MOBILE TECHNOLOGY IN CANCER CONTROL FOR EMERGING HEALTH SYSTEMS: DIGITAL DIVIDE OR DIGITAL PROVIDE?

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We live in an age of technology optimists, where innovation has become a byword for facilitation, improvement and success. In the field of development, information and communication technologies – defined broadly as any technologies used to create, disseminate and manage information, and including the internet, broadcasting mediums, and both fixed line and mobile telephony – have repeatedly demonstrated their use value in offering solutions to challenges facing emerging nations. There is a great deal of excitement around the use of mobile technology to overcome infrastructural limitations across all fields – business, health, education, agriculture and governance. Health in particular has seen numerous applications of smartphones and analogue phones being used to improve health coverage and access to services. The technology has been used to promote health and healthy behaviours, raise awareness of health risks, facilitate early diagnosis, manage treatment and adherence, increase surveillance and data collection, and in general improve health systems management and information sharing. There is however the contrasting view that mobile services and mobile technology solutions are not yet validated sufficiently to merit their use in strengthening or replacing existing public health delivery programmes, and have no standard operating systems.

Noncommunicable diseases (NCDs) are the leading cause of global death and disability *(1)*. Among these, cancers were responsible for some 8.2 million deaths in 2012 *(2)*. Evidence suggests that a comprehensive approach to cancer control and prevention across the life course of an individual will reduce the burden of the disease. The goal of any comprehensive cancer prevention and control programme is typically to reduce the burden of cancer by focusing on three main approaches: 1) health promotion and lifestyle changes such as tobacco control; 2) increasing screening and early-stage treatment of pre-cancers and cancers; and 3) providing timely, appropriate treatment, patient follow-up and palliative care for advanced-stage cancers.

In 2008, over 80% of all NCD-related deaths occurred in low- and middle-income countries *(3)*. Of these, two-thirds of all cancer-related deaths occurred in low- and middle-income countries, with some rates even higher *(4)*, such as breast mortality rates *(5)*. The cancer burden in these countries is predicted to worsen over time, with an estimated percentage increase in cancer incidence greater in low- (82%) and lower-middle-income countries (70%) by 2030, compared with the upper-middle- (58%) and high-income (40%) country rates *(6)*. This is often related to problems within the primary health-care infrastructure where challenges relating to issues with awareness, access, appropriate policy and data, all of which contribute to elevated mortality rates. Of over 270,000 women who die from cervical cancer every year, for example, more than 85% of these deaths are in low- and middle- income countries and are linked to systemic problems such as a lack of cervical cancer policies and programmes, insufficient data,

insufficient skills for diagnosis and management, high cost of immunization against Human Papilomavirus (HPV), one of the primary causes of cervical cancer, and socio-economic and geographic barriers to care *(7)*. This should serve to highlight the scope of the challenge facing national health systems in managing the disease.

A growing awareness of cancer incidence rates in developing countries is paralleled by another rising rate – mobile phone usage. By the end of 2014 the mobile penetration rate in developing countries reached 90%, with the total number of mobiles accounting for 78% of the global total of 7 billion *(8)*. The ubiquity, popularity and established social acceptability of the mobile makes it a potential delivery channel for communication between public health providers and populations. Mobiles have already been used in multiple small or medium size projects to improve treatment adherence in specific health programmes such as HIV Antiretroviral Therapy *(9)*. They have also been used in several knowledge expansion programmes for different audiences. In Maternal and Child Health, the MAMA Alliance and MOTECH programmes have used SMS and voice messaging to increase knowledge of child care for expectant or new mothers in South Africa and Ghana. They have also been used as a confidential hub for youth knowledge access by the U-Report application in countries including Uganda and Zambia, where young people can access medical information and advice on a number of conditions which they might refrain from asking publically, such as sexually transmitted conditions or stigmatized diseases like HIV/AIDS. Nor has activity been restricted to Africa; the MAMA Alliance has also implemented programmes for maternal support in Bangladesh, and the BBC Media Action programme Mobile Kunji has provided similar pregnancy and neonatal support to remote communities in the Indian state of Bihar *(10)*.

Populations in low- and middle-income countries frequently suffer from weak health infrastructure for disease control: minimal clinical resources, infrequent health worker visits, and a general apathy towards preventative measures due to a lack of information. In cancer control this is particularly acute. About 70% of all cancer cases are diagnosed when the disease is already at too advanced a stage to be cured *(11)*. The pro-mobile arguments see mobiles as an "enabler" to improve awareness, facilitate access to timely screening, and ensure proper patient follow-up, overcoming some of the commonest barriers to cancer control.

The questions that require examination are the following. Firstly, the validation of the appropriateness of mobile solutions for wide-scale use in cancer control programmes carried out in low- and middle-income settings (LMICs). This involves looking at how to integrate mobile interventions within the broader framework of existing health systems, since mobile programmes working in isolation will fail to provide these benefits. Secondly, an assessment is needed of the exact value-add of mobile-based solutions in terms of their evidence as effective public health tools.

The third and final question hinges on cost. A similar validation process needs to be undertaken in order to assess the true cost-effectiveness of mobile health (mHealth) programmes. Excluding its return on investment in terms of improved population health, which is difficult to calculate accurately, the technology offers two primary areas of quantifiable cost-effectiveness to national health services. The first reason is that once it is built and embedded into a public health system, the mobile platform infrastructure used for one intervention can be used to target any number of programmes for other diseases. The platform itself is disease-agnostic, making it a solid investment case for governments since the content can be constantly adapted to target the specific health needs of a population or sub-group. This renders the infrastructure investment for a single programme a one-time cost for servicing needs across communicable and noncommunicable diseases alike, as has already been demonstrated in several mobile projects *(12)*. Secondly, the scale at which mobiles are able to reach and engage patients offers a clear opportunity for economies of scale in national programmes, via a low cost per user ratio to render the intervention cost-effective overall. A caveat to this is the need for a strong, sustained promotion campaign for any new mobile-based service, in order to ensure sufficient enrolment and uptake amongst patients and professionals during the initial phase whilst it is normalized as part of basic service provision.

The following article assesses existing evidence on interventions using mobile technology to improve cancer control in emerging health systems. It reviews existing evidence on interventions based around prevention, diagnosis and management of cancer, and draws some broad conclusions on the effectiveness and suitability of incorporating mobile-based solutions into primary health-care services in low-resource settings.

Interventions

In an exploration of opportunities and challenges facing cancer management, the primary challenges were based around four themes: patient-related challenges, health-care providers, health facilities and management *(13)*. These

challenges can be extended to apply to the barriers facing the control of other cancers across the continent, and should provide a useful focus for research on how to leverage mobile technology in a way that effectively addresses the needs of the existing health systems and resources. Overall it seems that if mobile technology is to be applied successfully to cancer control, its focus should be on addressing existing health system needs as opposed to adding innovation for innovation's sake. This is in accordance with conclusions on the general use of mHealth within national health systems *(14)*.

Health promotion

As seen in other mHealth promotion examples from other disease areas – maternal and child health for example – mobile technology can improve access to information. In cancer this could be used to improve awareness of the importance of screening and of how to access the service. This has already been conducted successfully in one trial, carried out in a high-income country setting, where information delivered by SMS saw a 23% increase in female screening rates *(15)*. Another study found significant willingness from users to receive information on cancer prevention and awareness delivered via mobiles; this was conducted among an African diaspora but within a high-income country *(16)*. The challenge will be to test whether these results can be replicated in a low-income setting at scale using sufficiently high-quality evidence. There are numerous examples of SMS-based public awareness campaigns for disease control in developing countries, but the majority of these are based on grey literature and may not hold sufficient scientific validity to be implemented at national scale *(17)*. Another factor key to the success of a cancer prevention programme carried out by SMS will be the suitability of the message tone and content to the intended audience: it is not the SMS delivery channel itself that is successful, but the effect the message it contains has on the recipient. Tailoring the content is therefore a key step in the success of any mobile-based health promotion strategy *(18)*.

There is also evidence that mHealth can be useful for improving population knowledge of cancer prevention and management. Mobiles have been used to provide a communication channel to promote individual behaviour change in attitudes towards cancer prevention and self-management. A 2014 study reviewed a set of 28 mHealth applications for educating people on cancer prevention and management across income and age groups. The authors identified 28 articles reporting on mobile applications for patients related to cancer, involving direct patient education, patient/professional communication and patient self-management *(19)*. Patients who had mobile contact with health workers demonstrated increased engagement with the knowledge content and treatment processes, showing that mobiles can help increase the understanding of both the importance of self-monitoring, and provide a reliable source of information on how and where to seek medical assistance if needed.

Health access

In cancer screening, mobile technology could play a role if properly designed and applied. Early screening is more cost-effective and has better health outcomes than treatment, yet in the example of cervical cancer the majority of women present themselves at clinics at a late stage *(20)*. Given the complexity of organizing national screening programmes, there is currently a gap in large-scale national cancer screening programmes in the developing world, including the African continent *(21)*. The introduction of basic mHealth services to help address this gap is an area where the technology could have a real and relatively immediate use value, for linking patients to the formal health system as much as expanding health service outreach through health worker training. They can be used for basic preliminary diagnoses of certain cancers such as cervical or skin cancer. In a trial in Botswana, images of suspected cases of cervical cancer were sent to trained gynecologists for preliminary diagnosis, also showing that mobiles can be used to improve patient-provider communication and increase a country's health workforce *(22)*. The technology however is a stop-gap measure: remote diagnosis should not be relied upon as a full substitute for clinical attendance. This is partly because formal cancer diagnosis is often an activity requiring physical examination as well as ocular; it is also connected to a substantial lack of reliability from the point of view of medical professionals. It has not yet been fully trialed in any setting; yet simple techniques could be used to help health workers reach remote rural patients, expanding health access coverage.

Mobiles could also be incorporated into expanding and strengthening vaccine coverage. For the few cancers where preventative vaccinations are available, these appear effective and should be offered nationally. The vaccine against Hepatitis B, a major cause of liver cancer, has been classified as a "best buy" intervention according to WHO standards, denoting it as a good investment for countries on the grounds of its health impact in relation to cost. Vaccination against human papillomavirus (HPV), the main cause of cervical cancer, has also been recommended *(23)*. In

order for vaccination to be effectively managed, basic data needs to be collected from every recipient (name, age, date of vaccination, dose) – an area where the mobile as data collection unit has a clear use value. Other immunization programmes, such as those for polio, have used SMS and Interactive Voice Response Systems (IVRS) to connect with beneficiaries and their families, allowing vaccine uptake and coverage to be tracked *(24)*. There has also been geographical tracking of vaccine supply chains using mobiles which has increased procurement and delivery efficiency *(25)*.

Follow-up

When the focus is not specifically on treatment, which tends to be heavily disease-specific, the contribution of mobile technology to health system strengthening can be considered using examples from other disease areas *(26)*. Cancer researchers and practitioners have an opportunity to leverage the experiences of mHealth in its application to topics such as health system management (appointment tracking and follow-up, patient reminders), health worker training, and health promotion campaigns. The flexibility of mobile technology for achieving this easily is one of its main strengths as a disease support tool in health systems, since it allows replicability and avoids the need to reinvent the wheel for each new disease programme addition. Relevant examples can be seen in appointment reminders for HIV patients and gestational diabetes in low-income settings *(27, 28, 29)*. Reviews of clinical trials of SMS appointment reminders carried out in 2012 and 2013 concluded that the intervention is moderately effective in improving attendance *(30)*.

Box 1: Case study: Be He@lthy, Be Mobile

One effort to translate trial outcomes into large-scale national programmes can be seen in the work of a new joint UN initiative between WHO and the International Telecommunications Union (ITU), which works to scale up mHealth programmes targeting a range of NCDs including cancer. In this initiative, Be He@lthy Be Mobile, the emphasis is to create a blueprint which allows governments to adopt and implement mHealth technologies such as mTobaccoCessation, mDiabetes, mCervicalCancer, and mWellness, with an emphasis on building an institutional framework. The programmes are led by the government and fully aligned to the national health programme priorities. In the specific case of cervical cancer control, the initiative identifies the options which best address the gaps and needs of existing national cervical cancer control programmes. This allows greater outreach of the service, increasing its role in primary health care without portraying it as an additional burden for health workers or a new and unfamiliar aspect of health care which would see minimal population demand.

Further details on the initiative and its work can be found at: **http://mhealth4ncd.itu.int**

Replicability

The mHealth technology is a strong example of the benefits of layering multiple programmes: integrating cervical cancer awareness with services for maternal and child health for instance, by adding components from each into a single mHealth platform or by using the same platform to deliver different disease control services to the same users. The mHealth initiative above demonstrated the feasibility of this approach during the recent Ebola outbreak in West Africa, where a 1-way SMS programme providing information to people with diabetes was scaled up to send out 4 million SMS messages on Ebola prevention in Dakar and St Louis. This demonstrates the opportunity mSolutions offer to reinforce the health objectives of multiple disease strategies within a country. For example, given that at present more women in LMICs die from cancer than any other condition in Africa, it would be logical to combine early cancer screening with health check-ups for other issues prevalent amongst women such as pregnancy or post-natal care *(31)*. This could be managed directly through their own phones, by delivering information to increase awareness or registering patients and clinical results through SMS; alternatively it could be managed by local health workers sending data via SMS to centralized databanks to track patient check-up attendance and results, as is currently done in other maternal and child health programmes such as those run by the MAMA Alliance in South Africa and Bangladesh.

From these studies, it appears that a good area for future mCancer programmes to consider focusing on is the reduction of existing barriers in areas which are hindering the provision or uptake of basic services. It is anticipated that mHealth will have the greatest impact when programmes are focused on areas such as raising awareness of cancer risks and symptoms, preliminary diagnosis by health workers, clinical appointment management and diagnostic follow-up.

Conclusion

Policy-makers, cancer researchers and practitioners have an opportunity to leverage the experiences of mHealth in other disease areas, avoiding reinventing the wheel *(32)*. The benefits of mobile interventions remain conditional on an understanding of the technology's use value as a support

device for improving existing gaps in a developing country's health system. This is important in terms of the mobile's relevance to developing country health support systems because of the mobile phone's ubiquity and high user trust, especially in Africa where services such as mobile banking originated and are widely used. This trust in the mobile phone is a key factor in the technology's potential as a public health tool, since it encourages regular use and a willingness to follow behavioural change recommended by mobile-based programmes. It is especially relevant for encouraging the creation of interventions based on feature phones as opposed to smartphones, predominantly SMS or voice messages.

Overall, the focus which is most promising is one that understands the mobile phone primarily not as a solution in and of itself, but as an enabling device for health care. It should not be considered as a conduit for delivery of an intervention which will directly improve the health of the recipient. The mobile remains true to its original use value as an instrument for improving communication. Its most reliable use value, for the time being at least, seems to be facilitating interaction between the population and the health-care system. The disjuncture between the national health system and populations means that the problem can be phrased as being essentially a breakdown of communication in health systems between user and provider. This reconceptualization of the underlying problem automatically raises the appropriateness of the mobile phone as an instrument to resolve the challenges facing cancer control in low- and middle-income settings – reminding us of the technology's primary role as the definitive communication tool. •

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References

1. Di Cesare, M., et al. Inequalities in non-communicable diseases and effective responses. *Lancet* 381, 585-597 (2013).
2. GLOBOCAN IARC 2012
3. World Health Organization (WHO), Global Status Report on Noncommunicable Diseases 2010. Geneva, 2010
4. WHO, 2010 NCD Global Action Plan, ibid.
5. International Agency for Research on Cancer, "GLOBOCAN 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012". Cached copy available at: http://globocan.iarc.fr/Pages/fact_sheets_population.aspx
6. WHO, 2010 NCD Global Action Plan, ibid.
7. Ferlay J, Bray F, Pisani P, Parking DM. International Agency for Research on Cancer (IARC), GLOBOCAN 2002. Cancer Incidence, Mortality and Prevalence Worldwide. *CancerBase No.5*, version 2.0. Lyon, France: IARC Press; 2004
8. International Telecommunications Union, "The world in 2014: ICT facts and figures", online publication 2014. Available at: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf
9. Lester RT, Ritvo P, Mills EJ, Kariri A, Karanja S, Chung MH, Jack W, Habyarimana J, Sadatsafavi M, Najafzadeh M, Marra CA, Estambale B, Ngugi E, Ball TB, Thabane L, Gelmon LJ, Kimani J, Ackers M, Plummer FA. "Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial." Lancet. 2010 Nov 27;376(9755):1838-45. doi: 10.1016/S0140-6736(10)61997-6. Epub 2010 Nov 9. (http://www.ncbi.nlm.nih.gov/pubmed/21071074)
10. BBC Media in Action report, active since 2010. Onlien summary available at: http://msbcindia.org/mobile-kunji/
11. International Atomic Energy Agency (IAEA) and Programme for Action on Cancer Therapy, "The Problem: Cancer in Low- and Middle-Income Countries", online report 2014. Cached copy at: http://cancer.iaea.org/documents/PACTBrochure.pdf
12. See for example the use of SMS awareness messages to women after childbirth on the importance of re-testing for post-gestational diabetes. Heatley et al 2013, "The DIAMIND study: postpartum SMS reminders to women who have had gestational diabetes mellitus to test for type 2 diabetes: a randomised controlled trial - study protocol (available at: http://www.ncbi.nlm.nih.gov/pubmed/23587090)
13. Holeman I, Evans J, Kane D, Grant L, Pagliari C, Weller D. "Mobile health for cancer in low to middle income countries: priorities for research and development". Eur J Cancer Care (Engl). 2014 Nov;23(6):750-6. doi: 10.1111/ecc.12250. Epub 2014 Oct 17. (http://www.ncbi.nlm.nih.gov/pubmed/25324023)
14. Labrique, AB, Vasudevan, L, Kochi, E, Fabricant, R and Mehl, G. "mHealth innovations as health system strengthening tools: 12 common applications and a visual framework". Glob Health Sci Pract. Aug 2013; 1(2): 160–171. Published online Aug 6, 2013. doi: 10.9745/GHSP-D-13-00031 (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4168567/)
15. Lee HY, Koopmeiners JS, Rhee TG, Raveis VH, Ahluwalia JS. "Mobile Phone Text Messaging Intervention for Cervical Cancer Screening: Changes in Knowledge and Behavior Pre-Post Intervention". *J Med Internet Res* 2014;16(8):e196
16. Schoenberger, YM, Phillips, JM, Mohiuddin ,MO. "Text Messaging as a Method for Health Ministry Leaders to Disseminate Cancer Information" *J Cancer Educ.* 2014 Oct 30. [Epub ahead of print] (http://www.ncbi.nlm.nih.gov/pubmed/25355523)
17. See for example the map of SMS prevention campaigns in the developing world up until 2012: Figure 1. Déglise, C, Suggs, LS, and Odermatt P. "Short Message Service (SMS) Applications for Disease Prevention in Developing Countries" J Med Internet Res. 2012 Jan-Feb; 14(1): e3. Published online Jan 12, 2012. doi: 10.2196/jmir.1823 (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3846341/)
18. Déglise et al. 2012.
19. Davis SW, Oakley-Girvan I. "mHealth Education Applications along the Cancer Continuum". J Cancer Educ. 2014 Dec 9. [Epub ahead of print] (http://www.ncbi.nlm.nih.gov/pubmed/25482319)
20. Dey S. "Preventing breast cancer in LMICs via screening and/or early detection: The real and the surreal" World J Clin Oncol. 2014 Aug 10;5(3):509-19. doi: 10.5306/wjco.v5.i3.509 (http://www.ncbi.nlm.nih.gov/pubmed/25114864)
21. Freddy Sitas, Max Parkin, Zvavahera Chirenje, Lara Stein, Nokuzola Mqoqi, and Henry Wabinga. Chapter 20, "Cancers", from Disease and mortality in Sub-Saharan Africa, second edition. Jamison DT, Feachem RG, Makgoba MW, et al., editors. Washington (DC): World Bank; 2006.
22. Quinley KE, Gormley RH, Ratcliffe SJ, Shih T, Szep Z, Steiner A, et al. Use of mobile telemedicine for cervical cancer screening. *J Telemed Telecare*. 2011;17:203–9 (http://www.ncbi.nlm.nih.gov/pubmed/21551217)
23. WHO, 2010 NCD Global Action Plan
24. Arogyadeep programme, Uttar Pradesh. Online report available at The Indian Media Knowledge Center: http://www.audiencescapes.org/india-text-messages-boost-immunization-555
25. Programme for Appropriate Technology in Health (PATH), Op-ti-mize newsletter, Issue 6 2010 http://www.path.org/files/TS-optimize-newsletter-sep10.pdf
26. Holeman et al., ibid.
27. Bigna JJ, Noubiap JJ, Kouanfack C, Plottel CS, Koulla-Shiro S."Effect of mobile phone reminders on follow-up medical care of children exposed to or infected with HIV in Cameroon (MORE CARE): a multicentre, single-blind, factorial, randomised controlled trial." Lancet Infect Dis. 2014 Jul;14(7):600-8. doi: 10.1016/S1473-3099(14)70741-8. Epub 2014 Jun 2. (http://www.ncbi.nlm.nih.gov/pubmed/24932893)
28. Kunutsor S1, Walley J, Katabira E, Muchuro S, Balidawa H, Namagala E, Ikoona E. Using mobile phones to improve clinic attendance amongst an antiretroviral treatment cohort in rural Uganda: a cross-sectional and prospective study. AIDS Behav. 2010 Dec;14(6):1347-52. doi: 10.1007/s10461-010-9780-2. (http://www.ncbi.nlm.nih.gov/pubmed/20700644)
29. Heatley et al 2013, ibid.
30. Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R, Car J. "Mobile phone messaging reminders for attendance at healthcare appointments." Cochrane Database Syst Rev. 2013 Dec 5;12:CD007458. doi: 10.1002/14651858.CD007458.pub3 (http://www.ncbi.nlm.nih.gov/pubmed/24310741)
31. Dey S. 2014, ibid.
32. Holeman et al. 2014, ibid.