

The occupational diary as a smartphone application for monitoring the activities of daily living and physical exertion

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Abstract:

Problem Statement. For both patients and their families, the use of medical diaries represents an up-to-date approach, especially in the digital information context. In Occupational Therapy and Physical Therapy, the patient's diary acquires specific valences, overcoming the purely medical interpretation, and moving to the occupational side, which gives individualization notes of the clinical context. In the field of Sports Science, there are also many mobile applications that serve to monitor health and physical fitness levels. **Purpose.** The aim of this study was to develop an application for mobile devices as an occupational diary, able to provide synthetic information regarding the clients'/patients' occupational profile and needs. **Methods.** We designed a mobile software application by using a free mobile app builder. With the help of the interactive interface, the user of our application has easy access to multiple pages with descriptive technical elements of the software application, information about the terminology used, assessment questionnaires and tools. **Results.** We proposed an accessible electronic diary for client's daily activities survey, adapted for the Occupational Therapy and Physical Therapy practice domain of intervention. **Discussion.** Electronic diaries allow the use of new information technologies to create highly accurate databases that can be adapted to different clinical contexts. Through this approach, we have been able to develop an accessible electronic diary, which is addressed to the clinical environment and adapted to the practice of the Occupational Therapy and Physical Therapy. Our application can also serve as an incentive factor to stimulate the individual to improve his physical fitness by awareness of the need for daily physical exercise. **Conclusions.** An electronic diary of occupational activities, designed for the use on smartphone/tablet for different types of patients/clients, can help both the developing of professional reasoning and the ability to provide a clear, fast, and tailored feedback for each beneficiary. A distinct finality of the proposed application is to motivate the beneficiaries to adopt a healthy and active lifestyle based on physical exercise.

Key words: mobile application, occupational profile, journal, recording.

Introduction

Patient medical diaries are written forms of recording personal medical information with regard to temporal factors (daily activities), being in general prospectively completed by care staff (Egerod et al., 2006) or even by patients (with or without help). For both patients and their families, the use of medical diaries represents an up-to-date approach, especially in the digital information context. A health/disease diary can be considered as an extremely useful tool for recording, storing and organizing different information related to the patient that benefits from various types of health care services, from a dynamic perspective over time.

These variants of data recordings help the patient to memorize a number of medical information that can be reviewed and updated at any time. One example is a medical check-up, when the patient's medical file must be completed with the most accurate data, or when the patient has to follow a certain type of therapeutic recommendation (such as taking medication, adopting sanogenic lifestyles, and avoiding harmful behaviours etc.).

As verbal information is not always sufficient, it has been demonstrated that patients should be helped to memorize medical information by using explicit categorization techniques and different variants of written support (Kessels, 2003). Another usefulness of the medical diary reported by several authors refers to increase the patient's compliance with the proposed therapeutic program. Thus, studies have highlighted the existence of significant positive correlations between the patient's compliance with the diary filling in and his compliance with taking medication (van Berge Henegouwen et al., 1999).

In Occupational Therapy and Physical Therapy, the patient's diary acquires specific valences, overcoming the purely medical interpretation, and moving to the occupational side, which gives individualization notes of the clinical context. Classically, the diary, as a professional tool, is completed by the occupational therapist, in the sense of reflexive support of own activity, with the establishment of time and space extensions (Orban et al., 2012).

In the field of Occupational Therapy, there are also variants of applications that support the occupational therapy process in relation to different types of clients. In this case, the programs are designed to identify the client's needs and to evaluate the outcomes of the specific interventions (Erickson, 2015).

From the perspective of Physical Therapy, numerous mobile electronic applications, especially with potential for use in the field of neurorehabilitation, have been proposed (Sánchez Rodríguez et al., 2018). In the field of Sports Science, there are also many mobile applications that serve to monitor health in general and the physical fitness levels, especially (Hermann and Kim, 2017). Moreover, healthcare providers and some insurance companies are proposing applications that can better help individuals to reach their health and fitness goals (Higgins, 2016).

Methods

Most occupational therapy studies, based on the use of professional diaries, refer to qualitative aspects related to the reporting of the occupational therapist to reflexive clinical practice, with introspection on the degree of job satisfaction or work-related stress (Bendixen and Ellegård, 2014). The idea of building and using an occupational diary, addressed to the patient/client, to provide the possibility of a structured, real and truly customized feedback, becomes in the given context a generator of new opportunities for the clinical research.

Starting from the recognized opinions on the relevant occupational categories (Hammell, 2009; Johansson et al., 2009; WFOT, 2013), the occupational diary should take into account four major activities/occupations: work, leisure, household, and self-care. The occupational profile of the patient/client can be recorded using a software application developed for different types of devices: smartphones, tablets, personal computers etc.

Basically, we used a freeware program (with free use online) that provides the possibility to build an application (for Android, iOS, or Windows operating system) by automatically generating a Java encoded script that runs in the form of a personal electronic diary.

The application has been developed by including several pages, which follow in a logical order. Thus, with the help of the interactive interface, the user has easy access to descriptive technical elements of the software application, information about the terminology used, assessment questionnaires and tools. The diary integrates a series of self-administering and quick-fill quizzes (by ticking and writing text comments) to evaluate the client's participation in daily life activities that are considered to be significant at a personal level. The used items, which have suggestive pictograms attached, refer to the time allocated, the activities/occupations, the location, the particular context, and whichever observations the patient considers doing. For daily completion of the diary, an average of 5-10 minutes is required, with the possibility of data recording over a variable period of time. Note that the subject can get familiar with the technical instructions for completing the diary following a minimum training tutorial.

Results

The resulted program was initially entitled Occupational Diary, version 1.0, 2017. After a series of field tests, the initial model of the application was improved, resulting in version 2.0, 2018. The program can be downloaded and installed free of charge by the beneficiaries, in a form supervised by the authors, by following a dedicated Web link. Practically, after installing step by step, compliant with the device operating system, we can distinguish the following descriptive elements of the occupational journal:

1. According to the consecrated models, the application's start page displays the terms and conditions of use and the copyright, according to Romanian Law no. 8/1996 on Copyright and Neighboring Rights and The General Data Protection Regulation.

Initially, the user views a minimal description of the program under the About the Program section: The Occupational Diary is addressed to patients/clients who wish to monitor their activities of daily living. The Occupational Diary focuses on four major types of activities: work, leisure, household, and self-care.

2. The second page that can be accessed is entitled The Editor's Page and contains brief information, provided by the authors, about the importance of the application and its utility in different settings and domains.

3. The third page of the application, also informative, useful for delimiting the conceptual framework, is entitled Occupational Therapy and includes the following headings:

a. Meanings of the term occupation:

- the way how people perform their daily existence, with reference to time and space;

- the way how human collectivities interact in the form of social relationships, from a dynamic perspective over time and with reference to a particular geographic area;

- the way in which the existence of the individual and of the communities is structured in terms of work, leisure, family support and household, health maintenance/promotion in the context of multiple factors: economic, social, cultural, political etc.

b. Occupational Therapy – interdisciplinarity, representative guidelines and skills, methods and implementation facilities, applications:

Occupational Therapy aims at optimizing the individual's independence in the sense of promoting his or her capacity and willingness to self-achieve an activity or activities that are significant in the existential plan (WFOT, 2013). According to the International Classification of Functioning, Disability and Health, the activity refers to the execution of a task or action by a person (WHO, 2007). Occupational Therapy, as a health profession, is a form of therapy through activity. In Occupational Therapy, the term activity refers to a habit of life that can acquire therapeutic valences (Clark, 2000).

4. The fourth page contains a Glossary of terms, which is valuable for the correct understanding of the terminology used in the next occupational questionnaires. We mention that the explanations are extracted and adapted from the Romanian language explanatory dictionaries (DEX, 2018) or from other bibliographic sources:

a. Work activities – any type of work performed on a job, completed by an employee, according to a work contract (paid productive activities, volunteering within organizations etc.).

b. Leisure activities – any type of activity chosen for pleasure, relaxation or other emotional satisfaction, usually done outside working hours or other types of responsibilities (sports activities, outdoor activities, hobbies, walks etc.).

c. Household activities – any type of household maintenance/care activities, typically done in the family (cleaning, interior/exterior fittings, house maintenance, repairs etc.).

d. Self-care activities – any type of activity to maintain own hygiene (washing, eating, dressing, sphincter control etc.).

e. Sleep-wake pace – the succession of sleep and vigilance periods (activity status as a form of manifestation of human's interaction with the environment). The internal biologic mechanism of this rhythm is dependent on the circadian rhythm (day/night).

f. Physical effort – any form of movement of the human body that is achieved by contraction of the skeletal muscles with energy consumption (Westerterp, 2013).

g. Perceived rate of physical effort – the perceived level of body load, correlated with the intensity of the physical effort (Eston, 2012).

5. The fifth page is the Questionnaire page. These are six questionnaires entitled: personal data, sleep-wake rhythm, schedule activities, satisfaction questionnaire, performance questionnaire, and perceived exertion scale. Overall, the questionnaires contain open, semi-closed or closed questions (single textbox, multiple choice, and rating scale questions).

The first questionnaire must be completed only once and forwarded by the patient, serving as a record in the database managed by program administrators. The file contains personal identification information, anthropometric data, and a short medical history. On this occasion, each patient must use a personal ID, which will help in his further subsequent quick identification.

The second questionnaires can be filled in daily, all the results being sent on-line to the central database, with the possibility of statistical processing of the results. Thus, the first assessed items refer to the sleep-wake pace, the patient's quality of sleep, the amount of sleep and the fatigue index (from a visual analogue scale). Next, the schedule of activities captures the time spent on various daily activities in the last 24 hours (activities of work, leisure, household, and self-care).

The following two questionnaires (satisfaction and performance in daily activities) aim to identify the extent to which the patient/client is satisfied with the activities of the current life, and the way the patient/client appreciates the performance in doing the respective activities. For each activity, the subject can select from a Likert scale (from 1 to 5 the option regarding the accessibility (performance) and the satisfaction related to each item.

The last questionnaire is aimed at assessing the perceived exertion scale during the four types of activities performed in the last 24 hours. The physical effort perception is quoted on a visual analogue scale from 0 (absent) to 10 points (very, very heavy). For leisure activities, their type should also be specified. A final parameter to be filled in is the number of steps performed in the last 24 hours resulting from the reading of the pedometer attached as a tool on the next page of the application.

6. The sixth page is reserved for the tools that can be used by the e-diary user. Thus, the device camera can be selected to capture pictures, video snapshots or video collages related to the various performed activities. These files will be stored in a special folder of the diary. Using the location icon, the subject can view and save the location's GPS coordinates, with the orientation in a loco-regional map.

Also within the tools menu, there is the possibility of writing personal notes in the diary, such as impressions, opinions, personal reflections, which can be chronologically recorded.

Last but not least a pedometer is included in this page, useful for measuring the number of steps the client performs over a given set time. The pedometer can automatically record the number of 24-hour steps and

the travelled distance (in km or miles), with the possibility of comparing the recorded result against a previously set target.

7. The last page (seventh) contains reviews from the program users. Basically, every user has the possibility to evaluate the application on a scale from 1 to 5 stars and to send any comments about the personal experience related to the diary. For each submitted review, the application managers are notified and able to validate and to post online critical or appreciation messages, if they consider it appropriate.

Discussion

The patient/client occupational diary represents a useful tool for self-assessment/assessment of the daily clinical status of individuals and it has a wide applicability in medicine and related fields. Electronic diaries allow the use of new information technologies to create highly accurate databases that can be adapted to different clinical contexts. The usefulness of occupational diaries can be anticipated and argued by extrapolating the results of similar research conducted from another perspective and with other finalities.

Starting for the growing importance given to digital technologies, numerous clinical researches have been carried out in the latest years. These studies have highlighted the utility of digital platforms to provide interventions based on self-management of various diseases, which can be easily implemented at low costs (Marcano Belisario et al. 2013). Smartphone applications have real effectiveness for lifestyle improvement, as suggested in many types of research on communicable and noncommunicable diseases (Lunde et al., 2018). For example, it has been demonstrated that using a computer by patients to record a lifestyle diary can reduce the decline in motivation associated with self-management of morbid conditions like obesity. However, the mentioned results are influenced by certain variables such as personal characteristics, patient knowledge and vocabulary, gender, particular anthropometric data (such as initial Body Mass Index), experience in computer use and level of education (Blanson Henkemans et al., 2009).

Another area of applicability, which can be argued, is that of the interventions based on the informational web-technologies (for example, the situational feedbacks or the electronic diaries, addressed to patients with various forms of chronic painful syndrome). These methods have demonstrated that patients have rated the interventions as being feasible, supportive and accessible, thereby contributing to a better self-management of the algic symptomatology, increasing of the psychological support and optimization of the level of functionality (Kristjánsdóttir et al., 2011; Kristjánsdóttir et al., 2013).

An important result that can be extracted from the occupational journal concerns the physical activity regime of the subject. Thus, the analysis of pedometric data reveals a significant parameter correlated with the daily physical stress level. Practically, with the pedometer, we can get indirect information about the physical activity regime and the energy consumption achieved in the occupational context of the client (Hills et al., 2014). In fact, smartphone pedometers are now considered to be reliable tools for clinical research, being recommended for walking sessions even for low walking speed (Preset et al., 2018).

In the case of our application, the subject can set itself a goal of physical activity, in terms of number on predetermined daily steps. In this way, the premises of stimulating the individual's adherence to the functional physical rehabilitation program are created, according to recent studies (Cupples et al., 2013). That is why we have opted for the self-control of the walking activity, for the better further management of the patient's therapeutic intervention plan. Our application can also serve as an incentive factor to stimulate the individual to improve his physical fitness by awareness of the need for daily physical exercise. In fact, it has been proven that users of interactive digital fitness applications are more likely to be involved in leisure physical activities, compared to those who do not use such applications (Litman et al., 2015). In conclusion, the motivational factor has a major role to play in increasing involvement in physical activity, and this desiderate can be mediated by the access to a self-monitoring or patient counselling digital platform (Jee, 2017).

Through this approach, we have been able to develop an accessible electronic diary, which is addressed to the clinical environment and adapted to the practice of the Occupational Therapy and Physical Therapy. We are currently focusing on improving the software and adapting it to different types of clients, depending on the age, the level of physical training, the pathology/disability etc.

Also, in the near future, we intend to calibrate this new tool on large population groups, using the cluster method.

As far as the limits of the new technology, we can take into account the issues raised by the software installing. Therefore, it is required to set the electronic devices in order to find, accept and download the software. Nevertheless, we consider as possible punctual technical difficulties that may occur the eventual installation errors and difficulties in completing the use steps.

These may happen especially in patients with reduced digital skills or when using older devices, non-performant, or with out-of-date operating systems. In order to solve these cases, technical solutions can be found. Moreover, informational services and personalized support for the beneficiaries can be provided online or with the help of an emergency dispatcher.

Conclusions

The use of electronic devices has become a natural necessity in the life of the modern human. Therefore, the attempt of adapting some consecrated tools in the field of Occupational Therapy and Physical Therapy for digital platforms usage contributes to the scientific development and generates new research directions. An electronic diary of occupational activities, designed to be used on smartphone/tablet for different types of patients/clients, can help both the developing of professional reasoning and the ability to provide a clear, fast, and tailored feedback for each beneficiary. A distinct finality of the proposed application is to motivate the beneficiaries to adopt a healthy and active lifestyle based on physical exercise.

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