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Development and Testing of Painometer: A Smartphone App to Assess Pain Intensity

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Abstract: Electronic and information technologies are increasingly being used to assess pain. This study aims to 1) introduce Painometer, a smartphone app that helps users to assess pain intensity, and 2) report on its usability (ie, user performance and satisfaction) and acceptability (ie, the willingness to use it) when it is made available to health care professionals and nonprofessionals. Painometer includes 4 well-known pain intensity scales: the Faces Pain Scale–Revised, the numerical rating scale–11, the Coloured Analogue Scale, and the visual analog scale. Scores reported with these scales, when used in their traditional format, have shown to be valid and reliable. The app was tested in a sample of 24 health care professionals and 30 nonprofessionals. Two iterative usability cycles were conducted with a qualitative usability testing approach and a semistructured interview. The participants had an average of 10 years' experience in using computers. The domains measured were ease of use, errors in usage, most popular characteristics, suggested changes, and acceptability. Adding instructions and changing format and layout details solved the usability problems reported in cycle 1. No further problems were reported in cycle 2. Painometer has been found to be a useful, user-friendly app that may help to improve the accuracy of pain intensity assessment.

Perspective: Painometer, a smartphone app to assess pain intensity, shows good usability and acceptability properties when used by health care professionals and nonprofessionals.

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Key words: Pain intensity, assessment, mobile app, smartphone, usability testing.

O ver the last 2 decades, significant advances have been made in the assessment of pediatric pain. One important development has been the integration of electronic and information technologies

(EITs), particularly web-based systems and mobile hand-held devices. EITs have a number of advantages when assessing pain in young people, such as greater accessibility,[8,9] improved compliance,[1,7] and minimization of recall bias because data are collected in real time.[22] Children report greater satisfaction with[21-23] and preference for these EIT-based devices than the traditional paper-and-pencil format.[3,4,26] Generally speaking, available studies show that children learn easily[25] and have no difficulties using these EIT-based devices.[15]

Nowadays, an increasing number of smartphone apps claim to be of value in assessing different pain domains. Nevertheless, most of their properties have not undergone any validation or empirical analysis.[24] For example, although electronic pain diaries using real-time data capture might be able to improve compliance and ensure reliability and validity, their usability, feasibility, acceptability, and psychometric properties must be tested in patients and health care professionals before recommending

widespread use. Of particular importance is the influence of age and developmental stage issues.

The aims of this study are to 1) describe the purpose and functionality of Painometer, a smartphone app that helps users assess self-reported momentary pain intensity, and 2) report its usability and acceptability properties when made available to health care professionals and non-professionals (children, adolescents, and young adults).

Methods

A Brief Description of the App and Its Development

Painometer is a smartphone app that contains 4 pain intensity scales: the Faces Pain Scale–Revised (FPS-R),[5] the numerical rating scale–11 (NRS-11), the Coloured Analogue Scale (CAS),[10] and visual analog scale (VAS). Settings and instructions are available in Catalan, English, French, Portuguese, and Spanish. These scales have satisfactorily been used with children and adolescents,[19] adults,[2,12] and the elderly,[11] and thus it could also be implemented with these populations when appropriate.

Written permission for using 2 of the scales (CAS and FPS-R) was requested and obtained from the authors and copyright holders. The other 2 scales (NRS-11 and VAS) are not copyrighted or authored, so no permission was required. The resulting app is free for academic and research purposes.

There are 2 approaches to developing mobile apps: native technology and web technology. Painometer is powered by the latest web technology: html5, css3, and JavaScript. It uses a JavaScript framework called Sencha.[27] It should be pointed out that a desktop app written with web technology is not necessarily a web app. Painometer is not executed in a web server but in the device itself. The visual interface of the app is shown via a web browser, and the app can also be used without an Internet connection once it has been installed.

Any device with a web browser can use Painometer. It is compatible with iPhone, iPad, and Android-based devices. It can also be used in a web page as an embedded "gadget" (eg, YouTube videos). Painometer can be used in 3 different ways: 1) face-to-face: a health professional, such as a nurse, shows the scales to patients, provides explanations, and records their self-reported pain intensity; 2) self-administered: people with pain can keep a record by downloading the app to their device; and 3) programmatically: as an extension of another app, Painometer can be used as a web gadget and extended to third apps. For example, it can be used as a gadget in an electronic pain diary.

The identification of Painometer users is not possible through collected data; the data are only used to show a temporal chart of pain intensity records. Users may share the data by sending the information to an e-mail address of their choice. Painometer does not use the data in other terms (ie, neither accessing nor collecting data from other apps in the device is allowed; uploading or collecting data to an external server is not possible either).

The first version of the app is shown in Fig 1.

Usability and Acceptability Testing

As defined by Schoeffel,[16] "usability is the effectiveness, efficiency and satisfaction with which specific users can achieve a specific set of tasks in a particular environment" (pp. 6–7). The usability objectives for Painometer are that the app is 1) easy to learn, 2) error-free, and 3) liked by the user. Because it is fundamental that the testing be conducted with end users, health professionals and children, adolescents, and young adults, as
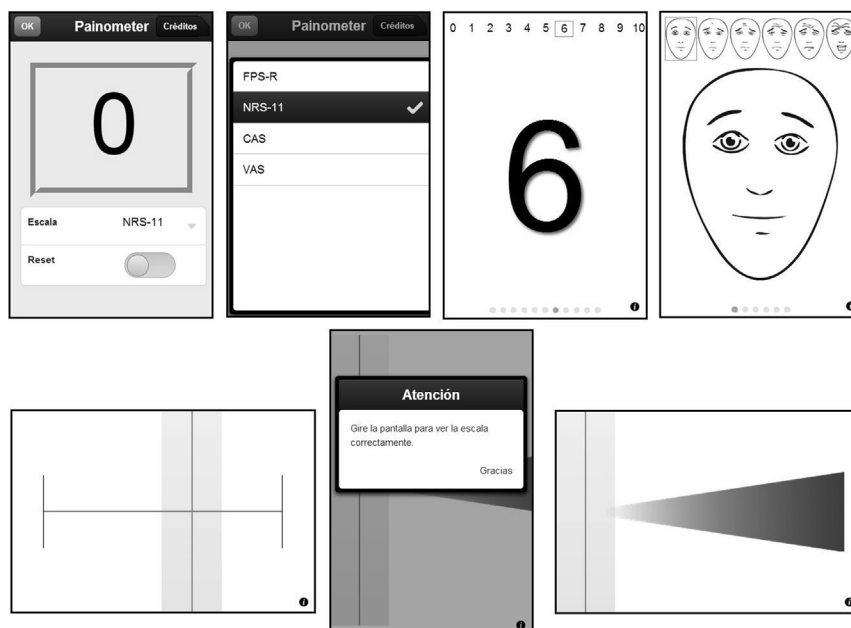

Figure 1. Screenshots of the different parts of the original Painometer.