

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.

Form edit - GSD999

Glue Show rectangles

ID: Facility ID:

Geriatric Depression Scale

Date:

please cross the box (x)

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

Total score:

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

The screenshot shows a software application titled 'MainWindow' with a menu bar containing 'Load Images'. Below the menu bar, there is a file path 'D:\Dotazniky' and a file name '2012_Pardubice\GSD999.xml'. The main area is divided into two panels, each displaying a 'Geriatric Depression Scale' form. The left panel shows a patient with ID '751124' and Facility ID '002', dated '10.9.2013'. The right panel shows a patient with ID '751124' and Facility ID '002', dated '10.9.2013'. Both forms contain 15 questions with 'YES' and 'NO' checkboxes. The total score for both forms is 07. The software interface includes a 'Load Images' button, a file path 'D:\Dotazniky', and a file name '2012_Pardubice\GSD999.xml'.

Figure 2 — Software tool for data digitizing

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Hello, jankutoni!
Log off

Home
About
Contact

Select template type:
GSD
and choose template view:
999

ID:
7511245688
Facility ID:
452

Geriatric Depression Scale

Date:
10. 04. 2013

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:
10

Save

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. Theapplication 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

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Home About Contact Forms Templates Create Role Register new User [Help](#) [Logout](#) [Log Off](#)
Change User Role

Forms

Template Name: Write Search:

Date Created From: To:

User Created:

Template Type	User Created	Date Created	Last Changed By User	Date Last Changed	Export Collection	Export Collection To Excel
ADL000	jenkutom	5/2/2013 16:08:42	ly	5/14/2013 23:35:38	Details	<input type="checkbox"/>
SRP000	ly	5/7/2013 07:45:06		5/7/2013 07:45:06	Details	<input type="checkbox"/>
ADB000	ly	5/7/2013 07:46:46	ly	5/7/2013 10:47:49	Details	<input checked="" type="checkbox"/>
ADB000	ly	5/7/2013 07:49:54		5/7/2013 07:49:54	Details	<input type="checkbox"/>
GSD000	ly	5/7/2013 10:47:07		5/7/2013 10:47:07	Details	<input checked="" type="checkbox"/>
MNA000	ly	5/14/2013 22:53:50		5/14/2013 22:53:50	Details	<input checked="" type="checkbox"/>
OSR000	ly	5/15/2013 00:04:59		5/15/2013 00:04:59	Details	<input type="checkbox"/>
ADB000	jenkutom	10/2/2013 16:35:44		10/2/2013 16:35:44	Details	<input checked="" type="checkbox"/>

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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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References

- [1.] Colombo F, Llena-Nozal A, Mercier J, Tjadens F (2011). *Help Wanted? Providing and Paying for Long-term Care*. Paris: OECD Publishing; 2011.
- [2.] EC (2013). *Long-term care in ageing societies - Challenges and policy options*. Brussels: European Commission, 2013 Contract No.: 41.
- [3.] OECD/EC (2013). *A Good Life in Old Age? Monitoring and Improving Quality in Long-term Care*. 2013.
- [4.] Holmerova I, Koopmans R, Skela Savic B, Egervari A, Hermann B, Ruseckiene R, et al (2012). *Advancing long term care: central European perspectives*. *Journal of the American Medical Directors Association*. 2012;13(7):578-80.
- [5.] Healy J (2004). *The benefits of an ageing population*. The Australia Institute, 2004 ISSN 1322-5421.

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