

DATA COLLECTION AND PROCESSING SOFTWARE IN LONG-TERM CARE

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Abstract

Data acquisition and subsequent evaluation are crucial tools both for effective quality management of long-term care institutions, as well as for research in the social field. These data analyze, for instance, self-sufficiency or frailty and their risk factors. Data collection (from the social care institutions in the Czech Republic) is performed in the form of paper questionnaires. However, this method is inappropriate from the viewpoint of long-term storage and bulk processing. Therefore, we developed a comprehensive software suite that is designed for use in long-term care institutions. This software suite consists of three tools: the questionnaire editor, a tool for digitizing printed questionnaires, and web application for electronic completion of the questionnaires. The data are electronically stored, which means data can be easily managed and fully available for the needs of long-term care institutions or scientists.

Keywords

data acquisition, long-term care, questionnaires, web storage, assessment tools

1. Introduction

Considering the demographic structure of the population and the increasing number of patients with chronic diseases, long-term nursing care is a significant health and socio-economic issue [1, 2, 3]. Despite the tendency to modernize and increase the quality of long-term care, its availability and quality are not adequate in the Czech Republic. One of the crucial elements of effective planning and quality management of long-term care is the collection of data. These data analyze, for instance, self-sufficiency or frailty and their risk factors. Apart from the economic point of view, data collection is also important for research in the social and demographic area [4, 5].

Nowadays, long-term nursing institutions use paper surveys for data acquisition and storage. This method is not appropriate for long-term storage, mass processing or evaluation. The solution would be software that allows not only questionnaire creation, but also the digitization of completed data, storage and processing. Hence, we introduce a software suite that meets the needs of long-term care institutions. These tools offer the possibility of creating questionnaires that can be either filled in electronically or printed. The completed printed version can be scanned and the data converted into electronic form. Our software was developed in cooperation with the Centre of Gerontology and CELLO Faculty of Humanities, Charles University in Prague and consultation with the Czech Alzheimer Society.

The screenshot shows a software window titled "Form edit - GSD999". The window contains a form for the "Geriatric Depression Scale". At the top, there are fields for "ID:" (a grid of 10 boxes) and "Facility ID:" (a barcode). Below these is the title "Geriatric Depression Scale" and a "Date:" field (a grid of 6 boxes). A note says "please cross the box (x)". The form contains 15 numbered questions, each with "YES" and "NO" checkboxes. At the bottom, there is a "Total score:" field with two boxes for the score.

Question	YES	NO
1. Are you basically satisfied with your life?	<input type="checkbox"/>	<input type="checkbox"/>
2. Have you dropped many of your activities and interests?	<input type="checkbox"/>	<input type="checkbox"/>
3. Do you feel that your life is empty?	<input type="checkbox"/>	<input type="checkbox"/>
4. Do you often get bored?	<input type="checkbox"/>	<input type="checkbox"/>
5. Are you in good spirits most of the time?	<input type="checkbox"/>	<input type="checkbox"/>
6. Are you afraid that something bad is going to happen to you?	<input type="checkbox"/>	<input type="checkbox"/>
7. Do you feel happy most of the time?	<input type="checkbox"/>	<input type="checkbox"/>
8. Do you often feel helpless	<input type="checkbox"/>	<input type="checkbox"/>
9. Do you prefer to stay at home, rather than going out and doing things?	<input type="checkbox"/>	<input type="checkbox"/>
10. Do you feel you have more problems with memory than most?	<input type="checkbox"/>	<input type="checkbox"/>
11. Do you think it is wonderful to be alive now?	<input type="checkbox"/>	<input type="checkbox"/>
12. Do you feel pretty worthless the way you are now?	<input type="checkbox"/>	<input type="checkbox"/>
13. Do you feel full of energy?	<input type="checkbox"/>	<input type="checkbox"/>
14. Do you feel that your situation is hopeless?	<input type="checkbox"/>	<input type="checkbox"/>
15. Do you think that most people are better off than you?	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1 — Software tool for data digitizing

2. Survey management tools

Electronic format of data is crucial for their processing and evaluation. Therefore, we designed and implemented „questionnaire editor“. Once the questionnaire has been built, there are two ways to fill it in. The first option is to fill in the questionnaire via custom implemented web application. The second option is to export the questionnaire into PDF format and print it. A developed questionnaire scanner digitizes printed questionnaires and imports data to web application.

2.1. Questionnaire Editor

We developed desktop application to create a wide range of questionnaires. C# and WPF technology were utilized for implementation. Editor lets one drag & drop elements to create questionnaires. The elements' toolbar contains passive elements as well as active ones. Passive elements are barcode, label, image and separating elements, e.g. line, border. Active elements are elements designed to fill in the data, such as single letter input field, checkbox, date field, field for hand-writing or hand-drawing. Each element has a set of attributes.

The most important attribute is the name attribute. Data filled in active elements are later stored as key-value pair where name attribute is the key. Therefore, the name of active elements have to be unique in the questionnaire.

In order to create a collection of data relating to one patient, each questionnaire contains a set of input fields for the social security number of the patient. In addition, each questionnaire has a barcode. The barcode encodes the type of questionnaire and version number. Thereby the questionnaire has a unique identifier which is used during the process of digitizing.

Once the questionnaire is completed, the output is stored in XML format. Above all the questionnaire can be printed or exported to XPS format.

2.2. Digitizing of Questionnaires

When the completed questionnaire has been scanned, the orientation of the paper, eq. rotation, needs to be distinguished. Then, the usable area, that is the area of the questionnaire excluding surrounding paper area, is detected. For this purpose, usable area is bordered by four small squares placed in its corners. Secondly, the barcode is recognized and the electronic template in XML format is found. XML template is required to identify places that can be filled and have to be digitized. Furthermore, the detection of checkboxes' state is performed, hand-written text and drawn images are located.

The digitized data can contain errors, for example, misspelling patient's name. Sometimes, the checkbox state can be incorrectly detected. For this reason, the digitized data can not be stored directly, that is to say, manual check

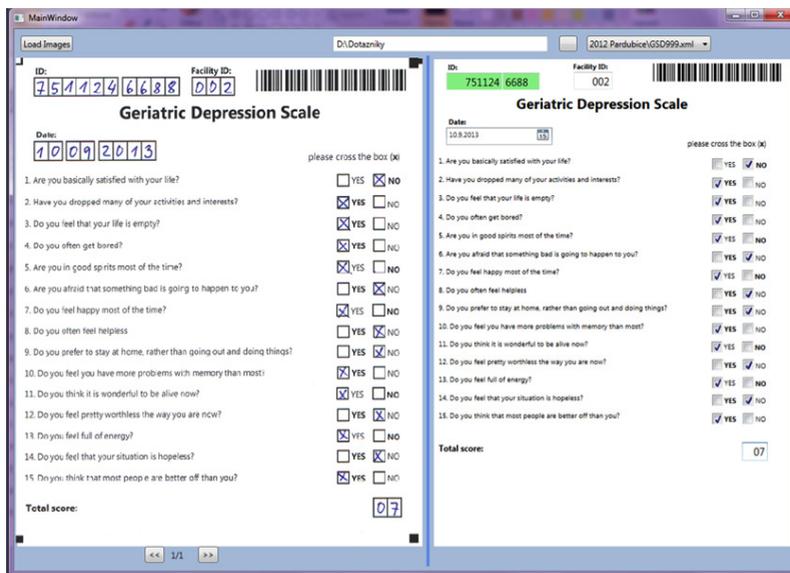


Figure 2 — Software tool for data digitizing

Geronto Centrum Hello, jankutoni! [Log off](#)

[Home](#) [About](#) [Contact](#)

Select template type: and choose template view:

ID: Facility ID:

Geriatric Depression Scale

Date: please cross the box (X)

1. Are you basically satisfied with your life? YES NO
2. Have you dropped many of your activities and interests? YES NO
3. Do you feel that your life is empty? YES NO
4. Do you often get bored? YES NO
5. Are you in good spirits most of the time? YES NO
6. Are you afraid that something bad is going to happen to you? YES NO
7. Do you feel happy most of the time? YES NO
8. Do you often feel helpless YES NO
9. Do you prefer to stay at home, rather than going out and doing thing YES NO
10. Do you feel you have more problems with memory than most? YES NO
11. Do you think it is wonderful to be alive now? YES NO
12. Do you feel pretty worthless the way you are now? YES NO
13. Do you feel full of energy? YES NO
14. Do you feel that your situation is hopeless? YES NO
15. Do you think that most people are better off than you? YES NO

Total score:

Figure 3 — Electronic version of questionnaire

of digitized data is necessary. Hence, the scanned questionnaire is displayed next to the visualized electronic template with automatically digitalized data. In this step, it is possible to manually correct misspelled digitized data.

Finally, digitized and corrected data are exported to central storage.

2.3. Web Application

The ASP.NET based web application has two purposes. First, the application serves as a central storage of massive data from questionnaires. Second, it is used to fill in questionnaires electronically.

Web application uses a role-based security model, it means that each security entity is associated with a role. The application offers to search within the data from the questionnaires. Automated questionnaires' anonymization is also included, collections of data can be created and exported to various formats. Thereby, the data are fully accessible for additional scientific evaluation.

3. Conclusion

We developed software suite for the entire life-cycle of questionnaire: creation, digitizing and storing. The questionnaires are suitable for long-term care institutions. Furthermore, we designed and created by the software suit a set of

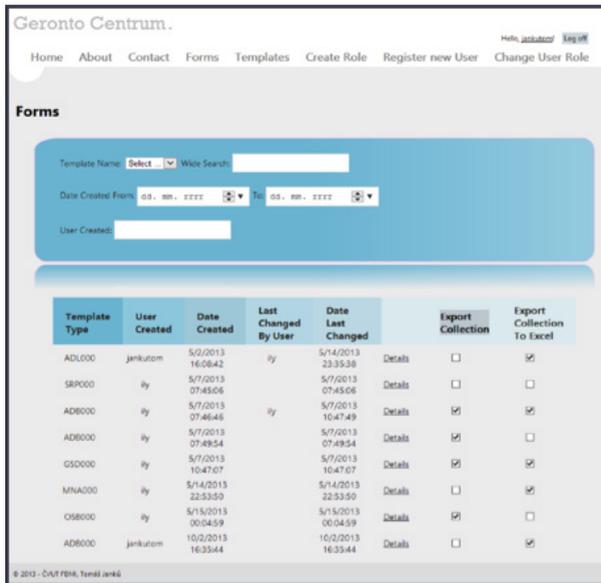


Figure 4 — Web application for questionnaire's data storing

well structured questionnaires for nursing care assessment. In addition to the clinical use, questionnaires and obtained data will be available for research in the field of long-term nursing care in the Czech Republic.

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