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Digital technology in respiratory diseases: Promises, (no) panacea and time for a new paradigm

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Abstract

In a world where digital technology has revolutionized the way we work, shop and manage our finances it is unsurprising that digital systems are suggested as potential solutions to delivering clinically and cost-effective care for an aging population with one or more long-term conditions. However, recent evidence suggesting that telehealth may not be quite the panacea that was promised, has led to discussions on the mechanisms and role of digital technology in respiratory care. Implementation in rural and remote settings offers significant benefits in terms of convenient access to care, but is contingent on technical and organizational infrastructure. Telemonitoring systems rely on algorithms to detect deterioration and trigger alerts; machine learning may enable telemonitoring of the future to develop personalized systems that are sensitive to clinical status whilst reducing false alerts. By providing access to information, offering convenient and flexible modes of communication and enabling the transfer of monitoring data to support professional assessment, telehealth can support self-management. At present, all too often, expensive 'off the shelf' systems are purchased and given to clinicians to use. It is time for the paradigm to shift. As clinicians we should identify the specific challenges we face in delivering care, and expect flexible systems that can be customized to individual patients' requirements and adapted to our diverse healthcare contexts.

Keywords

Telehealthcare, self-management, remote healthcare, machine learning algorithms, long-term respiratory disease

Delivering clinically and cost-effective care for an aging population with one or more long-term conditions (including chronic respiratory diseases) is a challenge for healthcare systems globally.[1] In a world where digital technology has revolutionized the way we work, shop and manage our finances, it is unsurprising that digital systems are suggested as potential solutions.[2,3] However, recent evidence suggesting that telehealth may not be quite the panacea that was promised[4–6] has led to discussions on the mechanisms and role of digital technology in respiratory care. This series of papers, reflects the debate and we hope that, by offering reasoned arguments, it may help to shape a new paradigm.

Overcoming the challenges of distance has long been recognized as a potential benefit of telehealth. Goodridge and Marciniuk, in the first of the papers discuss the role of telehealth in providing care for people in remote communities.[7] Building on personal experience in remote Saskatchewan, their review balances practical challenges (the limited infrastructure and technological expertise available in many rural communities) with benefits (enabling video consultations, diagnostic and dispensing services, pulmonary rehabilitation or multidisciplinary case management for people living a day's journey

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from professional support). Their conclusion, however, that 'successful implementation of telehealthcare programmes in rural and remote settings is contingent upon technical, organisational, social and legal considerations at the individual, community and system levels' has lessons for us all, whatever the setting in which we work.

Algorithms underpin telemonitoring systems that aim to detect deterioration in clinical status and trigger alerts. The challenge is to devise algorithms that are sufficiently sensitive to be safe, yet not so nonspecific as to generate unnecessary alerts. Traditional algorithms (e.g. Anthonisen's criteria for diagnosing chronic obstructive pulmonary disease (COPD) exacerbations[8]) may work when interpreted by experienced clinicians in a clinical consultation but may not be fit for purpose when applied to telemonitoring data in the absence of clinical nuance. Sanchez-Morillo and colleagues in the second paper in this series discuss how machine learning can develop algorithms that accurately predict events.[9] Their review explains the concept for the benefit of non-statistically minded readers and also systematically identifies and discusses the algorithms currently used in asthma and COPD telemonitoring. We are left with the promise that improved mathematical systems may enable telemonitoring of the future to 'contribute to the reduction of health resource utilisation and improve quality of life of patients'.

One mechanism by which digital technology may work is by supporting self-management – indeed many policy documents assume that better self-management is a benefit of telehealth.[2,3,10] Some studies, however, have suggested that telemonitoring support for self-management may be balanced by the potential for creating over-reliance on professional oversight.[11] Morrison and colleagues in the third paper in this series discuss how digital technology can support the implementation of self-management in asthma and COPD.[12] Possibilities include offering innovative sources of information, convenient and flexible modes of communication and transfer of data on clinical status. The design of technology is crucial: smartphone 'apps' are easily downloaded and readily forgotten so unless they have ongoing utility they will not prove to have lasting benefit. Successful interventions need extensive developmental work to ensure that they reduce, rather than add to, the patients', professionals' or organizations' burden of managing a long-term condition.

What is clear is that digital technology is not the panacea that some healthcare policymakers might have inferred but that does not mean that telehealthcare is without promise, as this series of papers demonstrates. Perhaps we are on the threshold of adopting a new paradigm in our approach to telehealthcare. At present, all too often, expensive 'off the shelf' systems are purchased and given to clinicians to use – effectively solutions looking for problems. As clinicians we need to grasp the potential of digital technology to change how we do things (as most of us have in everyday life). We need to identify the problems we have in delivering services and consider whether using telehealthcare might contribute to the solution – and then ask technology developers to build on high-quality developmental research in order to provide us with the bespoke technology we need.

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References

1. Barnett K, Mercer SW, Norbury M, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet* 2012; 380: 37–43.
2. Stroetmann K, Kubitschke L, Robinson S, et al. *How can telehealth help in the provision of integrated care? EU policy brief 13*. Copenhagen: World Health Organization, 2010.
3. Liddell A, Adshead S and Burgess E. *Technology in the NHS: transforming the patient's experience of care*. London: The King's Fund, 2008.
4. Steventon A, Bardsley M, Billings J, et al.; Whole System Demonstrator Evaluation Team. Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial. *BMJ* 2012; 344: e38743.
5. Pinnock H, Hanley J, McCloughan L, et al. Effectiveness of telemonitoring integrated into existing clinical services on hospital admission for exacerbation of chronic obstructive pulmonary disease: researcher blind, multicentre, randomised controlled trial. *BMJ* 2013; 347: f6070.
6. Ryan D, Price D, Musgrave S, et al. Mobile phone supported self-monitoring of asthma: a multi-centre randomised controlled trial. *BMJ* 2012; 344: e1756.

7. Goodridge D and Marciniuk D. Rural and remote care: overcoming the challenges of Distance. *Chron Respir Dis* 2016; 13(2): 190–201.
8. Anthonisen NR, Manfreda J, Warren CPW, et al. Antibiotic therapy in exacerbations of chronic obstructive pulmonary disease. *Ann Intern Med* 1994; 106: 196–204.
9. Sanchez-Morillo D, Fernandez-Granero MA and Leon-Jimenez A. Preventing admissions: a question of algorithms. *Chron Respir Dis* 2016; forthcoming.
10. World Health Organization. *2008–2013 action plan for the global strategy for the prevention and control of noncommunicable diseases*. Geneva: WHO, 2008.
11. Fairbrother P, Pinnock H, Hanley J, et al. Exploring telemonitoring and self-management by patients with chronic obstructive pulmonary disease: a qualitative study embedded in a randomized controlled trial. *Pat Ed Counsel* 2013; 93: 403–410.
12. Morrison D, Mair F, Yardley L, et al. Living with asthma and chronic obstructive airways disease: using technology to support self-management. *Chron Respir Dis* 2016; forthcoming.