Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/burns

Smartphone applications in burns

Paul Wurzer [a,b,1,*], Daryousch Parvizi [a,1], David B. Lumenta [a], Michael Giretzlehner [c], Ludwik K. Branski [a,b], Celeste C. Finnerty [b], David N. Herndon [b], Alexandru Tuca [a], Thomas Rappl [a], Christian Smolle [a], Lars P. Kamolz [a]

[a] Division of Plastic, Aesthetic and Reconstructive Surgery, Department of Surgery, Medical University of Graz, Graz, Austria
[b] Burns and Trauma Research, Acute Burn Surgery, and Reconstructive Burn Surgery, Shriners Hospitals for Children and The University of Texas Medical Branch, Galveston, TX, USA
[c] Research Unit Medical-Informatics, RISC Software GmbH, Johannes Kepler University Linz, Hagenberg, Austria

ARTICLE INFO

Article history:
Accepted 12 November 2014

Keywords:
Total body surface area
Total fluid requirement
Application
Burns
Apple
Android

ABSTRACT

Objective: Since the introduction of applications (apps) for smartphones, the popularity of medical apps has been rising. The aim of this review was to demonstrate the current availability of apps related to burns on Google's Android and Apple's iOS store as well as to include a review of their developers, features, and costs.

Methods: A systematic online review of Google Play Store and Apple's App Store was performed by using the following search terms: "burn," "burns," "thermal," and the German word "Verbrennung." All apps that were programmed for use as medical apps for burns were included. The review was performed from 25 February until 1 March 2014. A closer look at the free and paid calculation apps including a standardized patient was performed.

Results: Four types of apps were identified: calculators, information apps, book/journal apps, and games. In Google Play Store, 31 apps were related to burns, of which 20 were calculation apps (eight for estimating the total body surface area (TBSA) and nine for total fluid requirement (TFR)). In Apple's App Store, under the category of medicine, 39 apps were related to burns, of which 21 were calculation apps (19 for estimating the TBSA and 17 for calculating the TFR). In 19 out of 32 available calculation apps, our study showed a correlation of the calculated TFR compared to our standardized patient.

Conclusion: The review demonstrated that many apps for medical burns are available in both common app stores. Even free available calculation apps may provide a more objective and reproducible procedure compared to manual/subjective estimations, although there is still a lack of data security especially in personal data entered in calculation apps. Further clinical studies including smartphone apps for burns should be performed.

* *Corresponding author at*: Division of Plastic, Aesthetic and Reconstructive Surgery, Department of Surgery, Medical University of Graz, Auenbruggerplatz 29, Graz 8036, Austria. Tel.: +43 6765448224.
E-mail address: wurzer_paul@gmx.at (P. Wurzer).
[1] These authors contributed equally to this work.

http://dx.doi.org/10.1016/j.burns.2014.11.010
0305-4179/

1. Introduction

Since the introduction of smartphones by the "Stockholm Smartphone Team" [1] in 1997, the term smartphone has become common in our daily lives. Nowadays, a smartphone is synonymous with a device, which associates the properties of a mobile phone with the possibilities of a personal computer. Another historic milestone of the smartphone was the introduction of the first touch screen [1] on mobile devices in 2000. Heather Leonhard of the "Business Insider" expects that there will be 1.4 billion smartphone users worldwide at the end of 2014, indicating that nearly every fifth human being on the planet will possibly own one [2]. Most smartphones run on Google's operating system Android (60%) followed by Apple's iOS (40%) [2]. In 2008, both Apple and Google introduced their application (app) stores, which have made it easy for users to individualize their mobile devices. From 2008 until July 2011, 15 billion apps were downloaded from the Apple's App Store [3]. Google Play Store, formerly Android Market from Google, hosts more than one million apps to date [4]. About half of these apps have become available in Apple's App Store [3]. The widespread penetration of smartphones in the population has, of course, had an effect on the way in which we interact in our professional and private daily lives: smartphones are supposed to be used more often than personal computers, laptops, or even pen and paper.

Even in daily clinical practice, electronic devices form an integral part of modern medicine. These devices may help guide patient care in hospitals, they may help find the right diagnosis, and they are sometimes helpful in therapeutic decision making. All these properties can be provided by different devices or they can be included in one system. Nowadays, custom-made apps for smartphones and their users are able to assume a majority, if not all, of these tasks. Therefore, modern app stores have special categories for medical/health-care apps. In the medical literature, a growing number of authors described the continuous rise in the popularity of smartphone apps [5–8]. Mosa et al. [5] described that most apps in medicine are used for disease diagnosis, medical calculations, or drug references. To enable special apps for every field of medicine, numerous different apps for almost every medical specialty have been made available. Most are free for download and some are to be purchased.

In the treatment of burns, many different apps have been on offer ranging from first-aid leaflets, literature and papers, or games to calculation apps.

The aim of this study was to review the offered apps applicable in the treatment of burns on Google's Android and Apple's iOS smartphones and to focus on the following parameters: costs (free/paid), developers, content, target groups (medical professionals/laypersons), and available interfaces (e.g., hospital information system/HIS). Furthermore, we compared all available calculation apps in a study based on a standardized patient model.

2. Methods

2.1. Ethics

A formal ethical review board approval was not required, because we did not use any personal or patient data.

2.2. Design

A systematic review of the two provided app stores was performed from 25 February until 1 March 2014. The terms for research were defined: "burn," "burns," "thermal," and the German word "Verbrennung." At first, the terms were searched in Google Play Store (formerly Android Market) by using the following link: https://play.google.com/store/apps. As a second step, Apple's App Store was browsed by using the following link: https://itunes.apple.com/en/genre/ios/id36?mt=8. Using these home pages, we could easily access both stores. The information of all the listed apps was analyzed and individually graded based on their applicability in the treatment of burns. Apps concerning the treatment of other medical diseases containing such terms (e.g., burnout, etc.) were excluded.

The following information was collected: medical link of the developer, available languages, type of app (information, calculator, etc.), and available interfaces between other devices.

All available free and paid calculation apps underwent a trial by using a standardized patient: male, 25 years of age, with a height and weight of 175 cm and 75 kg, respectively, and 18% burned total body surface area (TBSA) (II–III°). The total fluid requirement (TFR) within the first 24 h for this standardized patient is 5400 ml, calculated with the Parkland formula ($4 \times$ patient's weight $\times$ percentage burned TBSA (II–III°).

2.3. Analysis and illustrations

For a descriptive analysis, we created spreadsheets using Excel 2008 (Microsoft, Richmond, VA, USA) and flowcharts using PowerPoint 2008 (Microsoft, Richmond, VA, USA) to illustrate the research process.

3. Results

Detailed results of the available apps are described in Table 1 (for Google's Android) and Table 2 (for Apple's iOS). The research process is illustrated in two flowcharts (Figs. 1 and 2). In every store, we could identify four types of apps: calculators, information, books/journals, and games. Thirty-two calculator apps (13 for Android, 21 for iOS, and two of the same name in both stores) usually provide functionality both for estimating the TBSA and for calculating the TFR, whereas some apps only provide one of these features. Twenty-six information apps (15 for Android, 12 for iOS, and one of the same name in both stores) provide quick and easy-to-use first-aid guidelines and guidelines for treatment of burns. Three book and journal apps (one for Android, three for iOS, and one of the same name in both stores) are designed to provide more detailed information for the treatment of burns, usually developed for medical professionals. Most games (five; two for Android, and three for iOS) are quizzes, which provide an amusing way of obtaining more information about burns and learning first-aid procedures.

Please cite this article in press as: Wurzer P, et al. Smartphone applications in burns. Burns (2015), http://dx.doi.org/10.1016/j.burns.2014.11.010