SmartGIS: Supporting Public Health in the Age of the App

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January 13th 2017

Summary

Health monitoring via mobile devices is a developing field, allowing people to volunteer personal information in tracking symptoms. This paper proposes that now is the time for GIScience to assume a new role in this burgeoning field. Data collected on the health profiles of individuals can be collated to allow visual mapping of diseases, offering opportunities to improve the containment of infection and to help the afflicted. Assessing possible opportunities and barriers to implementation in this field, this paper concludes that today's ubiquitous mobile technology provides a formidable basis for innovative use of GIScience to aid in public health surveillance.

KEYWORDS: *Public Health, Volunteered Information, Mobile Technologies, Mapping, Health Informatics*

1. Introduction

This paper charts new opportunities for the use of GIS in the realm of public health and epidemiology, specifically through its implementation into smart phones and mobile technologies. In the current day, virtually all members of Western society have ready access to mobile technology: many of them already use these on a daily basis to chart health symptoms. This can be done through built-in apps such as Apple Health for iOS, which allows mobile device users to record their heart rate, blood pressure (McConnell, et al., 2016), and other health variables with ease and immediacy. Users are also able to supplement these tools by downloading additional apps, extending the capacity of the technology to record health data and allowing them to volunteer additional information such as hours slept or quality of sleep. In tandem with the development of this technology, then, there is enormous potential for GIS to enter the fray and make strides towards improving public health. In utilising this ubiquitous mobile technology to map user symptoms and to visualise them as they progress, there is an extraordinary opportunity for members of the medical profession to improve the quality of treatment available; and, in doing so, to make a real change to the everyday lives of its users.

1.1. Background

Opportunities already exist for individuals to record and track their symptoms: many also allow health professionals to access this information, and employ it in an effort to improve the quality of healthcare on offer. Already, this has resulted in improvements, as it allows doctors as well as medical researchers to understand individual afflictions quickly and easily, as well mapping these in correlation with others who suffer from similar symptoms. In turn, this provides the opportunity for faster and more effective treatment of these ailments. Notable developments have already been made; for example, the eponymous Asthma Health app (Incahn School of Medicine at Mount Sinai, 2015). Cleverly making use of GPS mapping, this app ensures that the information it offers is directly relevant to mobile users by indicating areas of low air quality. Alerting asthma sufferers of areas to avoid provides an instant relief, as well as an improvement in their overall health. While mapping offers some benefits here already, real strides can be made through GIS developments.

In addition to this, further opportunities exist that can actively improve the tracking of symptoms temporally as well as spatially. Through the GPS embedded in mobile technology users can record their travels, and this can be combined by tracking symptoms in real time. Doing so enables the

gathering of data that allows health professionals to chart not only where, but *when* individuals suffer their ailments. This can be tracked precisely through mobile technology, and give a much more accurate portrait of their illness. By adding this information, more accurate diagnoses can be made, with the potential to result in improved quality and speed of response to dealing with illness and disease. Whilst this may impede the processing of the data slightly, it has the potential to act as a fruitful source of information later in the project regardless.

2. Opportunities and Limitations

Naturally, implementing GIS for use in the field of public health will not be without its challenges. Considerations must be made regarding the ethics behind using this data: while GIS does make use of increased quantities of voluntary data – recorded weight, for example, or flu-like symptoms – some may nonetheless view this as an invasion of the body, and personal health. Balancing ethical concerns with the potential benefits these advancements may make is essential, and an issue that must be carefully weighted before implementing any of the strategies this paper outlines.

Importantly, it must be stressed that whilst personal information is being used, this data has not been appropriated, but volunteered: devices and the apps developed for them do not take information without explicit user agreement. Although this information is likely to appear inherently personal to the users who record it when seeking a personalised and accurate suggestion for treatment of their affliction, a potential solution to this would be to anonymise the data collected and thus mask the identity of individuals (Hanchette, 2003). As such, the wider use of the volunteered data – as a composite part of a larger collection of data from which meaningful, useful conclusions could be drawn regarding the mapping of public health – must effectively be considered separately to its use as a tool for personalised responses to individual afflictions. In practice, the data would be used on a macro scale rather than micro, allowing the mapping of disease, illness, and affliction across meaningful geographic areas; and subsequently providing opportunity to make practical suggestions for containing these sicknesses.

In fact, volunteering health information has become normalised by the increasing ubiquity of mobile technology, with a distinguishing contribution made by Apple's Health app and Apple Watch. Reception of such applications has been largely positive, with digital media giant Buzzfeed publishing multiple articles advising young adults of mobile technology's vast potential for profiling individual health (Lee, 2016). Indeed, one of Apple Watch's main functions – and, arguably, one of its most appealing consumer features – is its built-in health monitoring systems. These build upon the success and popularity of tracking apps for running which allow users to chart their progress in health attributes and distance covered. The conditions which allow for the volunteering of useful health data exist now: and now is the time for GIScience to make developments in this field.

However, this paper also considers other potentially limiting factors for the effectiveness of this enterprise: among them, the fact that although Apple's Health app provides a standard corpus of information it can collect, any additional apps or programs used to supplement this must be considered non-standard. This can cause disruptions and issues for data collection and processing. Although general health information will be collected from these resources, specific information such as symptoms may create issues in standardisation across individual cases. To create accurate maps to chart individuals with specific health issues, specific volunteered information is necessary. This problem is not insurmountable, but has the potential to limit the scope of potential benefits severely, as well as calling into question the accuracy of predictions in terms of disease containment and treatment. Apple may elect to remedy this problem by developing further software that allows individuals to volunteer symptoms and ailments, or this task may fall to the implementers of GIScience entering this field. By implementing a standardised model for collecting data, professionals will be able to access all the pertinent information quickly and effectively, resulting in the ability to provide a higher quality of service and to improve conditions for project participants.

These issues aside, the potential benefit of this project is vast. It will allow health professionals to

visualise the challenges they face in terms of illness and disease outbreaks, and to react quickly and appropriately to these epidemics. Treating the information collected from individuals as a data set, the information creates a literal body of the disease: a body which can be traced spatially through mobile technology GPS, and which can be inferred verbally through patient reports of illness symptoms. With a greater capacity to predict the movements of the sick, strategies can be effectively put into place which will limit the likelihood of the infection of others and, furthermore, suggest appropriate locations for the stocking of medical treatments. Additionally, we should not discount the scope of the project's benefits on an individual level: it can give people suggestions on how best to treat themselves, which may relieve some pressure on medical services at the same time as improving patient wellness, and therefore creating a noticeable difference on both the macro and micro levels to support the field of epidemiology.

3. Summary

In summary, this paper suggests that GIScience actively enter the field of public health by adding to the existing volunteered health information facilitated through smart phones and mobile technology, with the potential of offering real progress in the field and positively affecting the lives of numerous individuals.

Acknowledgements

My thanks to my PhD supervisors, Stephen Jarvis and João Porto de Albuquerque, for their valued support and academic guidance; and to the EPSRC, the funding body without which my research would not be possible.

Biography

Alexander Caton is currently undertaking his first year on the CDT Urban Science and Progress at the University of Warwick, looking at different methods regarding urban epidemiology, especially in big data and mathematical sciences. Alexander's holds a BSc(Hons) in Discrete Mathematics and MSc in Urban Informatics & Analytics.

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