

Will the introduction of the National Broadband Network change the face of preventive medicine?

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Introduction

Aging of the Australian population will increase the demand and provision of health services. Older Australians are significant users of healthcare, which is in disproportion to their number.¹ A large proportion of health utilisation is devoted to managing chronic diseases,² many of which are to a certain degree preventable. Some of the diseases are linked to unhealthy lifestyle factors such as cigarette smoking, excessive drinking, lack of physical activity and excess body weight. In some cases, the progress of the chronic diseases may be slowed and serious consequences (i.e. hospitalisations, moving to nursing home) can be avoided or significantly delayed by timely access to care and/or good disease management.³ Thus, preventive measures may ease the burden on the overloaded healthcare system and decrease the health expenditure.

There is considerable potential for internet-based solutions to play an increasing role in the provision of health services. Their role in the area of preventive medicine is less defined.

There are two key factors that may revolutionise the delivery of health services in Australia in the immediate future. The first is the National Broadband Network (NBN) rollout, delivering high-speed broadband fibre-optic connection to 93% of the Australian population, with the rest having access to wireless and satellite internet. The other is the recently announced health system reform, which will include the introduction and development of e-Health applications.

At present, major metropolitan institutions are linked by fast internet connections. The introduction of the NBN will not greatly change the way they operate. However, many rural and remote areas currently lack fast and reliable internet connections and it is these areas which will most likely benefit from the “communication revolution”. The development of fast, cheap and reliable internet connections will allow good quality two-way interactive communication and will open new opportunities for telehealth, supporting the possible shift in emphasis from curative medicine to a more preventive approach.

The introduction of the NBN will also impact the Australian military, which is in the process of introducing new electronic services. In 2011 the Australian Department of Defence signed a contract to develop and implement an electronic health information system for the Australian Defence Force known as the Joint eHealth Data and Information (JeHDI) system.⁴

In this paper we will provide a short overview of internet-based solutions, which are successful in providing effective primary, secondary and tertiary health prevention to end users. We have concentrated on interventions that are dependent on internet speed and therefore will be potentially enhanced by the introduction of the NBN. Additionally, examples of existing relevant online health services and health initiatives related to prevention are provided.

Existing internet-based solutions in preventive medicine

Primary prevention

Published literature on primary prevention covered topics such as health promotion and education, which also included information, coaching and

relevant interventions to promote healthier lifestyles.

- There was some evidence that videoconferencing may reduce social isolation^{5,6} and interactive online programs may reduce excessive drinking.⁷
- Online programs to reduce smoking are popular and regarded as helpful, but there is little direct evidence of their effect on smoking cessation.⁷

- There was no evidence that online programs increased physical activity, promote wellness or improve nutrition, provided any measurable health effects above offering information. However, interventions used in the studies were not interactive, tailored or sufficiently engaging to the user needs.

Secondary prevention

Published literature on secondary prevention covered topics such as online medical services and internet-dependent screening services for general (previously undiagnosed) populations.

Access to primary health care

Although currently there is no published literature linking online access to primary health care with improved health outcomes, several advanced internet sites developed by governments and private organisations provide online primary care sites. The effectiveness of these programmes in improving access that primary health care may be inferred from their wide use by patients, patient satisfaction and perception of their cost-effectiveness by providers.

Internet dependent screening of general population

There was very limited evidence that:

- Screening for glaucoma using portable devices and semiskilled, ancillary health-care workers and specialists situated off-site is feasible for rural, remote or nursing homes residents;⁸
- Online hearing tests and audiological diagnosis are feasible, may contribute to increased identification and treatment of hearing-impaired subjects and have the potential to provide health-care coverage for rural areas where specialised audiological services are lacking;⁹⁻¹¹
- Screening for lung cancer using a mobile tomography unit is feasible and may identify the disease at an early stage, thus improving quality of life and prognosis;¹²
- Screening for cardiovascular risk using mobile clinics with semiskilled, ancillary health-care workers and specialists off-site is feasible for rural and remote area residents.¹³

Tertiary prevention

Tertiary prevention is focused on prevention of disease progression and attendant disability after a diagnosis has been established. Topics such as screening for eye disease in the diabetic population, home tele-monitoring using automated devices in populations with selected chronic diseases (diabetes, heart failure, COPD), suicide prevention and wound management.

Screening for diabetic retinopathy

Internet-based screening for eye disease in diabetic populations using digital fundus photography performed by auxiliary health workers and a specialist off-site has been applied in rural and/or remote areas of Australia and Canada, and for American Indian and Alaskan Native populations. It is also being developed in the European Union as an international cooperation.¹⁴ The validity of the model has been thoroughly researched. Diagnosis was found to be reliable and accurate.¹⁵ It appears to be cost-effective for rural, remote and forensic populations, but not for urban areas, where a well developed system of screening by optometrists is in existence.^{14,16}

Home telemonitoring

Home telemonitoring of patients with chronic diseases is clinically effective. Clinical benefits appear greater in populations with heart failure and mixed chronic diseases than with those with COPD or diabetes. Evidence on the impact of health services utilisation is more limited. Compared with usual care, the following observations were made:¹⁷

- For patients with diabetes, home telemonitoring provided better glycaemic control and appeared to reduce hospitalisation but increased the use of non-hospital health care.
- For patients with heart failure, home telemonitoring appeared to reduce hospitalisations, but increased the use of non-hospital health care. In numerous small trials, telemonitoring reduced mortality;¹⁷ however, the results were not confirmed by a recent, very large single trial.¹⁸
- For patients with mixed chronic diseases, telemonitoring reduced mortality and health services utilisation.
- Quality of life (QoL) and satisfaction of telemonitored patients were similar or higher in all studies.
- Economic analysis indicates that home telehealth may be cost-saving, although the evidence is limited by the low quality of studies.¹⁹

Home telehealth interventions are becoming an integral part of health care delivery in Canada and with the US Department of Veteran Affairs.^{17,19}

Wound management

Internet-based solutions in wound care, including wound photography and videoconferencing for care management appear to have substantial health benefits, such as improved healing rates, fewer amputations, fewer hospitalisations and a shorter length of hospital stay.^{20,21} They increase

the effectiveness of utilisation of scarce specialist services and present objective health benefits for patients in rural and remote localities; they may result in reduction of costs associated with treatment and transportation. Telehealth-enabled wound management is in the process of being adopted in Western Australia.²²

Suicide prevention

There is very little evidence of direct outcomes (i.e. decrease in suicide rate) resulting from online programs of suicide prevention; most studies investigated intermediate outcomes such a change in mental state, caller satisfaction and session impact. There is some supporting evidence for effectiveness of online -based programs in achieving these intermediate suicide prevention outcomes. There is a reasonable level of evidence of online -based programs demonstrating the effectiveness of online suicide risk assessments and suicide screening.²³

An example of an online suicide prevention program is the United States Department of Veterans Affairs (US VA) online suicide assessment program for evaluations of self-harm in rural and remote sites via videoconferencing and to the home via videophone and in-home messaging devices.²⁴

NBN potential to affect the delivery of preventive medicine

While the NBN has the potential to change the current level of e-Health services available, primarily in areas that currently have poor connectivity such as rural and remote areas, the impact of the NBN on health service delivery is highly dependent on service development and user adoption.

Currently, one of the major problems for any new development of internet-based solutions in Australia is the great variation in connection speed available to users. According to Brad Howarth, author of the book "A Faster Future", many internet services were deliberately throttled back in terms of their bandwidth requirements in order to service the greatest number of people. It is only when the connection speed becomes uniformly high across the country that it becomes profitable for developers to start building applications that actually take advantage of the high network speeds.

In 2010, the Australian Government embarked on a reform of the health system. This reform, outlined in the "Release of Roadmap to Reform" media release, includes many fundamental e-Health initiatives, such as providing Medicare rebates for online consultations from July 2011 and the introduction of Personally Controlled Electronic Health Records (PCEHR) in 2012.²⁵

With the roll out of the National Broadband Network, it is expected that there will be an introduction of technological enhancements into areas of rural and remote Australia not seen before. It may also be assumed that when preventive measures in the area of secondary or tertiary prevention become available, community members will be informed via health services and health professionals. In the area of primary prevention, when suitable online programs become available, the existence of the programs should be advertised to the target community.

Out of the presently available internet-based initiatives in preventive medicine, one of the most positively affected by the introduction of the NBN will be videoconferencing-based health care services. These services may be used to reduce loneliness and bring people together by providing either specialised programs or by fostering communication between the elderly and their distant family members.^{5,6} They can also be used to enable access to primary and specialist health care from the patient's home, with those isolated by distance or age and disease, such as people living in rural and remote areas and the residents of nursing homes who will benefit the most.

Summary

The internet plays an increasing role in the provision of health services directly to the end users. Its role in providing internet-based interventions is well documented, but its role in the area of preventive medicine is less defined.

In this paper we provided a short overview of internet-based solutions which are successful in providing effective primary, secondary and tertiary health prevention to end users. We concentrated on interventions that are dependent on internet speed and therefore will be potentially enhanced by the introduction of NBN.

There were numerous studies providing evidence for the effectiveness of internet-based tertiary prevention measures, such as screening for diabetic retinopathy, chronic disease management by home telemonitoring and tele-wound care. There was less evidence for the effectiveness of internet-based interventions developed for primary and secondary prevention. A number of innovative, commercially available online health services and national health initiatives that are related to prevention, primary health care and disease management were identified.

The introduction of the NBN will improve access to these initiatives for those outside the metropolitan areas and may stimulate the development of new applications. The NBN is a powerful tool that may potentially enable the development of innovative e-Health solutions for the future.

Table 1: Online health services and national health initiatives that are related to prevention, primary health care and disease management

Primary Prevention

Government portals:

- <http://www.healthinsite.gov.au> (Australia)
- <http://www.nhs.uk> (UK)
- <http://www.healthfinder.gov> (USA)
- <http://www.publichealth.gc.ca> (Canada)

Intervention sites:

- Canadian portal website Evolution Health (<http://www.evolutionhs.com/>)
- Stop Smoking Centre (<http://www.stopsmokingcenter.net/>)
- Healthy Weight Centre (<http://www.healthyweightcenter.net/>)
- Alcohol Help Centre (<http://www.alcoholhelpcenter.net/>)
- ElderGym Senior Fitness (<http://www.eldergym.com/index.html>)

Secondary Prevention

Online screening tests:

- Phonak™ offers an online test that measures user ability to hear in the presence of noise.
- Siemens™ offers a test that measures the ability to pick a word out from background noise.
- Starkey™ lets the user listen to tones at different frequencies and compare their hearing curve to the standard ones.
- All these tests can be accessed from the About.com portal at <http://deafness.about.com/od/audiogramsandaudiology/f/hearingtest.htm>.

Online practice of primary medicine:

- Medgate AG (<http://www.epractice.eu/en/cases/medgate>) is a national provider of telemedical services in Switzerland since 2000.
- Online Care For Providers (<http://www.americanwell.com/>), launched in the US in April 2011 by American Well Company, provides nationwide live, on-demand consultations to patients in their homes or workplaces, using two-way video, secure text chat, and/or phone.
- NHS Direct (<http://www.nhsdirect.nhs.uk>) is a large UK national telehealth project, a mix of online/telephone health services and a health portal.

Tertiary Prevention

Home monitoring services:

- Telbios (<http://www.telbios.it/it/pagineOnline/layoutNewHome.jsp?idmenu=29>) is an Italian company providing services such as teleassistance.
- Vitaphone (<http://www.vitaphone.de/en/company/history-of-vitaphone.html>) is a Germany/Middle East company which offers home-monitoring of bio-signals such as blood pressure, weight, glycaemia or ECG.
- Australian home telemonitoring trials will start at two locations in NSW, Armidale and Kiama, after the NBN is rolled out.

Online mental health assessment:

- In Australia, online mental health assessment for anxiety and depression may be obtained via <http://www.anxietyonline.org.au>

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References

1. Karmel R, Hales C, Lloyd J. Older Australians in hospital. Cat. no. AUS 92. Canberra: AIHW;2007.
2. Australian Institute of Health and Welfare. Australian hospital statistics 2007-08. Health services series no. 33. Cat. no. HSE 71. Canberra: AIHW; 2009.
3. Mathers CD, Vos ET, Stevenson CE, Begg SJ. The burden of disease and injury in Australia. *Bulletin-World Health Organization*, 2001, 79(11): 1076-84.
4. http://www.csc.com/au/press_releases/60021-csc_announces_ehealth_contract_with_australian_department_of_defence.
5. Tsai HH, Tsai YF. Older nursing home residents' experiences with videoconferencing to communicate with family members. *J Clin Nursing*, 2010, 19(11-12): 1538-43.
6. Tsai H-H, Tsai Y-F, Wang H-H, Chang Y-C, Chu HH. Videoconference program enhances social support, loneliness, and depressive status of elderly nursing home residents. *Aging Ment Health*, 2010, 14(8): 947-54.
7. CMVH. Effectiveness of Electronically Delivered Therapies for Depression, Anxiety Disorders and Alcohol Abuse. 2010 [cited 30.6.2011]; Available from: http://www.cmvh.org.au/docs/ehealth/CMVH_Literature_Review__Effectiveness_of_Electronically_Delivered_Psychotherapies__April_2010.pdf.
8. Kumar S, Giubilato A, Morgan W, Jitskaia L, Barry C, Bulsara M, et al. Glaucoma screening: analysis of conventional and telemedicine-friendly devices. *Clin Experiment Ophthalmol*, 2007, 35(3): 237-43.
9. Bexelius C, Honeth L, Ekman A, Eriksson M, Sandin S, Bagger-Sjoback D, et al. Evaluation of an internet-based hearing test--comparison with established methods for detection of hearing loss. *JMIR*, 2008, 10(4): e32.
10. Givens GD, Elangovan S. Internet application to tele-audiology--"nothin' but net". *Am J Audiol*, 2003, 12(2): 59-65.
11. Swanepoel D, Koekemoer D, Clark J. Intercontinental hearing assessment - a study in tele-audiology. *J Telemed Telecare*, 2010, 16(5): 248-52.
12. Takizawa M, Sone S, Hanamura K, Asakura K. Telemedicine system using computed tomography van of high-speed telecommunication vehicle. *IEEE Trans Inf Technol Biomed*, 2001, 5(1): 2-9.
13. Malacarne M, Gobbi G, Pizzinelli P, Lesma A, Castelli A, Lucini D, et al. A point-to-point simple telehealth application for cardiovascular prevention: the ESINO LARIO experience. *Cardiovascular prevention at point of care. Telemed J E Health*, 2009, 15(1): 80-6.
14. Au A, Gupta O. The economics of telemedicine for vitreoretinal diseases. *Curr Opin Ophthalmol* 2011, 22(3): 194-8.
15. Bragge P, Gruen RL, Chau M, Forbes A, Taylor HR. Screening for Presence or Absence of Diabetic Retinopathy: A Meta-analysis. *Arch Ophthalmol*, 2011, 129(4): 435-44.
16. Tu KL, Palimar P, Sen S, Mathew P, Khaleeli A. Comparison of optometry vs digital photography screening for diabetic retinopathy in a single district. *Eye (Lond)*, 2004, 18(1): 3-8.
17. Tran K, Polisena J, Coyle D, Coyle K, Kluge E, Cimon K, et al. Home telehealth for chronic disease management. Technology report number 113. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2008.
18. Chaudhry SI, Mattera JA, Curtis JP, Spertus JA, Herrin J, Lin Z, et al. Telemonitoring in Patients with Heart Failure. *New England Journal of Medicine*, 2010, 363(24): 2301-9.
19. Polisena J, Coyle D, Coyle K, McGill S. Home telehealth for chronic disease management: a systematic review and an analysis of economic evaluations. *Int J Technol Assess Health Care*, 2009, 25(3): 339-49.
20. Santamaria N, Carville K, Ellis I, Prentice J. The effectiveness of digital imaging and remote expert wound consultation on healing rates in chronic lower leg ulcers in the Kimberley region of Western Australia. 2004, 12(2): 62-4, 6-8, 70.
21. Kobza L, Scheurich A. The impact of telemedicine on outcomes of chronic wounds in the home care setting. *Ostomy Wound Management*, 2000, 46(10): 48-53.
22. Barrett M, Larson A, Carville K, Ellis I. Challenges faced in implementation of a telehealth enabled chronic wound care system. *Rural Remote Health*, 2009, 9(3): 1154-63.
23. Krysinska KE, De Leo D. Telecommunication and suicide prevention: hopes and challenges for the new century. *Omega (Westport)*, 2007, 55(3): 237-53.

24. Godleski L, Nieves JE, Darkins A, Lehmann L. VA telemental health: suicide assessment. *Behav Sci Law*, 2008, 26(3): 271-86.
25. Nicola Roxon. Roadmap to Reform. Media release, 7 July. 2010 [cited 30.6.2011]; Available from: [http://www.health.gov.au/internet/ministers/publishing.nsf/Content/F469AD86C66576F7CA25775900223280/\\$File/nr140.pdf](http://www.health.gov.au/internet/ministers/publishing.nsf/Content/F469AD86C66576F7CA25775900223280/$File/nr140.pdf).