Challenges in Designing and Distributing a Not For Profit First Aid App Worldwide

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Abstract: First aid apps can assist people in preparing for emergencies, and they can help citizens to bridge the gap between the emergence of a disaster and the time when professional rescuers arrive on the scene. In this paper, we discuss key requirements and factors influencing the uptake, acceptance, and use of first aid apps from an end-user's as well as a distributor's perspective. Based upon theoretical considerations as well as practical experiences from a multi-national first aid app program, best practices for the adaptation of a first aid app to the local user context are identified, recommendations for successful market introduction are formulated, and the capabilities and limitations of first aid apps are discussed. Results presented are based on semi-structured interviews with 29 experts from eight countries, as well as a secondary analysis of Google Analytics data.

Keywords: First aid app, requirements, critical success factors, user behaviour.

1   Introduction

Smartphones and the mobile internet offer new opportunities to provide health information to members of society in developed and developing countries alike. In line with the United Nations' Millenium Development Goals, Hagar and Kartzintel [HK14] identify first-aid as a promising area for mobile health information initiatives. However, they also state that as of 2014, there is still a gap between the need for information and the availability of suitable mobile applications to deliver this information. This paper will address the issue of providing first aid information via mobile applications worldwide at limited cost by discussing the Universal App Program currently managed by the Global Disaster Preparedness Center hosted by the American Red Cross [GD13, GD15]. Section 2 discusses the state of the art in relation to first aid apps. Section 3 introduces the Universal First Aid App program and its key concepts. In section 4 we discuss the success factors that influence the uptake of not for-profit first aid apps that are disseminated globally but adapted and marketed locally by regional organizations in

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different target countries. We present the methodology used for primary and secondary research in our study (section 5), followed by a discussion of key requirements for First Aid Apps. In the final sectionwe discuss user behavior and user feedback on the apps. The article concludes by providing an outlook on future research activities.

2   State of the art

The potential impact of first aid apps is continuously improved by declining smartphone prices and an increased availability of feature phones worldwide. Royston et al. [Ro15] point out that even in low to middle income countries, feature phones that are able to display video and other media, are now becoming commonplace. Using such phones to provide high-quality healthcare information to people who do not have access to trained health workers could protect them from being exposed to ineffective or even harmful treatment [Ro15]. It could also enable people at the site of an emergency to help themselves and each other in cases where professional assistance will take time to arrive, or is unaffordable to affected people due to a lack of health insurance. A challenge exists, however, in providing first aid apps to those many feature phones in developing countries which do not support any mobile internet or Wi-Fi (or where the user cannot afford an internet connection). To counter this problem, Royston et al. [Ro15] propose asking manufacturers to store health-related information in their products by default at the factory, or to disseminate health content and health apps on micro-SD cards. However, the authors also identify a shortage of appropriate content and a lack of investment in such content. Quality issues with first aid app content were also identified by Thygeson et al. [Th12] who analyzed the content of 65 English-language first aid apps and calculated adherence scores of the apps with official guidelines. In many first aid categories, the apps scored on average less than 40% of the maximum points. This includes very important categories like: "assessing each victim for responsiveness, airway potency, circulation, breathing, and medical alert tags", or "performing logical head to toe checks for injuries". The study also found that free apps fared particularly poorly in a number of categories, e.g., "appropriate handling of amputated body parts", where they only received 7.7% of the maximum score (compared to 35.3% of paid apps). Among the top six first aid apps in the study, none were provided for free. The highly varying quality of healthcare apps has raised some regulatory concerns, and some state-run healthcare providers like the British National Health Service (NHS) took the issue into their own hands by creating an Online Health Apps Library (for an extract, see [Na16]), where it "lists and recommends some carefully selected apps", and where "developers can submit their apps for review and possible listing" [Ka14]. Such signalling helps citizens to choose a reliable and high-quality app among the alternatives on offer. However, to our knowledge, the NHS is the only authority so far which provides a vetting program for health related apps. As a result, in most countries people have to choose a suitable health app on their own. Consequentially, they may select a first aid app that does not meet global and local quality standards or guidelines. In the following sections, we will analyze an app program that places a particular focus on up-

to-date and quality-assured content and is distributed by trustworthy organizations (Red Cross / Red Crescent societies), thus addressing the abovementioned problems related to the quality of content that have been identified in the literature.

3   The Universal App Program

In 2012 the American Red Cross released a free First Aid App for iOS and Android devices (based upon app content licensed from the British Red Cross) that offers easy-to-follow advice for a variety of first aid scenarios. These scenarios are based on the International Federation of Red Cross and Red Crescent Societies' Guidelines for first aid [IF11]. The advice aims to help users to learn and understand the fundamentals of first aid, and to reinforce first aid concepts with those users who already have basic first aid training. The app provides users with information through animations, videos, quizzes and links to complementary information held on the respective national Red Cross society's websites. Figure 1 provides an overview of key topics presented within the app.[5] While some training courses are related to specific types of medical conditions (e.g. "diabetic emergency", "anaphylaxis"), other categories are relevant for large scale disasters as well as personal injuries, such as "bleeding", or courses explaining how to deal with unconscious people.
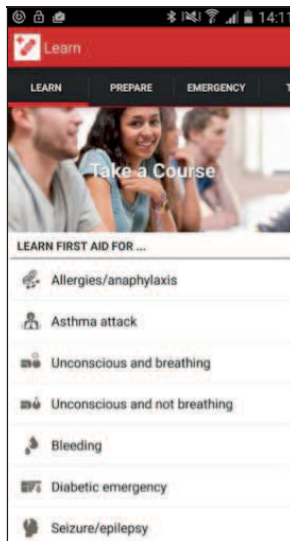

Fig. 1: Key topics of training courses in the First Aid App

Figure 2 shows an example screen for the topic "unconscious and not breathing", with

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[5] All screenshots are taken from the first aid app variant which is distributed by the Swiss Red Cross / Samaritans.

key instructions on how to treat people in such a state and an embedded explanatory video which visually illustrates the instructions.
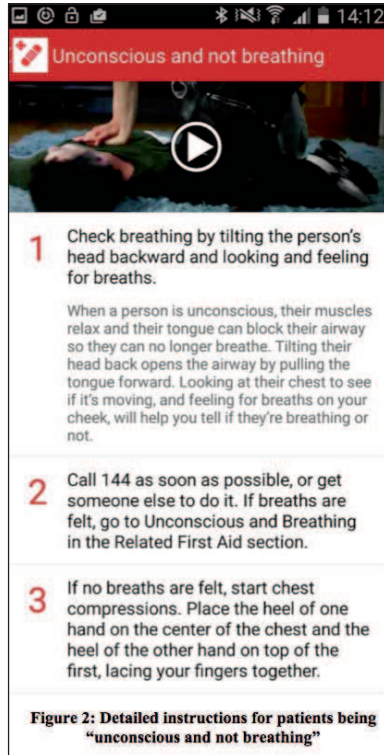

Figure 2: Detailed instructions for patients being "unconscious and not breathing"

Fig. 2: Detailed instructions for patients being "unconscious and not breathing"

Overall, app content may differ between countries but is structured into five areas.

Learn: Users are guided by simple step-by-step and easy to understand advice on multiple first aid scenarios in order to learn first aid concepts. Such concepts range from allergies/anaphylaxis to strains and sprains, missing persons, burns, shocks, and broken bones, among others. For each emergency case, simple and easy-to-understand explanations are presented, which are supplemented by a video tutorial. The app also provides answers to frequently asked questions for each of the cases. In some cases like allergies/anaphylaxis the app offers a panic button that directly leads to a national allergy center (if available in the country) in order to provide more information and advice. Step-by-step instructions are also equipped with short animations, teaching users how to treat injuries or how to apply a bandage in an emergency.

Prepare: The app offers information to users in order to prepare them for multiple types of emergency situations such as fire, chemical emergencies, earthquakes, landslides, heat

waves, traffic accidents and more. Users benefit from checklists and advice with specific instructions before, during, and after an incident. The information also varies with whether the emergency occurred indoors or outdoors. In any emergency the prepare segment of the app offers a deeplink to related first aid topics of the learn section. In case of an earthquake, users are equipped with checklists such as "Brace overhead light fixtures", hints such as "Stay away from windows to avoid being injured by shattered glass" as well as a deeplinks to "Broken Bone", "Head Injuries" and "Missing Person" topics in the Learn-section of the app.

Emergency: The emergency section differs from the "Learn" section by focusing more directly on instructions for an emergency. Additionally, each of the emergency cases includes a so called "panic button" which directly makes an emergency call if activated.

Tests: By providing a test section a user is able to test how much they have learnt from the app by taking part in offline interactive quizzes. The user can choose between six categories: "Unconscious and breathing, Bleeding, Choking, Heart attack, Prepare and Burns". Each category consists of up to three questions with several answers (multiple choice) or picture puzzles where they have to choose the correct picture. By solving the quizzes in one of the named categories correctly, the user gets rewarded with a badge belonging to that category. These badges can be shared on social media platforms such as Facebook or Twitter. With this so called gamification method, a user is able to obtain achievements in all of the six categories in order to validate the status of their knowledge of first aid skills.

Information/More: This section offers general information about national Red Cross first aid courses, blood donations, first aid shops or volunteer programs. Users can also donate to the national Red Cross or share their stories on using the app on social media channels from the app.

In May 2013 the Global Disaster Preparedness Center (GDPC)[6] launched the Universal App Program in order to introduce the application into new markets within the Red Cross/Red Crescent network across the world. The idea behind this approach was to exploit synergies and economies of scale, making the introduction of the app possible in countries independent of resources. Nevertheless, the internationalization of the app requires a strong localization of the application. In order to facilitate the development process as well as the translations, and video editing, the GDPC offers access to a content management system and different tools to participating national Red Cross societies. This concept enables an easy adaptation to each country with regard to language, content, emergency numbers as well as local additional information on training courses. As of June 2016, 79 national Red Cross societies decided to join the program and have launched a local version of the First Aid App.

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[6] The Global Disaster Preparedness Center is a joint initiative between the American Red Cross and the Internaitonal Federation of Red Cross/Red Crescent societies that strives to enhance disaster preparedness capacities at community, local, and national levels throughout the world.

4   Critical success factors for app uptake

As each Red Cross national society (in the foiling labeled as „host organization") participating in the Universal App Program has full ownership of their app once it is launched, app uptake depends on (a) the assessment of the first aid app program by the host organization, and (b) the evaluation and assessment of the app by ordinary citizens, and necessary facilitating conditions for them to actually use the app. Success factors related to these two groups of actors will be discussed in the following subsections.

4.1   Success factors related to the citizens

As discussed in the introduction, the availability, perceived quality of content, and costs are key factors for app uptake from the perspective of citizens. These factors influence technology acceptance, which is the crucial factor influencing the uptake of software systems. Previous research by Davis [Da85] indicates that design features of an information system induce a cognitive response with potential users, based upon the system's perceived usefulness and perceived ease of use. In a second step, this cognitive response is translated into an affective response, that is, the intention to use the system. The prevalence of facilitating conditions (in our case, for example, the availability of smartphones with Android 4.1. and above or iOS8 and above) enables the transition of intending to use an app to actual use. This early model by Davis was later modified and extended to be more suitable for a consumer and healthcare context. Venkatesh et al. [VTX12] focus on the consumer's perspective. Similarly to Davis, they identify "performance expectancy" and "effort expectancy" as key success factors. However, in the consumer context, additional factors need to be taken into account, including: hedonic motivation (i.e., user enjoyment), price value characteristics of the application, and habit (that is the ability to perform actions in the application automatically without learning, due to prior knowledge and experience). Another key factor is social influence, which is the influence of others on whether or how to use or not to use an application (e.g., because it is perceived as cool by others). While the models by Davis and Venkatesh et al. are not specific to a certain type of application, Cho et al. [Ch14] explicitly studied determinants of adoption of smartphone health apps. They identify three additional factors that influence app uptake: health consciousness (i.e., the "extent to which individuals have interest in and are aware of their own health conditions and well-being"), health information orientation (that is, "the extent to which a person actively seeks health information through diverse sources"), and internet health information use efficacy (i.e., the individual's "cognitive ability to seek health information through the internet"). Although none of the above-mentioned studies looked into first aid apps in particular, findings should have some relevance for first aid apps as they are a specific sub-category of health apps and information systems in general. However, one caveat needs to be ventured: the most specific of the studies cited [Ch14] was performed with college students only, thus, whether the findings can also be applied to substantially different user groups, e.g., individuals with low literacy levels,

still needs to be verified. The overview of success factors indicates that app uptake will be affected by the performance of the app itself (by being easy to use and by providing useful information to the citizen), but also by the marketing and dissemination activities of the host organization (as these may affect factors like social influence), and by addressing hedonic motivation (e.g., enhanced gamification features of the app). Other factors that indirectly influence app uptake are the availability of competing, for-free apps, and the presence of local threats in a country. Those who already have a first aid app, are unlikely to install a second app (due to limited additional usefulness), and the likelihood of needing first aid (due to an increased risk of, e.g., natural disasters or terrorism) will affect the perceived usefulness and value of the first aid app.

4.2   Success factors related to the host organizations

Host organizations will only adopt and market the app if these activities are in line with their own organizational goals and if they can manage the effort for translation, localization of content, and adaptation to the national context. This will be influenced by (a) the flexibility of the app structure, (b) the quality and usability of the underlying content management system, and (c) the local need for a new first aid app (mainly influenced by the eventual availability and quality of competing not-for-profit first aid apps in the national market). Other factors that influence app uptake by the host organization are legal issues (e.g., product liability), and their resources (both in terms of financial resources and skilled personnel, in particular personnel with some knowledge of and affinity to information technology, and personnel with medical and language expertise to provide precise translations of app content). The perceived effort needed to introduce the app will be determined by the expected quality and quantity of support provided by the GDPC. Figure 3 provides an illustration of key factors that influence the uptake of a first aid app that is globally provided yet locally adopted and marketed by not for-profit intermediaries, in this case the host organizations.
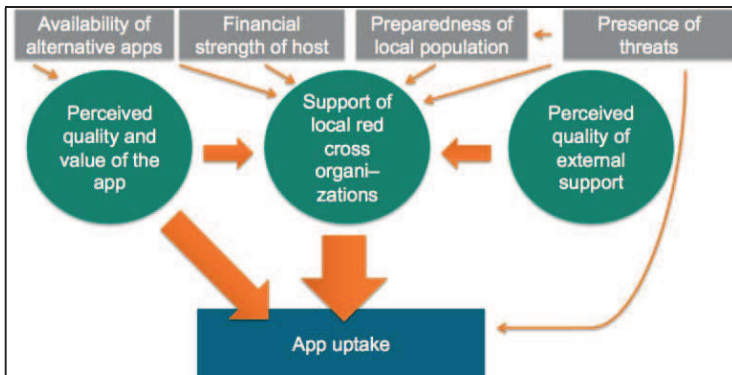

Fig. 3: Key factors influencing app uptake at the host organization and by citizens

5   Method

In order to idenfity requirements for a first aid app framework that is promoted globally but adapted to the local context, semi-structured interviews were conducted in 2015 with 29 interviewees from 8 socially, economically and culturally diverse countries. The interviews addressed issues including expectations, the goals and purposes of introducing the app, and experiences during customization, testing, and roll-out. Interviewees were members of the national Red Cross / Red Crescent organizations in the countries involved in the study and, had been involved in the actual adaptation or launch of the First Aid App in their respective country. Wherever possible, individual interviews were conducted. However, in a few instances, group interviewees were conducted (e.g. in cases where one of the interviewees had only limited knowledge of English). In most cases, interviews were conducted in person, whilst others were conducted virtually via Skype. The following table provides an overview of the countries analyzed, the number of interviewees in each country, and the interview format used.

Country	Number of interviewees	Interview format
Czech Republic	3	1 individual face-to-face interview 1 face-to-face group interview
Hong Kong	5	5 individual face-to-face interviews
Ireland	3	3 individual virtual interviews
Israel	2	2 individual virtual interviews
Malta	5	5 individual face-to-face interviews
Myanmar	4	1 face-to-face group interview
Iceland	5	5 individual face-to-face interviews
Switzerland	2	1 face-to-face group interview

Tab. 1: Setting of the interviews

Expert interviews were conducted to analyze the host organizations' views. Experts were also asked about the feedback that they received from the citizens who used the app. The interviews were recorded and transcribed and transcripts were used to identify system requirements with open coding.

In order to gain a deeper understanding of the citizens' views, user comments on Google Play and the Apple App Store were analyzed. User comments were coded and categorized into "positive", "negative", or "neutral". A comment was considered positive when it only contained positive adjectives or attributes, or a recommendation to

other users to use the app. A comment was considered negative when it only contained negative adjectives and attributes, or when it reported problems with the app or voiced criticism of the app. All other comments, incuding those with mixed attributes, were classified as neutral. In addition to the analysis of user comments, data on user behavior were extracted from Google Analytics to analyze patterns determing app download and usage activities.

6   System requirements from the host organizations' perspective

The analysis of expert interviews revealed five recurring items consistently mentioned by several host organizations, which will be discussed in this section.

User friendliness of the content management system. Since first aid information material is often prepared by medical experts, the content management system for the app must be easy to use even for non-IT professionals without the need for time-consuming training. Most host organizations do not have the resources to hire external IT professionals for system adaptation and implementation.

Localization of content. It should be possible to adapt the basic content of the app, and to add additional topics of local relevance. Examples of locally specific added content included information on snake bites in Switzerland (with an emphasis on specific poisonous snake species that are prevalent in the country), information on stabbing attacks (terrorism) or accidents related to swimming pools in Israel, information for beachgoers in Malta, and a special information feature on Ebola in the Czech Republic (there weren't any Ebola cases, but the additional feature addressed a general public interest on the Ebola disease during the recent epidemic). A second aspect is the adaptation of first aid content to local guidelines and the local context. The initial content of the app is based on IFRC first aid guidelines [IF11], but these always have to be reviewed against the local context. For example, recommendations in countries where ambulances are available within minutes and hospitals are reachable in a short time will substantially differ from recommendations for remote areas without any medical infrastructure. Furthermore, some first aid practices are internationally contested, so that adaptation to what is locally perceived as the best practice must be feasible. One example for a contested practice is whether to administer aspirin orally to a person who appears to be suffering from a cardiac infarction. Doing so is recommended in some countries (typically those with a poor medical infrastructure), but it is considered counterproductive in many countries or areas where ambulances arrive within minutes and medical experts will be able to administer more powerful drugs intravenously so that these take effect long before the aspirin has been digested.

Language adaptation. An app that is distributed and marketed worldwide has to be able to cope with multiple languages without any restrictions. This refers to the number of languages in which the content has to be implemented (Switzerland, for example, required 4 national languages plus English), and the handling of different character sets

and text orientations within the same app. The latter is, for example, relevant for Israel, where content is offered in English (Latin alphabet, text from left to right), and in Hebrew (Hebrew alphabet, text written from right to left). Similar issues were reported in Hong Kong and Myanmar. Language adaptation should not only consider characters and text orientation, but also alphabetic ordering of content, which has to be easy to implement for any language offered in the app. In order to enhance usability and for political reasons (equal representation of all population groups), it must be possible to select and store any of the available languages as the default language in the app's settings.

Local storage of the app. In order to assure instant availability of the app in all emergency situations, all app content including video material must be stored locally on the smartphone (in order to guarantee that the app works without delay even in case of breakdowns or loss of the mobile phone network). In the Czech Republic, Red Cross members also required the possibility to store and launch the app from an SD card (a feature requested by citizens who complained that the initial version of the app consumed too much memory on the smartphone itself). This requirement is also in line with recommendations from Royston et al. [Ro15].

Sharing of the app between smartphones. In some countries where Internet access is either very expensive or unreliable or unavailable, it will be necessary to provide the possibility to share the app between devices. In addition to copying / exchanging the app using SD cards (as already mentioned above), users in Myanmar reported that they use Zapya for app distribution, which is an app that establishes a Wi-Fi-connection between smartphones and then shares content between these devices.

The interviewees pointed out that the First Aid App's main purpose is (a) to generate or renew interest in the topic of first aid (with the goal to attract more participants to first aid courses), and (b) to help people in refreshing basic first aid knowledge, as practical experience shows that within three months, people already forget about 85% of the information that they received during a first aid course. By keeping users better trained, the app can enhance emergency preparedness and strengthen the resilience of laypeople in case of disasters, thus bridging the gap between the onset of disasters and the time when professional help arrives. In areas where first aid training is not available at all or too expensive, the app can provide citizens with some basic information on how to deal with emergencies once they occur.

7   User behaviour and user feedback

In order to identify when and how often people downloaded and used the app, Google Analytics data from the eight countries listed in Table 1 plus data from Mexico was analyzed. Central to this analysis was how successful the app had been in different countries in terms of downloads (as a percentage of the population). Table 2 shows the prevalence of the app in the countries under analysis. Some additional data, which were

analyzed, was the average duration of a session and the number of screens viewed in a session.

Country	Percentage of population who downloaded the app	Average session duration (minutes)	Average number of screens per session
Czech Republic	0.43%	2:29	7.42
Hong Kong	0.32%	2:54	9.92
Ireland	0.23%	2:16	7.21
Israel	0.72%	2:26	7.70
Malta	0.70%	2:25	8.20
Myanmar	0.01%	2:41	13.53
Iceland	3.97%	2:44	7.02
Switzerland	0.31%	1:58	7.27
Mexico	0.08%	2:50	8.66

Tab. 2: Downloads and usage statistics (as of Nov. 2015)

Data indicates that the success of the app varies between countries. In Iceland, the app has been very successful with downloads at 3.97% of the population. Typically, crisis communication apps reach up to 3% of the population directly, depending on the type of app, the threat levels in the region, and marketing activities (for examples see [BK16, Kr14]). The success in Iceland may be partly due to extremely high internet affinity (98.2% of the population, [WB15]). Additionally, the success in Iceland seems to have been affected by three factors in the app's rollout: 1) it coincided with the Icelandic Red Cross' 90th anniversary celebrations which invited a lot of publicity, 2) the Icelandic Red Cross benefited from wide and frequent media exposure and also created a cartoon character to promote first aid and, 3) unlike in other countries most of the Icelandic population live in the country's capital where the bulk of the app's marketing was focused making it easier for a larger percentage of the population to learn about the app. At the other end of the scale, in Myanmar only 0.01% of the population downloaded the app. This was partly due to the rather low available imcome and therefore limited availability of smartphones, but also due to the fact that sharing apps peer-to-peer is common because of high internet costs (Google analytics does not reliably detect such shared apps). App usage duration (between 2 and 3 minutes) and average number of screens viewed (typically 7-9) are similar in all countries under analysis, with Myanmar being again an exception with an average of 13.53 screens viewed per session.

A second point of inquiry was if the download rates were influenced by disasters or other major events. In order to analyze this a number of significant events in each country were selected, and download statistics were examinedfor a peak during this event. Although no general patterncould be identified, some incidents did in fact appear to result in a substantial increase in downloads. Figure 4 shows how a series of terrorism-related stabbing incidents (and the timely release of first aid information related to such incidents) influenced the download rate and app usage in Israel. The first stabbing incident was reported on October 3rd, 2015. The intensity of the attacks increased from October 7th onwards, with app usage starting to increase rapidly around October 8th.
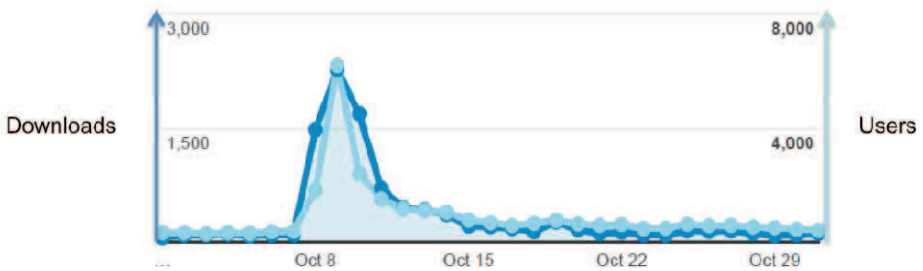

Fig. 4: Effect of stabbing attacks in Israel on downloads (left scale) and user statistics (right scale)

However, it is not always terrorism and disasters that drive app usage. In the Czech Republic, for example, usage and download intensity increased following a large scale sports event (the Fintail world championship).

Coding of the comments left by users on Google Play and the Apple App Store revealed that the overwhelming majority (>85%) of users gave positive feedback and / or found the app useful / helpful. In Switzerland, Israel, and the Czech Republic, for example more than 85% of comments were positive Negative comments referred mostly to some bugs and technical errors. However, these results cannot be regarded to be representative because they only include the views of those who actively decided to leave a comment in the Google Play / App Store, which is only a tiny fraction (<<1%) of overall users and most likely contains a self-selection bias.

8   Summary and Outlook

Within the study, we were able to derive key requirements that have to be met if a not-for-profit first aid app shall successfully be distributed worldwide (section 6). The study then analyzed an example of such an app (the First Aid App provided by the GDPC) and showed that this app does by and large meets the requirements of the national

distributors (here: the Red Cross / Red Crescent societies who have to decide whether to launch the app in a country), as well as requirements of the citizens using it (section 7). Some additional development focus still has to be placed on expanding the multi-language capabilities of the app, such as displaying content alphabetically ordered in any selected language. Figures on app uptake indicate that, under optimal circumstances (like in Iceland), approximately 4% of the population can be reached by a first aid app if it is distributed via app stores on a voluntary basis. This number may, however, be further increased through cooperations with mobile phone manufacturers (pre-installation of the app), or if governments decide to make installation of a first aid app a legal requirement for all smartphones to be sold in a country.[7] Expert inverviews indicate that first aid apps can potentially increase preparedness levels for an emergency

- by motivating people to look into the topic of first aid and to register for a first aid course,
- by refreshing existing knowledge on first aid (which is often initially obtained when acquiring a driving license or doing military / civil service, but rarely updated ever since), and
- by giving access to first aid information to people who otherwise would not have any access to first aid training.

However, they also indicate that first aid apps are a complement rather than a replacement for regular in-person training courses, because the latter are deemed to be much more effective in preparing citizens for emergencies. From the citizens' perspective, app uptake is driven by (a) media coverage of the app, and (b) sometimes by the prevalence of disasters, threats, or large scale events. However, in our study, only a limited number of incidents could be looked into, which did not reveal any clear pattern on which types of incidents and events actually drive app uptake and why some other incidents did not. Analyzing the relation between external threats / incidents and app uptake, complemented by a multifactorial statistical analysis, was beyond the scope of this study and remains an issue for future research.

Acknowledgements

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[7] A similar approach was chosen by the Dutch government when introducing its NL-Alert disaster warning service. Mobile phone manufacturers were required to pre-configure all new cellular phones so that they could automatically receive cell broadcasts issued by this service.

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