VMSReport: An Application for Visual Performance and Motor Skills Evaluation

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Abstract: With the increase of evidence-based practice, the registration and dissemination of the assessment data, became more and more important. In paediatric rehabilitation those procedures are particularly important since they allow for an initial characterization of the clinical situation, to compare results in different assessment moments and to disseminate the evaluation outcomes. However, in several kinds of evaluation, data registration is a complex and slow process. Similarly, the comparison of raw score to standard score can be very time consuming. To minimize that challenge it is important to develop a digital system that makes the registration fast and objective. The main purpose of this paper is to present VMSReport: an application to registrate visuomotor performance data, visual perception, as well as and motor coordination, in children aged 2 years and older. That digital tool allows also to compare results between various moments of assessment and can automatically generate a report for each evaluation. It also builds a database, which facilitates the process of global data analysis and modelling. This tool was developed in a clinical environment, giving clear answers to requests from rehabilitation caregivers. A pilot study, with 10 children, has already been carried out. The VMSReport can now be used.

1 INTRODUCTION

The assessment has an important role in any (re) habilitation process. In 2011 the world health organization described the rehabilitation as a process with five steps, where three of them are directed concerned with assessment. The paediatric assessment aims to understand the impact of any developmental delay in children and his family. During that process, important information about the child and his family is collected, which will support decisions in intervention plan (Case – Smith and O'Brien, 2015). Evaluation and diagnostic in medical rehabilitation should be based on methods that are as objective as possible. In this context, it is important the evaluation is quantitative, and not only qualitative (Biefang and Potthoff, 1995). In rehabilitation, assessments yield valuable information that can suggest treatment strategies, and rationales for case management decisions. That occurs in different areas of therapeutic intervention, such as occupational therapy, psychology or physiotherapy.

However, data registration is a fundamental procedure that allows for a better understanding of each situation. It also allows to compare results obtained at different moments of the therapeutic process. This is very important because it can evidence the child's evolution, and is also a way to measure the efficacy of the therapeutic approaches. It is important to note that such should also be easily shared with other stakeholders and include simple, age-appropriate recommendations, that parents can implement during everyday activities (Markepeace and Zwicker, 2014).

Traditionally the registration of assessment information is done in a case-by-case process, using paper and pencil. This takes a long time, is difficult to disseminate the results and the comparison between data collected at different moments is particularly hard. These are the main reasons why the therapists often avoid recording the evaluations. Health information technology reduces the paper work by eliminating the needs of paper based record and improve the administrative efficiency. It improves the healthcare by decreasing medical

errors with an assurance that all the healthcare providers have accurate and timely information (Sinha, 2010).

Building new and dedicated technology could be an opportunity to engage the registration data process.

Clinicians need documentation platforms that reflect the clinical reasoning and decision-making process of occupational therapy practitioners. Additionally, these systems must promote documentation of the actual care provided and the outcomes achieved (Leland et al., 2015).

Although a clearly identified paediatric occupational therapy necessity, few solutions have been developed.

In the current manuscript, we will present VMSReport, a digital tool that is meant to bridge the aforementioned practice gap. It allows for the registration of the patient´s visuomotor, visual perception and motor coordination performance. Emphasis is given to the qualitative study of children performance.

2 THE VMSREPORT DIGITAL TOOL

The VMSReport was developed based on registration grids, employed in developmental tests of visuomotor integration, and which are commonly used in clinical practice. The need to convert such a system to a digital platform was identified by the Occupational Therapy Team of Hospital D. Estefânia of Centro Hospitalar Universitário Lisboa Central.

VMSReport´s goals are to promote:
- easy registration;
- fast data analyses;
- construction of a report containing the performance of three tests: visuomotor; visual perception and motor coordination.

Data should also be automatically inserted in a database, facilitating future analyses.

2.1 Development of the Digital Tool

The digital tool should:

- be user-friendly
- be in digital format;
- allow for versatile recording, with the possibility of incremental insertion;

- allow for the recording of personal information; performance assessment and other relevant clinical information;
- facilitate the analysis of the patient´s clinical evolution;
- provide comparison of performance in different moments of therapeutic process;
- provide reports, to be delivered to caregivers or to be committed to file services;
- produce, if necessary, age-appropriate recommendations.

VMSReport was created using MatLab software (MathWorks ©) in association with Excel files. The normative data are all gathered in an Excel file, which is called by the main software platform, built in MatLab. In this way, the raw scores of an evaluated child can be compared to standard scores of normative data adjusted to his age. After the VMSReport also find the percentile point for each domain of performance: visuomotor, visual perception and motor coordination. This is very important because give the therapist a clear global view of child performance, comparing to others with the same age. In addition to the standard dataset, also the child-specific data is collected in a dedicated Excel file, which can be further analysed.

MatLAb was the software used attended its versatility and all the available solutions from interaction with the user to the graphic utilities.

In addition, MatLab software also allows building an executable file which could run in any clinical environment, and in all PC.

2.2 Functionalities of the Digital Tool

The system was developed using MATLAB's R2012b. The content was designed, having in mind the clinical requirements of information to be stored and the scores to be evaluated. The entire set of algorithms was simplified, so that the application would run faster, and present an easy-to-use interface, while allowing the access to programming code, if one needed to construct other specific functions. There is no need for the user to see all the moving information in the application. Yet there is great value in the complete interaction between the various elements of the application. Hence all functions interacted internally with each other, to register the values inserted by the therapist, and to calculate and show the needed parameters.

The digital tool box has the following five blocks:

1st – Main Page (Fig. 1)

The "cover sheet", where to register all demographic and clinical data (name, age, ID, clinical diagnosis, date of test, schooling, referral source, motivation to reference, and others). Also, in this block, the therapist can choose between the three tests.

The following three blocks deal with each of the tests separately.

Figure 1: Cover sheet.

In this sheet exist also the opportunity to order the production of report. This option is available after registration process. The digital information will be delivered to caregivers, parents, teachers or medical staff.

2nd – Visuomotor Skills (Fig. 2)

The qualitative and quantitative data concerning the visuomotor performance are registered here. The score obtained by the children is dependent of his performance in the representation of the stimuli. The evaluator can compare the image produced by the children with the model in the column "task or form".

Is also important note the observations box, that allow the registration of qualitative data. That information is automatically transfer to the observation – suggestions box in the final report.

After completing the test, the calculated raw score is presented in a box, in the bottom of the page.

All the information is transferred to a final report. The same procedure is followed with visual perception and motor coordination information.

These automatic transfers of information facilitate the built of final report and ensure that there is no loss of information.

Figure 2: Visuomotor skills record (part 1).

3rd – Visual Perception (Fig. 3)

Registration of the quantitative data, regarding visual perception, together with the calculation of the raw scores of this task. Is a simple grid that is built mainly with radio button to facilitate filling.

Figure 3: Visual perception record (part 1).

The evaluator will record 1, if the child identifies correctly the image.

4th – Motor Coordination

Registration of the data related to motor coordination, and calculation of the coordination raw scores. The process is similar to visual perception record. In that way, the therapist chooses 0 or 1

depending on the performance of child, regarding the exact reproduction of the presented stimuli.

After introducing the data, it is possible to return to the 1st block ("Main Page"), to automatically save the results into the database Excel file, for ulterior statistical analyses.

5th – Final Report (Figs. 4a and 4b)

The final report is a PDF file that show all the qualitative and quantitative data record. This information is very important for the therapists and allows a holistic and graphic information about the performance of each patient. The final report can be also delivered in "real time".

To the left column (figure 4a) of final report is automatically transfer the demographic information collected in the main sheet. Here is also find important data related to motive and source of reference. This date could be further analysed in a more global perspective comparing to other children.

Figure 4a: Left column of final report.

In the right column of the PDF document (Fig. 4b.) the caregiver can find three different graphic representation:

- A set of three graphics with score obtain in each item of visuomotor, visual perception and motor coordination;
- A graphic with the raw scores obtained in each test;

- A set of three graphics with the percentile score obtain in each item. It compares the individual scores to the normative data and returns the corresponding percentile.

It is, also, possible to characterize the child profile and identify the evolution of each one.

The report has a simple configuration, which can be easily read by therapists, parents and / or teachers.

That is an important improvement comparing with the traditional "paper and pencil" report. The caregivers can easily visualize the performance of children in the three areas, comparing the performance in each one. Is also possible, in a very intuitive way, to follow the evaluation of the child along the time.
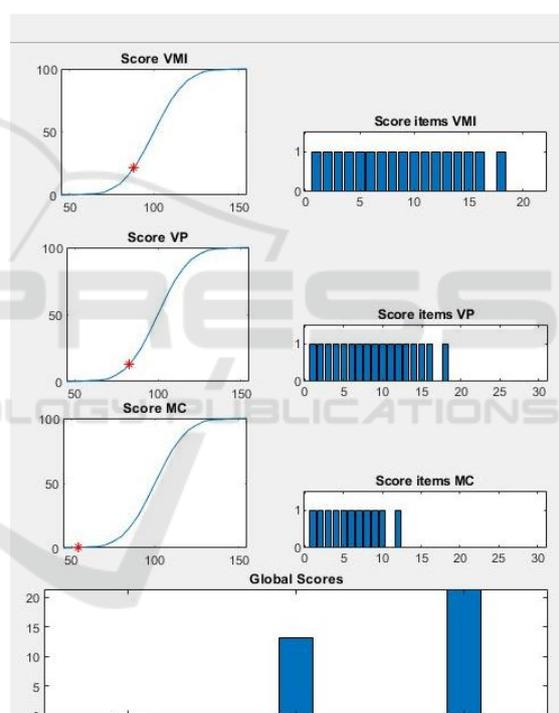

Figure 4b: Right column of final report.

2.3 The Pilot Application

The digital tool was used, in his prototype version, to record the assessment of ten children while in therapeutic process.

With the application therapists considered:
- the tool was easy to use;
- the comparisons of the recorded scores to the normative database were efficiently and quickly performed;

- the reports delivered appropriate information, when compared to standard procedures;
- it allows delivering the reported faster to caregivers, increasing the efficiency in the evaluation process.

Although the positive feedback of the therapist, one of them, made the follow suggestions: add, to main page, a reference source and clinical diagnosis. All the suggestions are implemented.

3 CONCLUSIONS

This work deals with the timely detection, prevention and / or reduction of possible effects of visual disfunction.

The main goal for the digital tool, VMSReport, was to give therapists and caregivers a platform for the collection of information regarding the evaluation of visuomotor, visual perception and motor coordination in children above 2 years of age.

With the information, systematically stored by the tool, various analyses can be performed, ranging from simple comparisons with standards, to assess different stages of progress in therapeutic context, to the construction of detailed reports of said progress.

We believe that VMSReport facilitates the record of each child data and allow in the future and more easy analyses to put in evidence the main related factors and evolution.

The digital tool can be used by occupational therapists and psychologists, and are particularly relevant to caregivers, family members and/or educative professionals.

In a pilot use of VMSReport, reports of its use included, very frequently, terms such as "intuitive", "user-friendly", "time-saving" and "extremely useful".

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