided to acquire knowledge about the actual strategy used by the experts. To this end, we composed a method that comprised an unstructured interview to gain general insight in the test-selection strategy used, and a subsequent structured interview, simulating daily practice through vignettes, to acquire full details. We used the method with two experts in our field of application and found that it closely fitted in with their daily practice and resulted in a large amount of detailed knowledge.

Keywords:

Decision-support systems; Knowledge elicitation; Procedural knowledge; Selection of diagnostic tests

1. Introduction

Decision-support systems are being developed for a wide range of medical fields. To support the reasoning processes in its field of application, such a system often includes a strategy for selecting tests. The system may, for example, suggest a number of diagnostic tests to be performed in order to reduce the uncertainty about a patient's true condition. In most decision-support systems, a strategy is offered in which tests are selected in a sequential manner. The system then suggests a test to be performed and awaits the user's input; after taking the test's result into account, the system suggests a subsequent test, and so on.

With the help of two experts in gastrointestinal oncology, we have developed, over a period of more than five years, a decision-support system for the field of oesophageal cancer [1]. Our system at present does not support the selection of diagnostic tests. Building upon its decision-theoretic foundation, however, a sequential test-selection strategy could easily be designed. Such a strategy would select, in a stepwise manner, the test that is the most...
informative given the already available evidence [2,3]. Upon working with our system, however, we felt that a sequential test-selection strategy would not be appropriate, as it appeared to be an oversimplification of our experts’ daily problem-solving practice. We decided, therefore, to design a new strategy that builds upon the arguments used by the experts for deciding whether or not to order specific tests. The resulting strategy then is expected to more closely fit in with the strategies for test selection that are currently employed in practice than a sequential test-selection strategy.

To gain insight in the actual test-selection strategy used by our experts, and in the arguments underlying their strategy more specifically, we composed a special-purpose method for eliciting this type of procedural knowledge. Building upon techniques commonly used for knowledge elicitation [4], our method was composed of two main interviews. The first of these was an unstructured interview that was aimed at providing insight in the overall strategy used. The second interview was a structured interview in which further details were acquired. In this latter interview, the experts’ daily practice was carefully simulated by means of cards, or vignettes, describing realistic patient cases.

We used our elicitation method with the two experts in our field of application. We found that the method, and the use of carefully designed realistic patient cases more specifically, closely fitted in with the experts’ daily problem-solving practice. The method resulted in a large amount of detailed knowledge, not just about the actual test-selection strategy employed but also about the experts’ reasons for ordering certain tests and for deciding not to order other ones. Although we used our method within the field of oesophageal cancer only, we feel that it is a more generally applicable, valuable method for gaining insight in medical problem-solving strategies.

The paper is organised as follows. In Section 2, we provide some preliminaries on oesophageal cancer and its therapies. In Section 3, we present an overview of our elicitation method. In Section 4, we focus on the use of vignettes. In Section 5, we briefly comment on our method. The paper ends with our concluding observations in Section 6.

2. The Domain of Application

Cancer of the oesophagus has a low incidence in the Netherlands and is often only diagnosed in an advanced stage of the disease. An oesophageal tumour typically invades the wall of the oesophagus and may, in time, invade neighbouring organs. When the tumour has invaded lymphatic vessels and blood vessels, it may give rise to secondary tumours, or metastases, in lymph nodes and in such organs as the liver and lungs. The depth of invasion of the primary tumour and the extent of its metastases indicate the severity of the disease, which is summarised in the cancer’s stage. In order to assess the stage of a patient’s oesophageal cancer, generally a number of diagnostic tests are performed, such as a gastroscopy and a CT-scan of the abdomen. Different tests serve to give insight in different aspects of the cancer.

For patients suffering from oesophageal cancer, various different treatment alternatives are available. These alternatives include surgical removal of the primary tumour, administering radiotherapy, positioning a prosthesis, and chemotherapy. Providing a therapy aims at removal or reduction of the patient’s primary tumour to prolong life expectancy and to improve the passage of food through the oesophagus. The therapies differ in the extent to which these effects can be attained.
3. The Overall Method

To gain insight in the test-selection strategy used by our experts, we composed a special-purpose method for eliciting this type of procedural knowledge. In our method we used two types of interview.

The first, unstructured interview was aimed at obtaining insight into the overall test-selection strategy employed and into the general arguments used by the experts for deciding whether or not to order specific tests. The main issues addressed in this first interview were whether or not the experts are guided by a standard procedure for selecting diagnostic tests, or are mainly guided by their own experience; whether the various tests are performed in parallel, or sequentially; which criteria the experts use for selecting tests and which criteria they use for deciding to stop testing. To gain insight in these issues, we prepared a small number of open questions. The main question was “Can you describe the way in which you select and order diagnostic tests, starting from the first consultation with a patient up to and including your final decision about the most suitable therapy?”. Since we wanted to avoid biasing the experts, we let them talk freely and did not interrupt unless it was strictly necessary, for example when further elaboration was desired. These interruptions then only consisted of open questions such as “Why?” or “What are you thinking right now?”.

Since the unstructured interview was focused on the test-selection strategy itself and not on real patients, we were aware that we risked acquiring a general, text-book procedure rather than the experts’ daily problem-solving practice [5]. We decided therefore to follow up on the first interview by a second, structured interview in which the experts were asked to think aloud and confer, while deciding, for a number of patients, which diagnostic tests to order. We felt that working with patient cases in a carefully conducted manner would closely fit in with the experts’ daily practice and would thus reduce possible biases from the elicitation method used. The aim of this second interview was to fill in details of the test-selection strategy employed and, more specifically, of the arguments underlying the strategy. We again asked the experts to discuss out loud the process from the first consultation with each patient up to and including their decision about the most suitable therapy.

The interviews were conducted at the Netherlands Cancer Institute, the home institute of the experts, who are the last two authors of the present paper. The first author conducted the interview, asking the questions that had been prepared. Since the second author, who developed the decision-support system with the two experts, had accumulated considerable knowledge about oesophageal cancer and its treatment, we felt that she might unknowingly and unwillingly bias the experts in their answers. She therefore did not partake in the main interview and only asked the more elaborate questions that emerged during the interviews. The third author typed in, using a laptop, the exact words both the interviewers and the experts used. We did not use a voice recorder since the experts had already indicated that they would feel hampered by it. For full details of our method, we would like to refer to a forthcoming extended paper [6].

4. Using Vignettes

As outlined in the previous section, we started with an unstructured interview to obtain insight in the overall test-selection strategy employed by our experts. From this interview, we found that tests are not ordered sequentially but rather in parallel. More specifically, we found that tests are ordered in three packages. Upon first seeing a patient, the experts order
the starting package of tests, including, for example, a gastroscopy. After the results from these tests have become available, the experts decide whether or not further testing is indicated. When further testing is opportune, the basic package of tests is ordered; this package includes, for example, a CT-scan of the abdomen. The remaining tests constitute the extensive package of tests. In contrast with the starting and basic packages of tests, not all tests from this last package are ordered just like that: one or more tests may be selected.

The main reason for parallel testing is the loss of time that would be incurred by sequential testing. For example, it may take several weeks before the results of tests become available and, the tumour having progressed within that time, the results may by then be unreliable. Although by ordering diagnostic tests simultaneously, more tests are likely to be performed than are strictly necessary, the experts indicated that they did not see this as a problem.

- **Age:** 67 years
- **Biopsy:** adenocarcinoma
- **Gastroscopy:**
  - Circumference: circular
  - Length: between 5 and 10 centimeter
  - Location: distal
  - Necrosis: positive
  - Shape: scirrhous
- **Passage:** puree
- **Physical condition:** no COPD, normal heart condition
- **Weight loss:** less than 10%

- **CT:**
  - Liver: negative
  - Loco regio: positive
  - Lungs: negative
  - Organs: diaphragm involvement
  - Truncus coeliacus: positive
- **Endosonography:**
  - Loco regio: positive
  - Mediastinum: negative
  - Wall: T3
- **Sonography neck:** positive
- **X-lungs:** positive

- **Barium swallow:** negative
- **Bronchoscopy:** negative
- **Laparoscopy:**
  - Diaphragm: tumour involvement
  - Liver: negative
  - Truncus coeliacus: negative

**Figure 1** – The three vignettes.

To acquire further details of the test-selection strategy used, we decided to simulate the experts’ daily problem-solving practice through carefully selected patient cases. We decided not to work with historical patient cases, since the experts might recall these patients and let the real final outcome influence their test-selection behaviour. Instead, we decided to employ fictitious patient cases. Working with fictitious patient cases brought the
additional advantage that it allowed us to design cases that were specifically suited to explore the experts’ decision boundaries. We prepared three cards, or vignettes, for each patient, with the results of the three different packages of tests. Since the tests from a single package would be ordered in parallel, we decided to present the results of these tests simultaneously, and not one by one. Since the experts might feel that the first results on a card are the more important, we simply listed them in alphabetical order and informed the experts of this order to avoid biasing their problem-solving behaviour. Figure 1 shows the vignettes for one of the eight patient cases that we designed.

We asked the experts to discuss each patient case out loud and to pretend that they were ordering real tests for real patients. For each patient, the card with the results of the tests from the starting package was presented first. Upon being presented with the first card for the patient case shown in Figure 1, for example, the experts reasoned as follows:

“Oh, a common patient! We regularly see this type of patient. As his physical condition is quite good and the tumour is of moderate size, we might wish to consider surgery, so let’s do the basic package of tests.”

Only when the experts indicated that they would order additional tests, would we show the second card, with the test results from the basic package. Upon considering the second card, the experts also had access to the first card; they could thus survey the accumulated patient data. When still further testing was desired, the last card was presented. The interview was conducted in the setting described in Section 3 and took approximately two hours for the eight patient cases that we had designed.

From the first interview we had learned various distinguishing features of the test-selection strategy employed by our experts. The second interview served to corroborate and further detail our previous observations. It provided additional insight especially in the way in which the experts used the results from the different tests as arguments for their subsequent decisions. The second interview further most prominently demonstrated that, from the very first moment of seeing a patient, the experts think in terms of appropriate treatment alternatives, rather than in terms of establishing the stage of the patient’s cancer.

5. Discussion

We found our special-purpose elicitation method to be quite effective. Especially the use of vignettes appeared to closely fit in with our experts’ problem-solving practice. In fact, the experts explicitly mentioned that using the vignettes was very intuitive:

“These cards and the way we discuss them are very similar to how patients are presented during the sessions we have with colleagues to discuss patients.”

The only difference with the experts’ daily practice may have been that in the current interview setting, not facing a real patient and with less time-pressure, the experts were more consistent and more thorough in their decisions than they usually are. One of the experts mentioned:

“Perhaps we are now more consistent that we normally are in practice.”

To summarise our experiences, we felt that linking up with practice was highly advantageous for the purpose of acquiring knowledge of the test-selection strategy used by
our experts. We would like to note, however, that especially for the set-up of the second, structured interview, considerable prior knowledge of the field of application appeared to be imperative. Without prior knowledge, we would not have been able to design the fictitious patient cases in a way that allowed us to explore the experts’ decision boundaries.

6. Conclusions

Upon working with our decision-support system for oesophageal cancer, we felt that using the sequential test-selection strategies commonly proposed in the decision-making literature, would be an oversimplification of the experts’ daily problem-solving practice. We decided to acquire knowledge about the actual strategies used to provide for the development of a new test-selection strategy for our system. To acquire this type of procedural knowledge, we composed an elicitation method that was comprised of two focused interviews: an unstructured interview, followed up by a structured one. With the first, unstructured interview, we found that tests were ordered not sequentially but in three different packages, with the tests from a single package ordered simultaneously. With the second, highly structured interview, we were able to fill in the details of the general strategy that we had elicited. In this second interview, we built upon the use of vignettes to simulate the experts’ problem-solving practice. Through these vignettes, we were able to establish the different arguments for the experts’ test-selection decisions. We now plan to extend our decision-support system with an automated test-selection strategy based upon these arguments.

7. References


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