



The role of apps & wearables in breast cancer prevention pathways

September 2018

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A wide range of emerging technologies are showing considerable potential for improving healthcare through enabling personalised approaches at different stages of care and disease prevention pathways.

Currently, health promotion and screening are the predominant vehicles for breast cancer prevention and, in the main, are targeted at large sub-sets of the population. This means they do not take into account detailed biological characterisation of individuals or provide tailored prevention pathways.

We know that the development of breast cancer is influenced by many different factors, which are likely to vary between individuals, and that breast cancer is not one disease but has many sub-types with different outcomes. Can we create prevention pathways that take these factors into consideration?

In this series of briefings we provide some perspectives on particular technology areas to stimulate discussion on the vision for the future. These perspectives have been developed together with experts in these fields with the aim of stimulating discussion about the 20 year horizon.

There is some way to go in gathering the scientific knowledge and technical capabilities sufficient to optimising the impact of these technologies. Nevertheless, it is important to reflect on their potential in order to visualise how prevention pathways could differ in the future and how health systems will need to adapt to move towards more personalised prevention pathways.

We'd like to thank Dr. Esther Lips, Dr. Pedro Estrela, Professor Brian Caulfield, and Professor Jonas

Almeida for their work on these think pieces.

What are apps and wearables?

Apps and wearables can both be categorised as mHealth technologies, with the broad purpose of tracking behaviours, providing information, capturing data and providing personalised feedback. Wearables generally comprise miniature biomedical sensing technologies to capture a range of biometric markers of behaviour and performance over time. This information can be stored and fed back to the wearer via software such as apps and online platforms. Apps are programmes created for smart devices such as phones and tablets, that offer a range of health related services. Although apps and wearables are often employed together, they can be used as standalone technologies.

What are apps and wearables useful for?

Apps and wearables are already a popular means of health and lifestyle monitoring and are commonly used as physical activity trackers or diet aids. However, many currently lack the accuracy and regulatory oversight necessary for use within the healthcare system and are generally aimed at consumers. Apps and wearables targeting breast cancer are available and range from those that focus solely on providing information to ones that provide tools for prevention or early detection.

One sphere where there is already widespread use of mhealth is patient-facing healthcare administration, such as in automated appointment reminders and booking applications (e.g. automated reminders). However, the use of such applications in delivering patient care is increasing. For example through devices such as glucose monitors and the ActiPatch – an NHS approved device for chronic pain management.

The future for wearables and apps

Apps and wearables offer an effective means of capturing and visualising biomedical data for individual or health system use. However, merely capturing the data and presenting it back to the user is not enough. In addition to making the information available to users in an accessible fashion is the need for tools that enable individuals and clinicians to act on this information.

We are now entering an interesting phase of development where researchers and industry are coming together to develop the data analytics, visualisation and feedback concepts to provide this functionality to users. Future applications will be enhanced through more precise biomarker information generated by smarter sensors embedded in less obtrusive wearables e.g. second skin sensors, ingestibles and

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implantables. Techniques such as integration of advanced machine learning models for personalisation and context aware explainable recommendations for users are being developed in order to maximise functionality and thereby the value to users.

In anticipation of the potential clinical benefits of apps and wearables, healthcare systems are already investigating the inclusion of data generated from such devices into health records. Consequently, in the future it is likely that such information will play an important role in diagnosis, and monitoring responses to therapeutic interventions.

For breast cancer prevention, it is envisaged that this data could be leveraged to provide tailored information or specific interventions - for example through individualised behaviour change programmes. Monitoring individual biomedical data may also provide an alternate means of early disease detection or identification of those at higher risk.

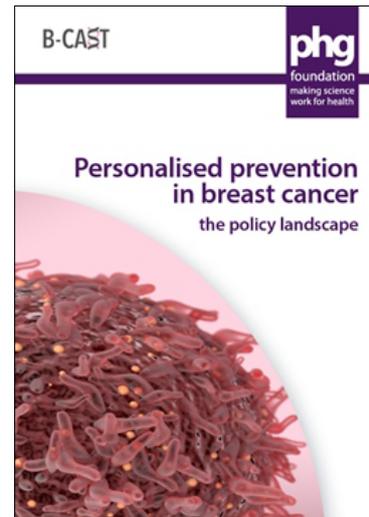
The field of apps and wearables is relatively new and their full potential across the healthcare spectrum is yet to be realised. Enabled by the creation of devices that not only provide data on health status but also leverage this information to encourage behaviour change to improve health status, this is likely to change.

Points for reflection

The future of personalised prevention for breast cancer will be very different in the light of further development and increasing use of apps and wearables. How will this knowledge be used in prevention? For example:

- What types of wearables and apps do we see having the greatest impact on breast cancer prevention pathways?
- Could risk assessment via apps be an integral part of the prevention pathway?
- Could monitoring of information from wearables and apps be part of early detection programmes for breast cancer?

A vision for the future starts with an understanding of the present. We have undertaken an analysis of current approaches to breast cancer prevention, and the discourse around personalised breast cancer prevention, with focus on primary and secondary prevention programmes.



About our work for B-CAST

As part of a European Commission (EC) funded research project, Breast Cancer Stratification (B-CAST), PHG Foundation is leading work on examining the potential for developing personalised prevention for breast cancer within national health systems. Building a better understanding of the influence of different risk factors on specific subtypes of cancer can, ultimately, help clinicians target treatments and prevention strategies to deliver improved health outcomes for patients.

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