The many different ways of saying mobile: The natural history of mHealth at EMBC

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***Abstract*— Technologies for providing mobile healthcare, or mHealth, form a major part of the IEEE Engineering in Medicine and Biology Conference (EMBC) today. This paper investigates the history of mHealth at EMBC, assessing the current state of the field and its direction. The results show a very healthy, and also very diverse, subject that is intrinsically at the interface of many different underlying technologies.**

I. Introduction

The advent of mobile electronic devices, from phones and laptops to iPods and Gameboys, has undoubtedly been one of the biggest impacts on daily life over the last twenty-five years. Mobile technology has also had a massive impact on healthcare over the same period with ambulatory and at home monitoring becoming much more common, and the presence of many healthcare applications on smart-phones.

As a result topics on mobile healthcare, or mHealth, are a now major part of the IEEE Engineering in Medicine and Biology Conference (EMBC). The IEEE Xplore database has twenty-five years of the conference proceedings online and available to the authors spanning the period from 1988 to 2012. This work presents a systematic review of the mHealth contributions to EMBC. The aim is to provide historical background and motivation to the current mHealth contributions at EMBC, and to consider what the trends and patterns found imply for the future of this important area.

II. Methods

The history of mHealth at EMBC is a complex mixture of contributed papers, special sessions, mini-symposiums, workshops and keynote speeches. To reflect this mixture a number of different searches were performed on IEEE Xplore.

Firstly, text searches for the terms ‘mHealth’ and ‘m-Health’ were performed. To compliment these the conference keywords database was also interrogated (for the years when available). Since 2007 all published papers have author assigned keywords and in the proceedings each paper is listed next to its top keyword. This allows all mHealth papers, as determined by the actual authors, to be easily identified. Prior to 2004 the conference proceedings contained keywords in the form of an index. This has also been searched for mHealth relevant terms and contributions.

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Finally, special session and mini-symposiums are recorded in conference timetables. The numbers and titles of these provide insights to the development of the conference over the years.

III. Results and Conclusions

The terms ‘mHealth’ or ‘m-Health’ appear only 26 times in the searches on IEEE Xplore, with the first appearance in 2003. This however belies the true scope and history of mobile health at the conference. Contributions under the ‘Mobile health’ keyword (‘Mobile health management’ in 2010) increased from 20 in 2010 to 42 in 2012 alone. References to mobile health in the keywords go back to 1991, and as early as 2004 there was an entire track on mobile health. The number of keyword matches is still low however, with only 179 in total.

This still hides however the diversity of the mobile health field. For example, in 2012 out of approximately 170 potential keywords there are at least 39 that cover different aspects of providing mobile health: from ‘Consumer health’ to ‘Personalized health systems’ to ‘Wearable systems’, making up a very big part of the conference.

IV. Conclusions

Mobile health monitoring is a massive part of EMBC today. Its presence at the conference goes back at least 20 years under various different titles and topics, not necessarily as ‘mHealth’. In many ways this natural history reflects mHealth as it is today where it is an intrinsically multi-disciplinary and multi-topic combination of:

- IT
- Databases
- Cloud computing
- Mobile platforms
- Electronic health records

As well as of the underling technologies:

- Low power consumption electronics
- Robust communications
- Signal analysis techniques
- Raw computing power
- Human factors engineering
- Fundamental medicine

Investigating this history is important for assessing the current state of the field and its direction. It highlights mHealth as a diverse topic at the interface of many different areas. For successful future mHealth solutions these different areas need to be tackled holistically.