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TECS evidence base review

Findings and recommendations

28th April 2017

Contents

1. Foreword	4
2. Acknowledgements	5
3. Introduction	6
4. Background to the review	7
4.1 What do we mean by technology-enabled care services?	7
4.2 How did this review come about?	8
4.3 Where do the next generation of TECS appear in this review?	9
5. Methods	10
5.1 Literature review	10
5.1.1 Definition of technology-enabled care services	10
5.1.2 Search development	11
5.1.3 Screening	11
5.1.4 Information extraction from included studies	12
5.2 Review of grey literature	16
5.3 In-depth interviews	17
6. Findings from the desktop survey	18
6.1 Our review: A pragmatic approach	18
6.2 TECS: Technology modalities in use	19
6.2.1 SMS text messaging	19
Overview of the evidence base	19
Is SMS text messaging effective? Findings from the evidence	19
Enablers and barriers	20
List of reviews considered	20
6.2.2 Telemonitoring	26
Overview of the evidence base	26
Is Telemonitoring effective? Findings from the evidence	27
Enablers and barriers	27
List of reviews considered	28
6.2.3 Video consultation	35
Overview of the evidence base	35
Is video consultation effective? Findings from the evidence	35
Enablers and barriers	36
List of reviews considered	38
6.2.4 Web-based interventions	47
Overview of the evidence base	47
Are web-based interventions effective? Findings from the evidence	48
Enablers and barriers	49
List of reviews considered	50
6.2.5 Mobile phone digital health 'apps'	57
Overview of the evidence base	57
Are mobile health 'apps' effective? Findings from the evidence	57
Enablers and barriers	59
List of reviews considered	59
7. Conclusions and recommendations	61
7.1 In which technologies should Vanguard and commissioners invest?	61

8.	Limitations of this research; opportunities for further work in this area.....	63
9.	Additional resources	64
10.	Appendices.....	65
10.1	Evidence review Bibliography	65
10.2	stakeholder engagement 'project explainer' card.....	93

1. Foreword

To deliver a health and care service that can meet the populations' needs and expectations it is widely understood that we need to think differently about the way we work, and digital tools are a key part of the answer. Developing a truly patient and citizen centred service means we need to think about where, when and how they want to interact with health and care, and how we can use digital tools to find new ways of communicating with patients. We need to provide the right tools and information to empower our patients and citizens to take greater control of their care. In parallel, we should be looking at similar tools and opportunities to support our most valuable and over-stretched asset, our formal and informal workforces, to work differently and in a way which is better for patients.

For many local areas, identifying the right areas to explore is challenging, and mistakes can be costly in time, resources and the goodwill of staff and patients. Whilst we need the opportunity to investigate new options and accept that some failure is inevitable and indeed a useful learning curve, we also need to make sure that we do not continue to repeat our mistakes. We commissioned this review of the evidence base for technology enabled care services (TECS) on behalf of the New Care Models Vanguard, to identify evidence-based areas for further development, for example, using wider learning to narrow down your options in order to pinpoint those interventions that will have the greatest impact.

The review is not designed to be exhaustive, but provides a pragmatic view of where localities could more confidently invest precious resources, freeing up time to really look at the needs of their population to ensure that projects are:

- **Strategically aligned:** Are other teams rolling out remote monitoring or other initiatives to the same patient cohort? Could the impact be reduced or could these projects be combined to greater effect?
- **Set up for success:** By co-designing digital services in line with face to face services and in collaboration with patients, public, staff, carers, projects stand a much better chance of succeeding. By identifying which patients will most benefit from digital intervention, looking at patient activation measures and the digital literacy of both staff and patients, you will be better prepared.
- **User friendly:** Once you have agreed the type of tool you want to use, how does this fit within the current way of working? What needs to change? How can you make it fit with the other tools and systems you use?

We really hope that this research will help you to reduce the time it takes to move the right projects past the pilot phase, into widespread adoption and business as usual.

Helen Arthur

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NHS England TECS Steering Group
NHS England 'Sandpit' delegates at the event on Thursday 9 th March 2017

3. Introduction

The [Health Innovation Network](#) (HIN) is the Academic Health Science Network (AHSN) for South London. We were commissioned by the NHS England New Care Models *Harnessing Technology* workstream in December 2016 to undertake a review of the evidence base for technology-enabled care services (TECS).

The New Care Models team's support offer aims to deliver practical advice and tools to Vanguard and Pioneers to form and deliver their own locally-led plans, within the framework of each new model, and based on best practice and evidence.

This review of the evidence base for TECS was requested by members of the *Harnessing Technology* TECS Community of Interest, comprising representatives from local Vanguards and Pioneers. The group reported that they found it challenging to identify a clear direction from the broad range of reviews and case studies available on the use of TECS. The primary aim of the review is to signpost the most appropriate and effective solutions to common needs, and – where the evidence makes it possible – demonstrating return on investment and/or improvements to patient or service user outcomes.

This review forms part of a range of practical tools to enable Vanguards, and other aspirant New Care Models to benefit from the progress to date of the Vanguards and Pioneers and the lessons they have learned to help them achieve their own locally-tailored plans.

The review ran from mid-January to early April 2017. This report presents the findings from the desk research that formed the main focus of the review. The desk research had three main components:

- A review of published literature – systematic reviews and meta-analyses – focused on TECS.
- A review of the 'grey literature' on the topic, including case studies, evaluation reports, think tank outputs, etc.
- In-depth interviews with a sample of stakeholders working within Vanguard and commissioning organisations with an interest in TECS.

We recognise that, given the scale and diversity of the field, the pace of development, and the varied approach to adoption of new technologies, any review of TECS will be, of necessity, an unfinished project. We hope that our findings contribute to meaningful discussions between Vanguards, providers, and commissioners about which TECS to adopt and sustain in local areas, as well as stimulate much-needed further work in this area.

A note on the referencing convention used in this report

In the course of this project, we have reviewed a large and diverse body of documentary evidence. In this report, we want to be transparent about this material in order to signpost the reader to sources of information that they may find useful. We have adopted the following convention for citing material in the pages that follow:

- Documentary evidence that we have extracted via the formal literature survey (i.e. academic research reviews extracted from indexed databases) is cited in the body of the text and in the summary tables in Section 6 using the Harvard referencing system, i.e. "(Smith et al., 2015)."
- Other material, including the grey literature we have considered, is referenced using footnotes.

4. Background to the review

4.1 What do we mean by technology-enabled care services?

Technology-enabled care services (TECS), also often described as ‘remote assistive technologies’, is a broad concept that encompasses many different types of technology solution. The NHS Commissioning Assembly’s *TECS Resources for commissioners*² provides a helpful definition of TECS:

“...technologies [...] that help people to manage and control chronic illness and sustain independence. They enable the remote exchange of information, primarily between a patient or citizen and a health or care professional, to assist in diagnosing or monitoring health status or promoting good health”³

The *Resource for commissioners* goes on to propose a taxonomy of TECS organised around five distinct delivery models:

- *Telehealth* (the remote monitoring of a patient’s health status and its use to vary or personalise care)
- *Telecare* (the placing of healthcare technologies such as monitors, sensors, and communication devices, in the patient’s home)
- *Telemedicine* (the use of remote consultation to deliver care at a distance from the health care provider)
- *Telecoaching* and related approaches (the provision of advice or talking therapy ‘at a distance’)
- *Self-care apps* (software provided on mobile devices which aims to support the delivery of treatment or preventive care)

Whilst this framework provides useful clarity, it is worth noting that one of the challenges of working within this field is that sometimes these different terms can be used interchangeably, or a term that relates to a specific type of technology is used as an umbrella term to refer to the field as a whole. Understanding this, and establishing and operationalising some consistency in our definitions and distinctions, has been a crucial step when making sense of the available literature for TECS.

Although TECS itself represents a large field of activity, it is but a subset of the broader landscape of information technology in use within health and social care. Understanding the distinction between these two areas of technology delivery is important from the point of view of this evidence base review. We have excluded a large amount of technology activity from our analysis based on the assumption that TECS are deployed *outside* of traditional health spaces (hospitals, clinics, GP practices, etc.). Therefore, for example, we have not considered conventional ‘MedTech’ devices within our review. This is in line with the focus of the NHS England *Harnessing Technology* workstream.

Some TECS are provided directly to individual consumers, bypassing traditional healthcare delivery systems, including the NHS. However, many TECS, while applied to individual patients, must be purchased by providers or commissioners—a process that entails a proper assessment of the

² NHS Commissioning Assembly, *TECS Resources for commissioners*, January 2015. See: <https://www.england.nhs.uk/ourwork/qual-clin-lead/tecs/>

³ *Ibid.*, p.6.

associated costs and benefits. Complicating any attempt to do so is the rapidly changing nature of the technologies themselves, and their falling outside evaluative and regulatory structures that can effectively control the introduction of new medicines and medical devices into health systems. In the English context, while commissioners receive advice from NICE on new medicines and their obligations in respect of them, no such structure operates in the case of TECs. Commissioners may be presented directly with proposals for new TECs that resemble existing technologies loosely or not at all, and for which any evidence, if it exists, may be partial and/or provided by the developer. A stalemate situation may develop in which intertwined issues of contracting, lack of agreement on the basis of evaluation, uncertainty around cost and benefits and an inadequate evidence basis may act to prevent even pilot introduction of new technologies.

This complicated and challenging context forms the basis of the need for this review.

4.2 How did this review come about?

The need for this review originates with a request from the NHS England *New Care Models* Vanguard sites.⁴ Since 2015, 50 organisations have been invited by NHS England to become Vanguards, with each of them “taking a lead on the development of New Care Models, which will act as the blueprints for the NHS moving forward and the inspiration to the rest of the health and care system”.⁵ Not every Vanguard is focused primarily on implementing digital solutions at the heart of a new approach to care, but a considerable number are. NHS England’s *Harnessing Technology* workstream seeks to provide support to these organisations, “to rethink how care is delivered, given the potential of digital technology to deliver care in radically different ways, [and] help organisations to more easily share patient information”.⁶

It is from Vanguards that the request for a cohesive evidence-based strategy for TECs has come, but it is clear that this has wider use and relevance across all local health and care economies. Because TECs is such a broad concept, with solutions offered across a range of settings and across the spectrum of clinical activities, it can be difficult for providers to determine which areas of delivery would benefit most from TEC interventions. Vanguards have identified the need for a strategy to overcome obstacles they have faced when trying to make an effective case for change to commissioners in order to acquire investment in digital health technologies.

There has been considerable effort and time investing in TECs both locally and nationally to date, with programmes like the Whole System Demonstrators, and a previous review of TECs by NHS England, but there is a need to draw together and synthesise this evidence into clear, practical advice. Vanguards and other organisations delivering TECs now need accessible, evidence-based guidance to be able to:

- Evaluate the outcomes of TECs models robustly and consistently.
- Determine the best use of TECs within the framework of their wider objectives.
- Ensure that they make the best investments in TEC and receive the optimal return on those investments, which will improve the quality of care they provide and the sustainability of their services. It will also ensure that they make best use of their limited transformation funds.

⁴ For more information, please see: <https://www.england.nhs.uk/ourwork/new-care-models/vanguards/>

⁵ NHS England, *New care models: Vanguards - developing a blueprint for the future of NHS and care services*, London: NHS England, September 2016.

⁶ *Ibid.*, p.5.

In order to inform the creation of an evidence-based strategy, a desk-based survey of remote assistive technologies is needed that synthesises research that has already been published with evidence-based recommendations. This can then be used by New Care Models or other localities, in order to secure investment in TECS.

4.3 Where do the next generation of TECS appear in this review?

One only has to consult the contemporary health and care press to discover the range of new and emerging technologies that are felt to have the potential to revolutionise healthcare delivery: virtual reality, robotics, machine learning and artificial intelligence (AI), 'Big Data'-based analytics, the Internet of Things (IoT), Blockchain, to name but a few. Such innovations, whilst extremely compelling, are still at the very preliminary stages of the spread and adoption curve—indeed some are at an even earlier stage in the innovation pathway than that. As such, they have not yet reached the point at which there is reliable evidence of benefit. As a result, such technologies are perhaps conspicuously absent from this review. It will be for subsequent reviews to explore the potential impacts of these technologies and to make recommendations to providers and commissioners about whether they are worthy of consideration and investment at that stage.

When we engaged stakeholders in the course of this review, it was striking that, whilst respondents were aware of, and excited by, some of these developments, their attention was very much more focused on understanding the potential impact of some 'mainstream' technologies that are available now. SMS text messaging, for example, is so ubiquitous within the population that most would probably consider it rather unremarkable and probably not worthy of further scrutiny. However, there is a sense among providers and commissioners that we have barely begun to scratch the surface of the potential of text messaging to support health-related behaviour change – a view supported by the published research literature. As a result, respondents were very keen to explore this area further—however 'old hat' that particular modality might seem.

As a result, this review focuses on the five areas of healthcare technology delivery that have emerged repeatedly in conversations with respondents as being of interest. For details of these modalities, please see section 6.1.

5. Methods

5.1 Literature review

The initial proposal envisaged an exhaustive summation of systematic reviews and primary sources too recent to have entered into those reviews, extracting not just basic information on efficacy, but also cost-effectiveness and, most ambitiously, evidence bearing on the important question of the mechanisms responsible for change and their associated contexts, such that it could be entered into logic models⁷ or similar devices for understanding context-mechanism-outcome relationships.⁸ However, initial exploratory searches of PubMed and EMBASE indicated that the potential number of primary studies was much larger than anticipated, numbering in the tens of thousands. Even when the same search terms were applied only to systematic reviews of the same primary studies (via the Cochrane Database and Database of Extracts of Reviews of Effects [DARE]), we retrieved 411 review abstracts.

Thus, a pragmatic approach, focusing on the key drivers for the project, was agreed with NHS England. **The project therefore was limited to a review of reviews, concentrating on the selection of studies and their cataloguing according to various criteria.**

This would allow us to focus on the areas that are of particular interest to Vanguards and commissioners and deliver useful recommendations within the specified timeframe.

5.1.1 Definition of technology-enabled care services

First of all, we developed a definition of TECS. Although the invitation to tender documentation does not provide a formal definition (such as that advanced by the NHS Commissioning Assembly—see section 4.1 above), the following explanatory notes were provided (in italics) and incorporated:

*“The Technology Enabled Care theme involves the use of remote and assistive technologies to enhance care by capturing and sharing information in new ways. The technologies underpinning this include: telehealth (remote monitoring of patients); telecare (technologies in the citizen’s home); telemedicine (remote consultations); telecoaching (telephone advice) and self-care apps”.*⁹

In addition, these technologies are specified as operating “outside traditional health spaces”.

In order to avoid concentrating unduly on specific technologies, which may or may not be described in consistent ways, and which may not represent the full scope of TECS, we developed the following overarching definition of TECS for use in the review:

Technology-enabled care is healthcare that (a) makes use of telecommunications, computers, digital devices, smartphones or similar computerised devices and (b) is primarily consumed outside hospitals and other healthcare premises.

⁷ See, for example, McLaughlin, J.A., and Jordan, G.B., ‘Using logic models’, in Wholey, J.S., Hatry, H.P., and Newcomer, H.E. (Eds), *Handbook of Practical Program Evaluation*, San Francisco, CA: John Wiley & Sons, 2004.

⁸ Pawson, R., and Tilley, M., *Realistic evaluation*, London: Sage, 1997.

⁹ NHS England, *Statement of Requirements: Harnessing Technology – Technology Enabled Care Evidence Base Review*, December 2016.

5.1.2 Search development

This definition and the specific terms mentioned in the tender were used to develop an initial set of terms that would be expected to feature in the title, abstract, key words, and/or index terms of relevant reviews as well as relevant primary sources that would be located in later stages of the review. We used MeSH terms where possible.

The following search string was entered into the Wiley interface to the Cochrane and DARE databases, in which reviews are indexed using MeSH terms:

((self-care and (internet or mobile application)) or Telehealth or telecare or telecoaching or "self-care app" or Telemonitoring or Telemedicine or Telerehabilitation or Telemetry or Teleconsultation or Remote Consultation or Telenursing or Cell Phones or Mobile Phone or Smartphone or Text Messaging or Telephone or "digital health" or "e-health" or "ehealth" or "m-health" or "mhealth")

We retrieved both Cochrane reviews and reviews collected in DARE.

5.1.3 Screening

Reviews were included or excluded purely based on whether they dealt with TECS, as defined in section 6.1.1 above. We relied on the quality screening operated by the Cochrane Collaboration and DARE to assume that all reviews included had achieved a certain threshold of high quality.

On the basis of the second criterion (place at which healthcare was consumed), we included studies which used technology to replace or reduce the use of traditional hospital- or clinic-based care was included, including studies that enabled the use of an in-hospital technology at other sites (e.g. blood pressure measurement, ECG in the diagnosis of myocardial infarction etc.). We excluded studies which used technology to promote the use of traditional hospital- or clinic-based care (e.g., appointment reminder systems) and also studies in which technology was used to alter work within hospitals—e.g. e-ICU—or which produced a relocation of work between hospital or clinic sites (e.g., teleradiology).

The definition of healthcare also needed to be clarified as we proceeded with the review. Interventions whose intended effect was on carers were excluded. Although it was possible that substitution effects did occur, we also excluded studies in which the primary focus was on changing peer interactions or encouraging peer-delivery of interventions—our focus was instead on interventions which aimed to alter the location of care or to reduce the use of health staff time. However, maternity care was included as a kind of healthcare, even though its primary focus (pregnancy) is not an illness. In line with the focus on healthcare, we excluded studies whose aim was health promotion, primary prevention or secondary prevention by influencing of lifestyle choices.

Each review was defined as “Yes”, “No”, or “Partly” in relation to the TECS consideration, those reviews which partly concerned TEC being composed of a mix of studies that did and did not conform to the definition. Reasons for outright rejection were collected. At least two individuals from the project team performed rating for inclusion and exclusion and rating for target illness, and disagreements were resolved through a consensus process. Foreign language reviews were excluded.

5.1.4 Information extraction from included studies

For all included reviews, we extracted the target health condition, if any. Based on review of the title, abstract and, if necessary, the review itself, we also rated whether each review used the following technologies: text messaging; video conferencing; health apps; web-based; recording and transmission of observations; and/or voice calls.

The total number of reviews retrieved was 411, of which 215 (52%) conformed fully, 31 (8%) conformed partly and 165 (40%) did not conform to the definition of TECS. Reasons for exclusion of reviews in total are tabulated below (Table 1):

Table 1: Reasons for rejection of reviews after screening for inclusion

Reason for rejection	N (%)
Irrelevant	90 (55%)
Health promotion	28 (17%)
Hospital-centred	20 (12%)
Primary prevention	18 (11%)
Carer intervention	5 (3%)
Peer-delivered	2 (1%)
Care home-based	1 (1%)
Reablement	1 (1%)

Among those studies that conformed in whole or in part to the definition of TECS, the distribution of target illnesses or healthcare areas is shown in Table 2:

Table 2: Target illness or healthcare areas; reviews partly or entirely concerning TECS

Target	N (%)
Multiple or various conditions	65 (26%)
Mental illness, sleep disorders and addictions	59 (24%)
Diabetes	36 (15%)
Heart disease	26 (11%)
Cancer	9 (4%)
Chronic obstructive pulmonary disease	7 (3%)
Asthma	6 (2%)
HIV/AIDS	6 (2%)
Hypertension	5 (2%)

Physical disability	4 (2%)
Dental disease	3 (1%)
Maternity	3 (1%)
Tuberculosis	3 (1%)
Eye disease	2 (1%)
Cystic fibrosis	1 (0%)
Dementia	1 (0%)
Frailty/old age	1 (0%)
Hypercholesterolaemia	1 (0%)
Inflammatory bowel disease	1 (0%)
Multiple Sclerosis	1 (0%)
Osteoarthritis	1 (0%)
Palliative care	1 (0%)
Skin conditions	1 (0%)
Stroke	1 (0%)
Ulcers	1 (0%)
Visual impairment	1 (0%)

Note. Total of fully or partly conforming reviews was 246.

The technologies used in the included studies are tabulated below (Table 3):

Table 3: Technologies used in included studies

Method	N (%)
Text messaging (SMS)	12 (5%)
Video consultation	7 (3%)
Mobile phone 'apps'	5 (2%)
Web-based interventions	19 (8%)
Sharing readings ('telehealth')	8 (3%)
Voice call	54 (22%)
Multiple	65 (26%)
Other	76 (31%)

Note. 'Multiple' denotes more than one of the other defined technologies in the table.

For the four largest illness areas, the cross-tabulation of methods and illness-area is shown in Table 4.

Table 4: Distribution of methods in four main target areas

Method	Target area			
	Diabetes	Heart disease	Mental health ¹⁰	Multiple
SMS text	2	0	2	4
Video consultation	0	0	3	3
Digital health apps	0	0	1	3
Web-based interventions	3	0	10	5
Telemonitoring	2	2	0	0
Voice call	7	11	13	15
Other	7	6	20	24
Multiple	15	7	10	11

The diagram overleaf (Fig. 1) illustrates the process of filtering and extracting evidence to inform the review.

¹⁰ Including sleep disorders and addictions (tobacco, drugs and alcohol).

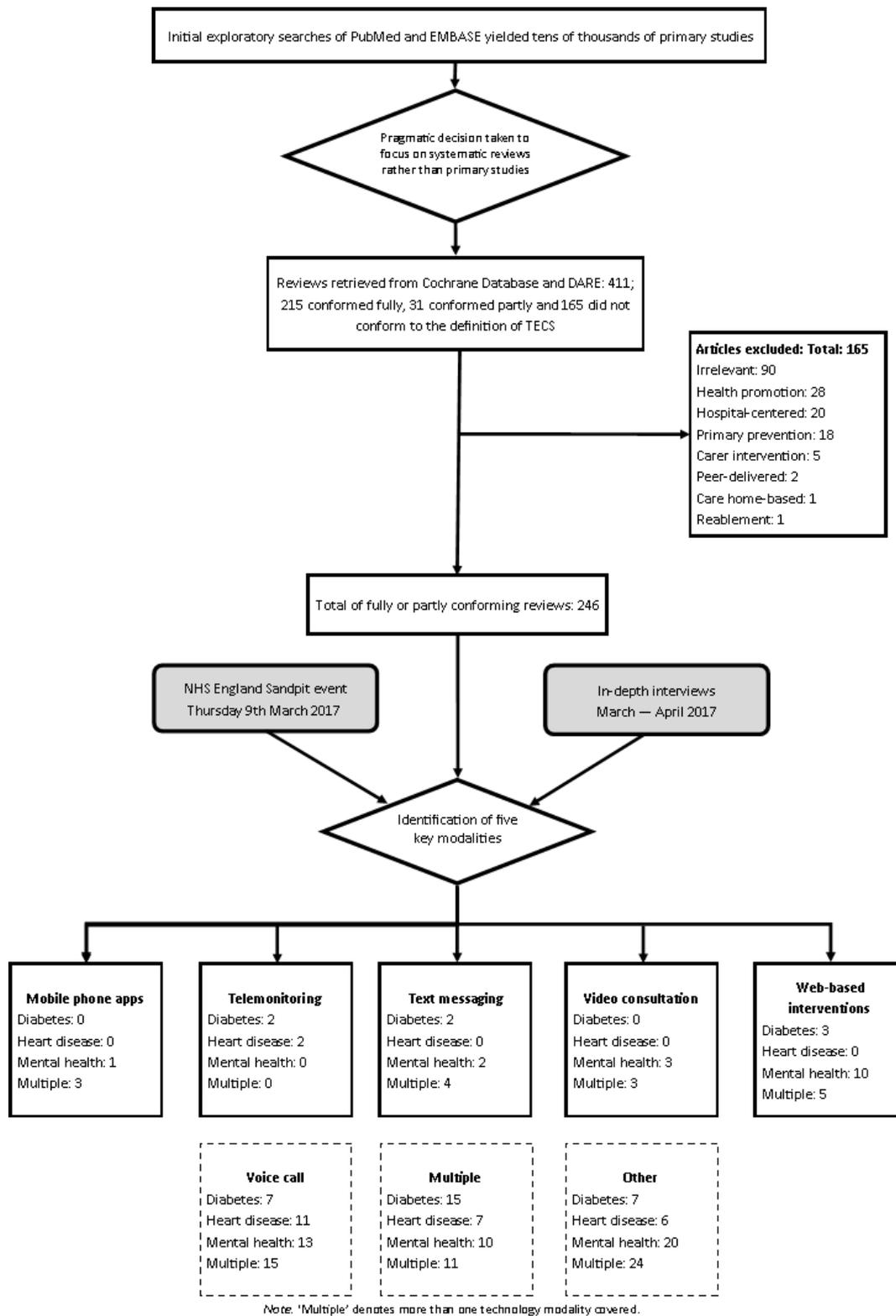


Fig. 1 Diagram illustrating the process of filtering and extracting literature

5.2 Review of grey literature

There is an enormous and rapidly growing body of material, being published by organisations such as the King’s Fund,¹¹ the Nuffield Trust,¹² the Health Foundation,¹³ as well as NHS England, that is of great significance to the field of TECS. We consulted a number of additional sources to complement the intelligence we had gathered through the survey of material in the formal, indexed databases. In particular, we were keen to surface insights into the experiential, operational, environmental, and procedural aspects of TECS: what makes for effective practice where TECS are concerned, and what are the factors that enable or inhibit successful delivery?

We adopted a ‘snowballing’-based approach, in which having identified, or having had referred to us, a source of information, we reviewed and analysed it and then followed up any relevant references cited therein. It is important to note that – mainly for reasons of time, and the fact that new publications were emerging throughout the period in which the project took place – our review of the grey literature was not exhaustive.

¹¹ www.kingsfund.org.uk

¹² www.nuffieldtrust.org.uk

¹³ www.health.org.uk

5.3 In-depth interviews

We conducted interviews with representatives from all but one of the so-called 'high-touch' Vanguard sites – a total of eight respondents out of nine Vanguards – as well as with a representative from a commissioning organisation in an area that had tried to implement a model that had been developed in one Vanguard area, but that experienced significant challenges in transplanting that model to its local system.

The focus of the interviews was on understanding the impact that Vanguards had achieved in their local areas and to understand the factors that had contributed to, or hampered, this impact.

6. Findings from the desktop survey

6.1 Our review: A pragmatic approach

Given the timeframe for completion of this project, and the sheer volume of material on the topic, it was not possible for us to undertake a full systematic literature review of the evidence. Our approach has been to return to first principles—to the fundamental driver for this project, which is **to deliver findings and recommendations that ensure that Vanguard sites, other providers, and commissioners have the information they need to make effective decisions about TECS to support the ongoing development of new models of care.** Thus, this report offers a comprehensive review of relevant evidence and tailored recommendations.

Based on insights gleaned from the in-depth telephone interviews we conducted with representatives from Vanguard sites and commissioning organisations, and from the NHS England ‘Sandpit’ event on Thursday 9th March 2017 at which we facilitated two focus group-based workshops, we identified **five key areas of TECS delivery** that are of current and future interest to Vanguard sites and commissioners. These are as follows:

1. **SMS text messaging:** used to provide patients with alerts and reminders to promote certain behaviours.
2. **Telemonitoring:** involving the submission by the patient of physiological readings for examination and assessment remotely by a clinician.
3. **Video consultation:** involving the use of videoconferencing applications to enable patients to communicate with healthcare professionals.¹⁴
4. **Web-based interventions:** using websites, often with chatrooms, discussion fora, message boards and similar functionality.
5. **Mobile phone digital health ‘apps’:** this is an area for which there is not currently a lot of evidence, but there is *some*, and the indications are that this corpus is likely to grow rapidly in line with providers’ and commissioners’ growing interest.

In addition, conversations with providers, commissioners, and internal clinical experts at the Health Innovation Network revealed that, as far as the review findings are concerned, there are three areas of particular interest:

- *Condition-specific insights:* That is to say, evidence that suggests that a particular technology modality appears to be effective in the management or treatment of a particular health condition. For example, if we are discussing text message alerts and reminders and these are shown to be particularly effective in promoting treatment adherence in diabetes care, but only of partial effectiveness of achieving the same end for COPD, then we should be sure to note that variation.
- *Insights into the nature and extent of professional involvement in the delivery of a particular technology modality:* For instance, where telemedicine or telemonitoring solutions are concerned, the professional *type* and *level* of the clinical expertise that is involved in reviewing patients’ physiological readings back at the clinical hub (or other destination for the readings generated by the equipment in the patient’s home). There is a keenness to understand the relative effectiveness of solutions that employ more skilled medical professionals GPs, nurses, etc., to undertake this work, and those that employ lower grade staff, such as healthcare assistants, ‘keyworkers’, etc.

¹⁴ As well, indeed, as enabling healthcare professionals to communicate; for instance, to seek expert advice from one another—although this particular application of video consultation is not considered to be a TECS, and therefore is not included in this review.

- *Insights into the time period within which the impacts and outcomes of a particular TECS intervention can be expected to be realised.* This is to help commissioners decide how long they should allow TECS models to continue in order reliably to assess their outputs.

Although the evidence is mostly very limited in providing this kind of detail, we have tried to derive insights in these three areas where possible and appropriate.

In this section, we present the findings emerging from our review of the literature.

6.2 TECS: Technology modalities in use

6.2.1 SMS text messaging

Overview of the evidence base

There were 27 reviews that conformed either fully or partly to our inclusion criteria that made mention of text messaging being used as a healthcare intervention. Of the 27 reviews, one was in a foreign language and therefore was not evaluated. The publication date range of these reviews covered the period between 2009 and 2014. The health conditions covered can be broken down into six separate areas as follows: diabetes, smoking cessation, substance misuse, HIV/AIDS, asthma, and acne.

Is SMS text messaging effective? Findings from the evidence

Diabetes

- Lack of evidence on cost-effectiveness for text message interventions in diabetes care; some evidence in the use of text messaging for telemonitoring on controlling blood pressure; consistent evidence of patient satisfaction with text message interventions (including feasibility and enjoyment); evidence that mobile health interventions have beneficial effects on HbA1C and glycaemic control. Recommendations to consider format, frequency and timing of text messages.

Smoking cessation

- Consistent evidence that text message support can increase likelihood of quitting in the short-term, but long-term results are unclear.

Substance misuse

- Evidence suggests that text messaging increases access to substance use interventions.

HIV/AIDS

- Evidence shows weekly text messages can enhance adherence to antiretroviral therapy (ART) and improve HIV viral load suppression.

Asthma

- Evidence shows telemedicine does not improve asthma function scores.

Acne

- Evidence that text messages can improve medication adherence.

While messaging services with extended functionality (increasingly referred to as ‘OTT’ [‘over the top’] messaging services), e.g., WhatsApp, Facebook Messenger, and direct/private messenger functions on social media platforms such as Snapchat and Twitter did not surface in any of the reviews uncovered by our search strategy, these services are worthy of mention on account of their rise in popularity and ubiquity among certain demographic segments and potential extended reach. In future, these services may contribute to the effectiveness of messaging as a health intervention.

Enablers and barriers

There is significant general overlap in the discussion regarding the use of text messaging and mobile phone intervention in a healthcare context. Most reviews made mention of the need to tailor and personalise text messages to the patient,¹⁵ and that the timing of text messages plays a significant role in their effectiveness. Mobile phone messaging is generally seen as an inexpensive intervention that can be used to support health outcomes. There are concerns regarding privacy and continuity if patients frequently change phone numbers, or where messages may be viewed by people other than the patient. In addition, in some cases, patients report disliking the use of text messages due to the increased anxiety that receiving messages can provoke, the fact that the presence of such messages serve to remind them of their illness,¹⁶ or the fact that they simply don’t want other people to know they are ill.¹⁷

The level of tailoring/personalisation will determine the sensitivity of the information contained within the text message – ranging from impersonal general information to highly sensitive personally identifiable information such as names, specifics regarding a person’s condition, and test results. Two reviewers suggested that future text message interventions should be designed using behaviour change theories to increase effectiveness, which they deemed as an element that was lacking in past interventions (Mason et al., 2014; Ghorai et al., 2014).

List of reviews considered

A full breakdown of the papers that formed part of this review follows below.

¹⁵ For a detailed discussion of the concept of ‘tailoring’ in healthcare-related communication, its main mechanisms, and the contexts in which it appears to most effective, see Hawkins, R.P. et al, ‘Understanding tailoring in communicating about health’, *Health Educ Res.* 2008 June ; 23(3): 454–466.

doi:10.1093/her/cyn004. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3171505/pdf/nihms321815.pdf>

¹⁶ See Cassimatis, M., et al, ‘Effects of Type 2 diabetes behavioural telehealth interventions on glycaemic control and adherence: a systematic review’. *J Telemed Telecare*, 2012 Dec;18(8):447–50. doi: 10.1258/jtt.2012.GTH105; and Anker, S.D.,I et al, ‘Telemedicine and remote management of patients with heart failure’, *Lancet*, 2011;378:731–9. doi:10.1016/S0140-6736(11)61229-4.

¹⁷ See Muessig, K. E., et al., ‘Mobile phone applications for the care and prevention of HIV and other sexually transmitted diseases: A Review. *Journal of Medical Internet Research*, 2013, 15(1), e1.

<http://doi.org/10.2196/jmir.2301>

Published	Author	Title	Condition	Summary	# of studies
2009	Krishna, S; Boren, SA; Balas, EA	Healthcare via cell phones: a systematic review	Diabetes	One study reported a significant improvement in insulin adherence in the group that received test messages. Eight of nine studies reported significant improvements in diabetes-related health outcomes with diabetes control and management information and education messages delivered via cell phone. Seven studies found diabetes education and advice via cell phone and text messaging resulted in significant reductions in HbA1c	25
2010	Verhoeven, F; Tanja-Dijkstra, K; Nijland, N; Eysenbach, G; van Gemert-Pijnen, L	Asynchronous and synchronous teleconsultation for diabetes care: a systematic literature review	Diabetes	Teleconsultation did not have consistent effects on clinical outcomes (as opposed to process measures) in diabetes	90
2011	Liang, X; Wang, Q; Yang, X; Cao, J; Chen, J; Mo, X; Huang, J; Wang, L; Gu, D	Effect of mobile phone intervention for diabetes on glycaemic control: a meta-analysis	Diabetes	Mobile phone based interventions improve glycaemic control in diabetes	22
2013	Herbert, L; Owen, V; Pascarella, L; Streisand, R	Text message interventions for children and adolescents with type 1 diabetes: a systematic review	Diabetes	Current evidence suggests that text message-based interventions that include text messages are feasible and enjoyable, but yet their clinical significance for long-term daily T1D management behaviors and glycaemic control is unclear. Researchers are recommended to carefully consider the format, frequency, and timing of text message interventions and to fully test software before implementation.	7
2013	Marcolino, MS; Maia, JX; Alkmim, MB; Boersma, E; Ribeiro, AL	Telemedicine application in the care of diabetes patients: systematic review and meta-analysis	Diabetes	There is some evidence for the effectiveness of telemonitoring in controlling blood pressure, but less for effects on health outcomes and costs	13
2014	Harrison, S; Stadler, M; Ismail, K; Amiel, S; Herrmann-Werner, A	Are patients with diabetes mellitus satisfied with technologies used to assist with diabetes management and coping? A structured review	Diabetes	Multiple devices and technologies used. Overall, the devices fulfilled patients' expectations and needs in terms of their diabetes management.	26

Published	Author	Title	Condition	Summary	# of studies
2014	Peterson, A	Improving type 1 diabetes management with mobile tools: a systematic review	Diabetes	Studies of mobile health interventions suggested that they had overall beneficial effects on HbA1C . Not enough detail on the technologies used.	14
2014	Zhai, YK; Zhu, WJ; Cai, YL; Sun, DX; Zhao, J	Clinical- and cost-effectiveness of telemedicine in type 2 diabetes mellitus: a systematic review and meta-analysis	Diabetes	Optimization of telemedicine approaches could potentially allow for more effective self-management of disease in type 2 diabetes patients, though evidence to-date is unconvincing. A variety of telemedicine approaches showed effects on HbA1c in diabetes; there was minimal evidence on cost-effectiveness	35
2014	Saffari, M; Ghanizadeh, G; Koenig, HG	Health education via mobile text messaging for glycaemic control in adults with type 2 diabetes: a systematic review and meta-analysis	Diabetes	Mobile text-messaging for educating Type 2 diabetics appears to be effective on glycaemic control.	10
2010	Whittaker, R; Borland, R; Bullen, C; Lin, RB; McRobbie, H; Rodgers, A	Mobile phone-based interventions for smoking cessation	Mental illness, sleep disorders and addictions	Positive short-term results but current evidence shows no effect of TM smoking cessation interventions on long-term outcomes	12
2012	Vodopivec-Jamsek, Vlasta; de Jongh, Thyra; GuroI-Urganci, Ipek; Atun, Rifat; Car, Josip	Mobile phone messaging for preventive health care	Mental illness, sleep disorders and addictions	High quality evidence showing that text messaging support can significantly increase likelihood of quitting smoking at 6 week and 12 week follow-ups	4
2012	Haug, S; Sannemann, J; Meyer, C; John, U	Internet and mobile phone interventions to decrease alcohol consumption and to support smoking cessation in adolescents: a review.	Mental illness, sleep disorders and addictions	Non-English; not reviewed.	31

Published	Author	Title	Condition	Summary	# of studies
2012	Chen, YF; Madan, J; Welton, N; Yahaya, I; Aveyard, P; Bauld, L; Wang, D; Fry-Smith, A; Munafo, MR	Effectiveness and cost-effectiveness of computer and other electronic aids for smoking cessation: a systematic review and network meta-analysis	Mental illness, sleep disorders and addictions	The volume of evidence for many of the delivery modes, for example e-mails and mobile telephone text messaging, remains limited. This well-conducted review found that computer and other electronic aids increased the likelihood of smoking cessation compared with no intervention or generic self-help materials, but that the effect was small. The authors' conclusions reflect the evidence presented and are likely to be reliable. Decision-analytic modelling indicated that adding an electronic intervention to non-electronic behavioural support was likely to be cost-effective but there was substantial uncertainty as to the most cost-effective type of intervention.	60
2014	Ghorai, K; Akter, S; Khatun, F; Ray, P	mHealth for smoking cessation programs: a systematic review	Mental illness, sleep disorders and addictions	Most of the interventions had short term positive behaviour change but none of the articles gave any information on long term effects of the interventions.	15
2014	Mason, M; Ola, B; Zaharakis, N; Zhang, J	Text messaging interventions for adolescent and young adult substance use: a meta-analysis	Mental illness, sleep disorders and addictions	Text messaging can increase access to substance use interventions and have now been established as an evidence-based, recommended approach towards substance use prevention.	14
2012	de Jongh, Thyra; Gurol-Urganci, Ipek; Vodopivec-Jamsek, Vlasta; Car, Josip; Atun, Rifat	Mobile phone messaging for facilitating self-management of long-term illnesses	Multiple	Mixed results - no difference in clinical outcomes; some evidence of increased treatment compliance. Lower hospital admissions. Overall low quality evidence.	4
2009	Fjeldsoe, B S; Marshall, A L; Miller, Y D	Behavior change interventions delivered by mobile telephone short-message service	Multiple	Positive behaviour change outcomes were observed in 13 of the 14 reviewed studies. Intervention initiation (researcher or participant), SMS dialogue initiation, tailoring of SMS content, and interactivity were found to be important features of SMS-delivered interventions.	14
2014	Nhavoto, JA; Gronlund, A	Mobile technologies and geographic information systems to improve health care systems: a literature review	Multiple	Mobile phone-based apps and SMS were found to be acceptable to patients, practical and acceptable, feasible, effective, and cost-effective. Patients had positive perceptions, positive impact on some clinical outcomes (eg, medication taking), and were highly satisfied	271

Published	Author	Title	Condition	Summary	# of studies
2014	Kannisto, KA; Koivunen, MH; Valimaki, MA	Use of mobile phone text message reminders in health care services: a narrative literature review	Multiple	No firm conclusions can be drawn so far	60
2012	Pellowski, JA; Kalichman, SC	Recent advances (2011-2012) in technology-delivered interventions for people living with HIV	HIV/AIDS	Despite the well-recognized need of one-third of HIV positive individuals not in treatment, we did not find evidence for using technology to improve engagement and retention in care, at least not in the research literature.	12
2012	Horvath, Tara; Azman, Hana; Kennedy, Gail E; Rutherford, George W	Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection	HIV/AIDS	High quality evidence that weekly text messages can enhance adherence to antiretroviral therapy and improve HIV viral load suppression	2
2013	van Velthoven, MH; Brusamento, S; Majeed, A; Car, J	Scope and effectiveness of mobile phone messaging for HIV/AIDS care: a systematic review	HIV/AIDS	Limited evidence on the effectiveness of mobile phone messaging for HIV care. No studies reported on cost effectiveness.	21
2014	Finitzis, DJ; Pellowski, JA; Johnson, BT	Text message intervention designs to promote adherence to antiretroviral therapy (ART): a meta-analysis of randomized controlled trials	HIV/AIDS	Text-messaging can support antiretroviral therapy adherence. Researchers should consider the adoption of less frequent messaging interventions with content and timing that is individually tailored and designed to evoke a reply from the recipient. Future research is needed in order to determine how best to optimize efficacy.	8
2013	Nglazi, MD; Bekker, LG; Wood, R; Hussey, GD; Wiysonge, CS	Mobile phone text messaging for promoting adherence to anti-tuberculosis treatment: a systematic review	Tuberculosis	Inconclusive evidence due to paucity of high quality studies	4
2010	Cutrona, SL; Choudhry, NK; Fischer, MA; Servi, A; Liberman, JN; Brennan, TA; Shrank, WH	Modes of delivery for interventions to improve cardiovascular medication adherence	Heart disease	Among person-independent interventions (56% successful), electronic interventions were most successful (67%)	51

Published	Author	Title	Condition	Summary	# of studies
2014	Zhao, J; Zhai, YK; Zhu, WJ; Sun, DX	Effectiveness of telemedicine for controlling asthma symptoms: a systematic review and meta-analysis	Asthma	Telemedicine interventions do not appear to improve asthma function scores	11
2014	Park, C; Kim, G; Patel, I; Chang, J; Tan, X	Improving adherence to acne treatment: the emerging role of application software	Skin conditions	Text message intervention groups showed improved medication adherence compared to control groups	11

6.2.2 Telemonitoring

Overview of the evidence base

Telemonitoring – the practice of capturing physiological data from a patient using a recording device based in their home (or, increasingly, using a mobile phone-based device or sensor worn on their person) and sharing this data with a healthcare professional for analysis and to inform decisions about treatment and management – is one of the areas of greatest interest within TECS. Remote monitoring enables patients to monitor and understand trends in their condition, and for professionals to intervene proactively; for example, by increasing their medication dose, or – when necessary – by inviting the patient to attend a clinic appointment (although telemonitoring is, of course, often heralded precisely as a means of *avoiding* the need for patients to attend a conventional clinic).

In its March 2017 report, *Shifting the balance of care: Great expectations*, the Nuffield Trust cites considerable evidence supporting the effectiveness of remote monitoring for people with certain long-term conditions.

“Remote monitoring has had a positive impact on managing a range of chronic conditions; e.g. improving glycaemic control (Bashshur et al., 2015; Wild et al., 2016) and peak expiratory flow (Paré et al., 2010), reducing blood pressure (Omboni and Guarda, 2011; McManus et al., 2010), and reducing the risk of mortality in heart failure patients (Inglis et al., 2015). Several studies have also shown improvements in patients’ quality of life (Cruz et al., 2014; Paré et al., 2010).”¹⁸

Our own literature review identified 19 reviews that addressed telemedicine.¹⁹ Of these, three were not considered relevant and were therefore excluded from our analysis. Four reviews were not able to identify telemedicine interventions as having an appreciable impact when compared to a control. Three reviews confirmed telemonitoring as having a positive impact but were unable to recommend the modality unequivocally due to, for example, issues with the quality of the studies they were appraising. Nine reviews concluded that telemonitoring does have a positive impact (five of these focused on diabetes management; four on management of heart failure). None of the reviews identified telemonitoring as causing harm.

At the level of the reviews, in most cases – with three notable exceptions (Bolton et al., 2011; Greenwood et al., 2014; Montori et al., 2004) – there was negligible information provided on the precise mechanism – the equipment model and accompanying procedural protocol – with which patients collected and submitted their data for clinical review.

¹⁸ Nuffield Trust (2017), *Shifting the balance of care: Great expectations*, London: Nuffield Trust, 1st March 2017, pp.81-82.

¹⁹ Interestingly we have since become aware of two studies, cited in the Nuffield Trust’s report, that are focused on telemonitoring, and that did not come to light in the course of our literature review. These are:

- Kitsiou, S., Paré, G., and Jaana, M. (2015) ‘Effects of home telemonitoring initiatives on patients with chronic heart failure: an overview of systematic reviews’, *Journal of Medical Internet Research*, 2015 Mar 12;17(3):e63. (<https://www.ncbi.nlm.nih.gov/pubmed/25768664>); and
- Cruz, J., Brooks, D., and Marques, A. (2014) ‘Home telemonitoring effectiveness in COPD: a systematic review’, *International Journal of Medical Informatics*, 2014 Apr;83(4):249-63. (<https://www.ncbi.nlm.nih.gov/pubmed/24529402>)

Is Telemonitoring effective? Findings from the evidence

Diabetes

- There is compelling evidence that the use of mobile phone-based telemonitoring leads to statistically significant improvement in glycaemic control and self-management in diabetes care, especially for Type 2 diabetes patients.
- All the reviews that recommended telemonitoring reported that the measures taken related to the patient's blood glucose level (HbA1c). The use of a 'glucometer' was mentioned specifically in two of the five reviews, and the remaining three reviews simply alluded to a 'device used to measure blood glucose'.
- Three of the five studies also stated that patients were also required to take their blood pressure as part of the suite of readings submitted. In some studies, patients were asked to submit data on their insulin dose, 'self-management information', symptomatology, and other 'lifestyle information' (diet, physical activity).
- The data was submitted through various means: via a web portal, via telephone (both by SMS texting and by 'calling the results in' using a voice telephone call), via videoconference.
- Submitted data was examined by various professionals in different studies: nurses, dieticians, physicians, endocrinologists, certified diabetes educators. These health professionals analysed patient data and devised tailored treatment recommendations on this basis. It is not possible to determine which type of professional input represents the optimum model as far as cost/benefit is concerned.
- It is difficult to estimate the cost effectiveness of these interventions. The cost/benefit ratio of mobile phone-based telemonitoring was only calculated in a couple of studies.

Heart failure

- A Cochrane review (Inglis et al., 2015) reviewed the evidence (current to January 2015) about the effect of structured telephone support and non-invasive telemonitoring in the management of people with heart failure. It demonstrated that supporting people with heart failure at home using TECS can reduce rates of death and hospitalisation. It can improve people's quality of life and knowledge about heart failure and self-care.
- All the reviews that recommend telemonitoring reported that blood pressure was measured, although the mechanism for doing this was not specified.
- Three of the four studies described approaches in which body weight was also measured. This was either submitted automatically through electronic scales attached to a computer, or typed in or reported via telephone.
- Data submitted to computerized database monitored by trained cardiac nurses. Physicians also viewed data.

Cost

The cost effectiveness of remote monitoring is uncertain, with costs varying according to the intensity of the initiative and the technologies used (Inglis et al., 2015).

Enablers and barriers

Several reviews considered studies in which telemonitoring interventions were associated with educational interventions (providing support and guidance to help individuals to take their own readings and self-manage their condition), or enhanced relationships with medical professionals. The reviews were, in effect, assessments of complex interventions that were composed of multiple

components. It is not clear whether the educational strategies, the increased professional contact, or the monitoring technologies had the most impact. The reviews conclude that it is likely that there is a synergistic effect between the different components, and caution is needed when making inferences based on the role of the technology alone. One review of telemonitoring interventions for diabetes management (Farmer et al., 2005) concluded that, "Self-monitoring of blood glucose with or without telemedicine is only likely to be helpful when test results are linked to educational or behavioural advice and changes in clinical management." A study of telemonitoring interventions for chronic heart failure (Nakamura et al., 2013) found that, "rapid-intervention models (those where healthcare practitioners are actively involved in patient monitoring) can enhance the efficacy of remote patient monitoring." Nevertheless, it seems to be the case that telemonitoring is a necessary ingredient 'in the mix'.

List of reviews considered

A full breakdown of the articles that formed part of this review follows below.

	Condition	Summary	# of studies
nts with nd emic nized nd meta-	Diabetes	Taken together, the evidence is insufficient to recommend telecare or to identify a subgroup of patients most likely to benefit from this technology.	8
ew of rventions glucose diabetes	Diabetes	There was insufficient evidence in 2004 in the usefulness of patients taking self-measurements of blood glucose (Hba1c was not reduced). However, the article did state that technology innovative developments for future might improve impact.	32
ies for managing natic	Diabetes	Self-monitoring of blood glucose continues to be an effective tool for the management of diabetes. Wireless technologies can improve diabetes self-care, and pedometers are effective lifestyle modification tools. The results of this review indicate a need for additional controlled trial research on existing and novel technologies for diabetes self-monitoring, on health outcomes associated with diabetes and CVCs, and device feasibility and compliance.	18
ring for n nalysis	Diabetes	Based on low quality evidence, blood glucose home telemonitoring and management technologies confer a statistically significant reduction in HbA1c of ~0.50% when used adjunctively to a broader telemedicine initiative in comparison to usual care in adults with type 2 diabetes.	7
edicine olving ion of a with on in youth tes: a	Diabetes	Cannot recommend from the evidence, effects on glycaemic control were too small (<0.5%)	9

Publication Year	Author	Title	Condition	Summary	# of studies
2012	Baron, J; McBain, H; Newman, S	The impact of mobile monitoring technologies on glycosylated hemoglobin in diabetes: a systematic review	Diabetes	Results for patients with type 1 and type 2 diabetes were examined separately. Study variability and poor reporting made comparison difficult, and most studies had important methodological weaknesses. Evidence on the effectiveness of mhealth interventions for diabetes was inconsistent for both types of diabetes and remains weak.	24
2013	Marcolino, MS; Maia, JX; Alkmim, MB; Boersma, E; Ribeiro, AL	Telemedicine application in the care of diabetes patients: systematic review and meta-analysis	Diabetes	Telemedicine strategies combined to the usual care were associated with improved glycaemic control in diabetic patients. No clinical relevant impact was observed on LDL-c and blood pressure, and there was a tendency of BMI reduction in diabetes patients who used telemedicine, but these outcomes should be further explored in future trials.	13
2014	Huang, Z; Tao, H; Meng, Q; Jiang, L	Management of endocrine disease: effects of telecare intervention for glycaemic control in type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials	Diabetes	Telecare useful in the long term management of patients with type 2 diabetes- telecare interventions seem to be more useful for patients with type 2 than type 1 diabetes in reducing HbA1c levels	18
2014	Greenwood, DA; Young, HM; Quinn, CC	Telehealth remote monitoring systematic review: structured self-monitoring of blood glucose and impact on A1C	Diabetes	Yes, but- Telehealth RPM (remote patient monitoring) clinical trials implementing SMBG (self-monitoring of blood glucose) should incorporate key elements of structured SMBG to consistently achieve a clinically significant decrease in A1C.	15
2007	Chaudhry, S I; Phillips, C O; Stewart, S S; Riegel, B; Mattera, J A; Jerant, A F; Krumholz, H M	Telemonitoring for patients with chronic heart failure: a systematic review	Heart disease	The daily physiologic monitoring of heart failure patients works in reducing hospitalisation rates. Our review suggests that telephone-based systems of monitoring are less expensive and appear equally effective when compared with more complex forms of monitoring. The evidence base for telemonitoring in heart failure is currently quite limited. Based on the available data, telemonitoring may be an effective strategy for disease management in high-risk heart failure patients.	9

Publication Year	Author	Title	Condition	Summary	# of studies
2009	Maric, B; Kaan, A; Ignaszewski, A; Lear, SA	A systematic review of telemonitoring technologies in heart failure	Heart disease	Telemonitoring appears to be an acceptable method for monitoring of HF patients. To date, studies investigating telemonitoring in HF indicate the feasibility and promise that these interventions may hold in the future. Specifically, various benefits have been reported using different modalities and in several instances successful integration of telemonitoring into routine care has been reported.	56
2009	Klersy, C; De Silvestri, A; Gabutti, G; Regoli, F; Auricchio, A	A meta-analysis of remote monitoring of heart failure patients	Heart disease	RPM confers a significant protective clinical effect in patients with chronic HF compared with usual care.	13
2012	Giamouzis, G; Mastrogiannis, D; Koutrakis, K; Karayannis, G; Parisis, C; Rountas, C; Adreanides, E; Dafoulas, GE; Stafylas, PC; Skoularigis, J; Giacomelli, S; Olivari, Z; Triposkiadis, F	Telemonitoring in chronic heart failure: a systematic review	Heart disease	Nevertheless, it appears that the above-presented randomized controlled trials tend to be in favor of telemonitoring. It could be argued that in some studies sample sizes were small and thus underpowered to detect significant associations. Importantly, however, an improved quality of life—a soft end-point gaining more and more clinical significance—has been reported in all studies, whereas telemonitoring was highly acceptable by chronic HF patients.	12
2012	Ciere; Y; Cartwright; M; Newman; Stanton, P	A systematic review of the mediating role of knowledge, self-efficacy and self-care behaviour in telehealth patients with heart failure	Heart disease	The overall quality of studies was poor (Table 4) with only a single study achieving a global rating of moderate.	12
2013	Nakamura, N; Koga, T; Iseki, H	A meta-analysis of remote patient monitoring for chronic heart failure patients	Heart disease	The results of the meta-analysis showed that RPM is effective in chronic heart failure. It also showed that rapid-intervention models (those where healthcare practitioners are actively involved in patient monitoring) can enhance the efficacy of RPM	13

Publication Year	Author	Title	Condition	Summary	# of studies
2010	Polisena, J; Tran, K; Cimon, K; Hutton, B; McGill, S; Palmer, K; Scott, RE	Home telehealth for chronic obstructive pulmonary disease: a systematic review and meta-analysis	Chronic obstructive pulmonary disease	The present review demonstrated that home telehealth is generally clinically effective, and no adverse events were reported in the selected studies. Evidence on the effect of health services utilization was limited.	10
2011	Bolton, CE; Waters, CS; Peirce, S; Elwyn, G	Insufficient evidence of benefit: a systematic review of home telemonitoring for COPD	Chronic obstructive pulmonary disease	Despite these significant caveats, all the studies are positive about their results. However, given the inherent risk of bias in research of this nature and the low quality of the studies overall, with heterogeneous populations and diverse outcome measures ,we conclude that the benefit of telemonitoring for COPD is not yet proven and that further work is required before wide-scale implementation be considered.	6
2011	McLean, Susannah; Nurmatov, Ulugbek; Liu, Joseph LY; Pagliari, Claudia; Car, Josip; Sheikh, Aziz	Telehealthcare for chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease	There was consistent evidence that the numbers of visits to the emergency department and also the number of hospitalisations were significantly reduced with telehealthcare over 12 months. In terms of quality of life, the evidence was inconclusive as the confidence intervals were wide.12–14,18 There was evidence of almost no effect on the OR of mortality.	10
2013	Kamei, T; Yamamoto, Y; Kajii, F; Nakayama, Y; Kawakami, C	Systematic review and meta-analysis of studies involving telehome monitoring-based telenursing for patients with chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease	THMTN (telehome monitoring-based telenursing) significantly decreases the use of healthcare services; however, it does not affect mortality in severe and very severe COPD patients.	9
2014	Cruz, J; Brooks, D; Marques, A	Home telemonitoring in COPD: a systematic review of methodologies and patients' adherence	Chronic obstructive pulmonary disease	Findings suggest that these interventions, although promising, still need to be adjusted to ensure their suitability to the target population. This study provides important recommendations for future telemonitoring interventions, such as the inclusion of additional training sessions to facilitate patients' education on the use of the systems and the assessment of patients' characteristics and acceptance of the technology prior to its implementation. These adjustments are essential before the wide-spreading of telemonitoring can occur.	17

Publication Year	Author	Title	Condition	Summary	# of studies
2014	Udsen, FW; Hejlesen, O; Ehlers, LH	A systematic review of the cost and cost-effectiveness of telehealth for patients suffering from chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease	The present study shows that healthcare decision makers seeking large-scale implementation of telehealth in routine clinical practice should be cautious, since the quality of the economic evidence is poor. The clinical effectiveness of a large-scale implementation of telehealth with follow-up exceeding 12 months has not yet been demonstrated	6
2014	Cruz, J; Brooks, D; Marques, A	Home telemonitoring effectiveness in COPD: a systematic review	Chronic obstructive pulmonary disease	Home telemonitoring appears to have a positive effect in reducing respiratory exacerbations and hospitalisations and improving quality of life. However, the evidence of its benefits is still limited and further research is needed to assess the effectiveness of home telemonitoring in COPD management, as there are still few studies in this area.	9
2007	Jaana, M; Pare, G; Sicotte, C	Hypertension home telemonitoring: current evidence and recommendations for future studies	Hypertension	This review presents preliminary evidence on the benefits of telemonitoring as a successful patient management approach. However, at present, limited information exists that would substantiate its effects on the utilisation of health services (e.g. office and emergency room visits, hospitalizations) and demonstrate its economic viability.	14
2010	AbuDagga, A; Resnick, HE; Alwan, M	Impact of blood pressure telemonitoring on hypertension outcomes: a literature review	Hypertension	Evidence on clinical effectiveness and compliance with the technology by patients in the home setting provides support to the view that BP can be managed in the community, with patients taking an active role in their own disease management. However, it should be noted that BP telemonitoring is only one effective intervention for management of hypertension. Hypertension management in the community requires a multifactorial approach involving identification, follow-up, and treatment with antihypertensive drugs.	15
2011	Verberk, WJ; Kessels, AG; Thien, T	Telecare is a valuable tool for hypertension management, a systematic review and meta-analysis	Hypertension	Telecare led to a greater decrease in systolic and diastolic blood pressure than usual care. For systolic blood pressure, this decrease was greater in trials without treatment modification.	9
2011	Omboni, S; Guarda, A	Impact of home blood pressure telemonitoring and blood pressure control: a meta-analysis of randomized controlled studies	Hypertension	Home blood pressure telemonitoring may represent a useful tool to improve blood pressure control. However, heterogeneity of published studies suggests that well designed, large-scale, randomized, controlled studies are still needed to demonstrate the clinical usefulness of this technique.	12

Publication Year	Author	Title	Condition	Summary	# of studies
2013	Omboni, S; Gazzola, T; Carabelli, G; Parati, G	Clinical usefulness and cost effectiveness of home blood pressure telemonitoring: meta-analysis of randomized controlled studies	Hypertension	HBPT (Home Blood Pressure Telemonitoring) may represent a useful tool to improve hypertension control and associated healthcare outcomes, although it is still more costly compared with usual care.	23
2016	Kew, Kayleigh M; Cates, Christopher J	Home telemonitoring and remote feedback between clinic visits for asthma	Asthma	Current evidence does not support the widespread implementation of telemonitoring with healthcare provider feedback between asthma clinic visits. Studies have not yet proved that additional telemonitoring strategies lead to better symptom control or reduced need for oral steroids over usual asthma care, nor have they ruled out unintended harms. Investigators have reported small benefits in quality of life, but these are subject to a risk of bias, as the studies were unblinded. Similarly, some benefits for lung function are uncertain owing to possible attrition bias.	18

6.2.3 Video consultation

Overview of the evidence base

47 systematic reviews included studies that looked at interventions involving the use of video calling. These studies covered several different illness areas, including: asthma, cancer, COPD, dementia, diabetes, heart disease, mental illness, stroke, physical disability and osteoarthritis. The publication date range of these reviews covered the period between 1999 and 2016.

Time and time again, the systematic reviews call into question the quality of the studies being reviewed. Many reviews cite difficulties such as small sample size, lack of control group, a lack of statistical significance. Where evidence is deemed to be of poor quality, we have sought to qualify any conclusions that have been reached that are pertinent to this review.

Is video consultation effective? Findings from the evidence

There is a general focus in the literature to provide evidence that video-conferencing and teleconsultation are as effective as face-to-face intervention. While there is a drive to maximise improvements to patient health outcomes, at this stage it may be unnecessary to prove that telehealth is better, but rather that it can act as an effective supplement or replacement for traditional modes of healthcare delivery, hopefully leading to reductions in costs.

Mental health

- There is a significant critical mass of evidence for video calls to be effective in treating mental illness—to provide consultation, short term support, and counselling (Hailey et al., 2008; Fisher et al., 2015; Pesamaa et al., 2004; Dorstyn et al., 2013).

Chronic illness

- Remote video technology found “no differences in the quality indicators of medication compliance, knowledge of disease, or self-care ability; patient satisfaction; or service use”, indicating that video calling is an acceptable substitute for face-to-face care in this instance. Cost savings were attributed to fewer hospitalizations while the quality of care remained stable.” (Bowles and Baugh, 2007).

Wound assessment

- In one study cited in a review, although the sample size was small and only one nurse was deployed in the intervention, the use of video consultation appeared to be at least as good as face-to-face care in the practice of chronic wound assessment. Additionally, the intervention was felt to offer benefits in terms of increasing the knowledge of the clinical staff involved (Bowles and Baugh, 2007).

Asthma

- Remotely-delivered follow-ups do not appear to improve health outcomes in asthma in comparison to follow-ups delivered face-to-face (Kew and Cates, 2016). Meta-analysis of the four studies suggests that telehealthcare reduced the risk of admission to hospital.

Stroke

- There is no clear evidence concerning the use of telerehabilitation after stroke (Laver et al., 2013).

Psychological therapies for chronic pain

- There is some evidence for the effectiveness of remotely-delivered psychological treatments on chronic pain in children

Diabetes

- Teleconsultation did not have consistent effects on clinical outcomes (as opposed to process measures) in diabetes (Verhoeven et al., 2010).

Heart failure

- One study on video consultation reported no significant changes. (Maric et al., 2009).

There is mixed evidence as to the extent to which patients are willing to engage with new technologies, which supports the notion that TECS should continue, for now, to be offered alongside traditional treatments to allow for differences in patient ability and willingness to depart from existing ways of working, with a longer-term view to increasing uptake of new technologies – “[The evidence indicates that patients are accepting of the technology and are willing to use it to self-monitor. Increased convenience and privacy are selling points. However, patients do not want to lose in-person contact completely so a combination of tele-homecare and in-person visits seems best. Little evidence exists to guide providers regarding what is the best combination of telehomecare and in-person contacts. (Bowles and Baugh, 2007)].” Further research should be conducted in this area.

There were few studies that focussed solely on video calling as an intervention, and video calls were often grouped together with other telehealth interventions. This means that there was a lack of meta-analysis on the mode of video calling, due to the heterogeneity of the studies. Heterogeneity of among studies is also cited by the AHRQ as ‘one of the major challenges when systematically reviewing the literature on telehealth’²⁰.

In one study that considered video consultation solely, we conducted further reading to ascertain the particular context and specific technology and methodology used.

Because most of the systematic reviews examined various different telehealth interventions rather than video consultation in isolation, very few of them detailed the exact technology used, and none were discussed the use of tablets, smartphones, or ‘smart TVs’ for this purpose. However, we can extrapolate some general observations about the evidence base for the mode of video calling as a whole rather than focussing on the specific technological solutions. The evidence does not address specific suppliers or systems providing video consultation. We don’t think that it is appropriate or necessary to draw out these details since many of the studies described using technology solutions that have been superseded or that have advanced significantly in the last few years.

Enablers and barriers

Costs

There was a general lack of methodical evaluation undertaken in relation to the cost effectiveness of video consultation as an intervention. However, some individual studies did provide details related to cost effectiveness, as detailed in the individual findings section below. Where costs are discussed, it is important to note the healthcare system context in which studies have been conducted, as

²⁰ Agency for Healthcare Research and Quality, *Telehealth: Mapping the Evidence for Patient Outcomes From Systematic Reviews*, June 2016. See: <https://effectivehealthcare.ahrq.gov/ehc/products/624/2254/telehealth-report-170222.pdf>

issues related to a private insurance-based healthcare system such as licensing and reimbursement are not always relevant to a UK-based context. One review cited three studies that discussed how initial equipment and training costs may impose additional expenses but increased use over time has the potential to reduce costs through reductions in rehospitalisations and travel costs, offsetting the initial costs and depreciation (Bowles and Baugh, 2007). However none of the studies were able to give any recommendation, indication or evidence of how long it takes for costs to be recuperated or offset.

One study found that average in-person home health visits have a duration of 45 minutes compared with 18 minutes for a telehomecare visit, meaning that “with traditional home care, the nurse can see 5 or 6 patients in 1 day; telehomecare may allow 15 to 20 video visits per day” (Bowles and Baugh, 2007).

Geography

Some of the benefits of videoconferencing in healthcare may be more applicable to patients who live in more remote areas where it may be difficult or expensive to travel to access healthcare services. However, in a UK context, travel times are on the whole significantly less than those that may be encountered in countries with a larger geographical spread such as those covered in many of the reviews included here.

User satisfaction

There are many different factors to consider when assessing the effectiveness of video calling. The more obvious factor is whether patient outcomes are either improved or the same as traditional interventions. However it is also important to assess patient and clinician satisfaction with the intervention if it is considered a departure from traditional ways of doing things/delivering healthcare. In some cases, it is patients that are reluctant or unable to interact with new technologies:

“However, 11 patients could not use it due to severe illness, physical conditions of the home, lack of interest, or concerns about the equipment, suggesting the importance of prescreening to determine eligible patients.” (Bowles and Baugh, 2007)

In other cases, clinicians are uncomfortable or dissatisfied with the intervention, either due to the impact on their working pattern/habits or because they feel that patient outcomes are affected/quality of care suffers. For examples, the poor quality video technologies can make it hard to read emotional cues while delivering telepsychiatry:

“The problems with emotional communication were also a concern to the staff.” (Pesamaa et al., 2004)

As we have heard from vanguards across the country, staff engagement is a huge contributor to the success of any TECS intervention. If staff feel that the intervention is not as effective as another method that they are more used to, then it follows that take-up and enthusiasm will be negatively impacted.

In some studies (Bowles and Baugh, 2007), staff noted the positive outcomes/benefits of using technology to interact with patients, including:

- The nurse at the distant site was not trained in wound assessment and felt that she learned a great deal, indicating this technology's potential to transfer nursing knowledge (video technology in wound assessment).

- Three studies found that nurses feel that they can provide quality care using telehomecare (not video-specific).
- Nurses reported that using telehomecare technology added dimensions to caring by creating new types of bonds with patients, and that patients who received telehomecare were more focused and more comfortable managing their diseases.
- Nurses also reported it was useful for monitoring vital signs, saved time and money, increased productivity and gave them the ability to provide better care to patients.

Miller (2001) cited the lack of quantitative information on cost, quality and access to telemedicine services as a “significant barrier to the acceptance of telemedicine by providers and policy makers” which has “also served to limit public support and private investment”.

List of reviews considered

The publication date range of the articles reviewed (1999-2016) is an important consideration as quality of video calls will have improved significantly in recent years, with regards to both image resolution as well as improved internet connectivity allowing for more stable connections during video calls. For some of the older studies, video conferencing was cited as a very costly intervention (Chaudhry et al., 2007), however costs of video calling will have dropped significantly due to the advent and popularity/ubiquity of inexpensive mobile devices with video call functionality among the general population.

A full breakdown of the articles that formed part of this review follows below:

Publication Year	Author	Title	Condition	Summary	# of studies
2001	Hailey, D; Roine, R; Ohinmaa, A	Assessments of telemedicine applications: an update	Multiple	Good quality evidence for telemedicine was scarce in 2000	68
2001	Hersch, W R; Wallace, J A; Patterson, P K; Kraemer, D F; Nichol, W P; Greenlick, M R; Krages, K P; Helfand, M	Telemedicine for the Medicare population: pediatric, obstetric and clinician-indirect home interventions	Multiple	There is some evidence for the efficacy of clinician-interactive telemedicine, but the studies do not clearly define which technologies provide benefit or cost-efficiency. Most of the studies measuring access to care provide evidence that it is improved.	28
2001	Miller, E A	Telemedicine and doctor-patient communication: an analytical survey of the literature	Multiple	Approximately 80% of abstracted findings favoured telemedicine. Verbal content analysis is important for the development of interventions aimed at facilitating doctor-patient telecommunication.	38
2002	Liss, H J; Glueckauf, R L; Ecklund-Johnson, E P	Research on telehealth and chronic medical conditions: critical review, key issues, and future directions	Multiple	The overall pattern of findings suggests that Internet, telephone and videoconferencing may be effective and efficient modes of treatment for people with chronic, disabling conditions. There is evidence from the videocounselling studies reviewed that telehealth interventions were at least as effective as traditional face-to-face treatments.	10
2003	Hailey, D; Ohinmaa, A; Roine, R	Recent studies on assessment of telemedicine: systematic review of study quality and evidence of benefit	Multiple	Good quality evidence for telemedicine until 2001 was limited	67
2006	Hersh, W R; Hickam, D H; Severance, A M; Dana, T L; Krages, K P; Helfand, M	Telemedicine for the Medicare population: update	Multiple	General review of technologies used in health care	97

Publication Year	Author	Title	Condition	Summary	# of studies
2007	Bowles, K H; Baugh, A C	Applying research evidence to optimize telehomecare	Multiple	The technology appears to have positive effects on chronic illness outcomes such as self-management, rehospitalizations, and length of stay. Due to savings from healthcare utilization and travel, telehomecare appears to reduce healthcare costs. The use of remote video technology with 212 chronically ill patients found no differences in the quality indicators of medication compliance, knowledge of disease, or self-care ability; patient satisfaction; or service use.	40
2009	Durrani, H; Khoja, S	A systematic review of the use of telehealth in Asian countries	Multiple	Broad-based study of telehealth literature in Asia - there is a lack of good quality studies.	109
2011	Hailey, D; Roine, R; Ohinmaa, A; Dennett, L	Evidence of benefit from telerehabilitation in routine care: a systematic review	Multiple	Broad based review of telerehabilitation in physical health care produced mixed findings	66
2012	van den Berg, N; Schumann, M; Kraft, K; Hoffmann, W	Telemedicine and telecare for older patients: a systematic review	Multiple	A broad based review of telemedicine among older adults found better evidence for changes in healthcare processes than healthcare outcomes	68
2014	dos Santos, MT; Moura, SC; Gomes, LM; Lima, AH; Moreira, RS; Silva, CD; Guimaraes, EM	Telehealth application on the rehabilitation of children and adolescents	Multiple	Most of the studies showed that telerehabilitation is able to produce better results in the treatment when compared to the traditional methods, providing less frequency of symptoms, better disease control, better quality of life and greater adherence to treatment.	9
2005	Farmer, A; Gibson, O J; Tarassenko, L; Neil, A	A systematic review of telemedicine interventions to support blood glucose self-monitoring in diabetes	Diabetes	Evidence for the effectiveness of telemedicine in diabetes is not strong, including evidence of effects on HbA1C	32
2009	Medical Advisory Secretariat	Home telemonitoring for type 2 diabetes: an evidence-based analysis	Diabetes	Telemedicine appears to produce a small improvement in HbA1C in diabetes	7

Publication Year	Author	Title	Condition	Summary	# of studies
2010	Verhoeven, F; Tanja-Dijkstra, K; Nijland, N; Eysenbach, G; van Gemert-Pijnen, L	Asynchronous and synchronous teleconsultation for diabetes care: a systematic literature review	Diabetes	Teleconsultation did not have consistent effects on clinical outcomes (as opposed to process measures) in diabetes	90
2010	Shulman, RM; O'Gorman, CS; Palmert, MR	The impact of telemedicine interventions involving routine transmission of blood glucose data with clinician feedback on metabolic control in youth with type 1 diabetes: a systematic review and meta-analysis	Diabetes	In its recommendations about the structure of pediatric diabetes care the International Society for Pediatric and Adolescent Diabetes (ISPAD) recommends the use of TM for patients living remotely from diabetes centres and acknowledges that TM may result in improved diabetes management in all areas [5]. Our paper will likely not change current practice as diabetes care clinics will have to embrace these novel forms of communication to mirror what patients are using.	10
2012	Cassimatis; M; Kavanagh; David, J	Effects of type 2 diabetes behavioural telehealth interventions on glycaemic control and adherence: a systematic review	Diabetes	Telehealth interventions appear to improve care processes and self-care behaviours in diabetes.	14
2013	Marcolino, MS; Maia, JX; Alkmim, MB; Boersma, E; Ribeiro, AL	Telemedicine application in the care of diabetes patients: systematic review and meta-analysis	Diabetes	There is some evidence for the effectiveness of telemonitoring in controlling blood pressure, but less for effects on health outcomes and costs	15
2014	Greenwood, DA; Young, HM; Quinn, CC	Telehealth remote monitoring systematic review: structured self-monitoring of blood glucose and impact on A1C	Diabetes	Reductions in HbA1C were greatest when telehealth interventions incorporated most of the defined elements of structured self-monitoring of blood glucose.	15

Publication Year	Author	Title	Condition	Summary	# of studies
2014	Zhai, YK; Zhu, WJ; Cai, YL; Sun, DX; Zhao, J	Clinical- and cost-effectiveness of telemedicine in type 2 diabetes mellitus: a systematic review and meta-analysis	Diabetes	A variety of telemedicine approaches showed effects on HbA1c in diabetes; there was minimal evidence on cost-effectiveness	47
2014	Peterson, A	Improving type 1 diabetes management with mobile tools: a systematic review	Diabetes	Studies of mobile health interventions suggested that they had overall beneficial effects on HbA1C . Not enough detail on the technologies used.	14
2004	Pesamaa, L; Ebeling, H; Kuusimaki, M L; Winblad, I; Isohanni, M; Moilanen, I	Videoconferencing in child and adolescent telepsychiatry: a systematic review of the literature	Mental illness, sleep disorders and addictions	Videoconferencing seemed to improve the accessibility of services and served an educational function. Some papers also mentioned savings in time, costs and travel. Problems with non-verbal communication and the audiovisual quality of the videoconference were mentioned as drawbacks. Telepsychiatry seems to offer several benefits, at least in sparsely populated regions.	27
2008	Hailey, D; Roine, R; Ohinmaa, A	The effectiveness of telemental health applications: a review	Mental illness, sleep disorders and addictions	There was evidence of success with tele-mental health (TMH) in the areas of child psychiatry, depression, dementia, schizophrenia, suicide prevention, posttraumatic stress, panic disorders, substance abuse, eating disorders, and smoking prevention. The quality of video conferencing-based studies covered in the review was relatively limited. A small RCT found no difference in short-term clinical outcomes between video conferencing and same-room use of CBT for treatment of combat-related posttraumatic stress disorder.	65
2010	Garcia-Lizana, F; Munoz-Mayorga, I	Telemedicine for depression: a systematic review	Mental illness, sleep disorders and addictions	There is insufficient scientific evidence regarding the effectiveness of ICT use in the management of depression.	10
2010	Boisvert, M; Lang, R; Andrianopoulos, M; Boscardin, ML	Telepractice in the assessment and treatment of individuals with autism spectrum disorders: a systematic review	Mental illness, sleep disorders and addictions	Results suggests telepractice is a promising service delivery approach in the treatment of individuals with autism spectrum disorder that warrants additional research.	8

Publication Year	Author	Title	Condition	Summary	# of studies
2011	Martin, S; Sutcliffe, P; Griffiths, F; Sturt, J; Powell, J; Adams, A; Dale, J	Effectiveness and impact of networked communication interventions in young people with mental health conditions: a systematic review	Mental illness, sleep disorders and addictions	Networked communication technologies can increase the opportunity for communication between patient and health care professionals. Limited improvements in quality of life and continuity of care for patients were reported.	12
2013	Dorstyn, DS; Saniotis, A; Sobhanian, F	A systematic review of telecounselling and its effectiveness in managing depression amongst minority ethnic communities	Mental illness, sleep disorders and addictions	Videoconferencing seemed to improve the accessibility of services and served an educational function. Some papers also mentioned savings in time, costs and travel. Problems with non-verbal communication and the audiovisual quality of the videoconference were reported.	8
2015	Fisher, Emma; Law, Emily; Palermo, Tonya M; Eccleston, Christopher	Psychological therapies (remotely delivered) for the management of chronic and recurrent pain in children and adolescents	Mental illness, sleep disorders and addictions	There is some evidence for the effectiveness of remotely-delivered psychological treatments on chronic pain in children. Psychological therapies delivered remotely, primarily via the Internet, confer benefit in reducing the intensity or severity of pain after treatment across conditions. However, there is considerable uncertainty around these estimates of effect.	8
2007	Chaudhry, S I; Phillips, C O; Stewart, S S; Riegel, B; Mattera, J A; Jerant, A F; Krumholz, H M	Telemonitoring for patients with chronic heart failure: a systematic review	Heart disease	Although 6-month heart failure readmission charges were higher in the usual care group compared with intervention groups, no differences were seen between the video conferencing and telephone support groups.	9
2009	Maric, B; Kaan, A; Ignaszewski, A; Lear, SA	A systematic review of telemonitoring technologies in heart failure	Heart disease	Most studies demonstrated improvements in outcome measures, including improved quality of life and decreased hospitalizations. Lack of robust evidence. Several studies on specialised devices reported significantly reduced hospitalisations and improved QOL.	56

Publication Year	Author	Title	Condition	Summary	# of studies
2010	Polisena, J; Tran, K; Cimon, K; Hutton, B; McGill, S; Palmer, K; Scott, RE	Home telemonitoring for congestive heart failure: a systematic review and meta-analysis	Heart disease	Mixed evidence but generally intervention groups showed equal or improved QoL, satisfaction and treatment adherence between control and intervention groups, with soem evidence for fewer ED visits and hospitalisations.	21
2011	Kraai, IH; Luttik, ML; de Jong, RM; Jaarsma, T; Hillege, HL	Heart failure patients monitored with telemedicine: patient satisfaction, a review of the literature	Heart disease	In general, patients seemed to be satisfied or very satisfied with the use of telemedicine.	14
2011	McLean, Susannah; Nurmatov, Ulugbek; Liu, Joseph LY; Pagliari, Claudia; Car, Josip; Sheikh, Aziz	Telehealthcare for chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease	Trials of interventions including telehealthcare as a component suggest improvements in quality of life and service use in chronic obstructive pulmonary disease.	10
2010	McLean, Susannah; Chandler, David; Nurmatov, Ulugbek; Liu, Joseph LY; Pagliari, Claudia; Car, Josip; Sheikh, Aziz	Telehealthcare for asthma	Asthma	A broad-based study of technology-enabled care in asthma produced mixed evidence of effectiveness.	21
2011	McLean, S; Chandler, D; Nurmatov, U; Liu, J; Pagliari, C; Car, J; Sheikh, A	Telehealthcare for asthma: a Cochrane review	Asthma	We found no evidence of a clinically important impact on patients' quality of life. Meta-analysis of the four studies suggests that telehealthcare reduced the risk of admission to hospital.	21

Publication Year	Author	Title	Condition	Summary	# of studies
2014	Zhao, J; Zhai, YK; Zhu, WJ; Sun, DX	Effectiveness of telemedicine for controlling asthma symptoms: a systematic review and meta-analysis	Asthma	Studies of telemonitoring in blood pressure management mainly show effects of blood pressure and medication adherence, rather than outcomes and costs.	11
2016	Kew, Kayleigh M; Cates, Christopher J	Remote versus face-to-face check-ups for asthma	Asthma	Remote versus face to face follow ups do not appear to improve health outcomes in asthma.	6
2009	Kairy, D; Lehoux, P; Vincent, C; Visintin, M	A systematic review of clinical outcomes, clinical process, healthcare utilization and costs associated with telerehabilitation	Physical disability	Studies report improvement in physical, functional and psychological measures following a telerehabilitation intervention. Similar outcomes obtained using telerehabilitation compared to a face-to-face. Patients and therapists reported positive perceived benefits, convenience and usefulness of the telerehabilitation program. Telephysiotherapy calculated as 17% cheaper than home visits.	28
2013	Dorstyn, D; Mathias, J; Denson, L	Applications of telecounselling in spinal cord injury rehabilitation: a systematic review with effect sizes	Physical disability	Only one study achieved a statistically meaningful treatment effect immediately following telephone counselling. This study found a moderate improvement in participants' ability to manage physical health symptoms related to spinal cord injury (e.g. muscle pain, poor sleep patterns). One telecounselling programme produced significant positive change in quality of life ratings that was maintained 12 months after treatment cessation. High attrition rate so results should be treated with caution.	7
1999	Campbell, N D; Ritchie, L D; Cassidy, J; Little, J	Systematic review of cancer treatment programmes in remote and rural areas	Cancer	Limited evidence concerning tele-oncology.	15
2007	Lauriks, S; Reinersmann, A; Van der Roest, H G; Meiland, F J; Davies, R J; Moelaert, F; Mulvenna, M D;	Review of ICT-based services for identified unmet needs in people with dementia	Dementia	There is little high-quality evidence concerning technology-enabled care in dementia.	21

Publication Year	Author	Title	Condition	Summary	# of studies
	Nugent, C D; Droes, R M				
2007	Barlow, J; Singh, D; Bayer, S; Curry, R	A systematic review of the benefits of home telecare for frail elderly people and those with long-term conditions	Frailty/Old age	Based on the evidence reviewed, the most effective telecare interventions appear to be automated vital signs monitoring (for reducing health service use) and telephone follow-up by nurses (for improving clinical indicators and reducing health service use).	98
2015	Khan, Fary; Amatya, Bhasker; Kesselring, Jurg; Galea, Mar	Telerehabilitation for persons with multiple sclerosis	Multiple Sclerosis	There is no clear evidence for the use of mobile phone based interventions for rehabilitation in multiple sclerosis.	9
2013	Pietrzak, E; Cotea, C; Pullman, S; Nasveld, P	Self-management and rehabilitation in osteoarthritis: is there a place for internet-based interventions?	Osteoarthritis	Postoperative rehabilitation performed by a physical therapist via videoconferencing and "in-person" resulted in similar health measure improvements. The review findings show that the Internet may be successfully used as a medium for providing community-based self-management and rehabilitation interventions in osteoarthritis.	5
2013	Laver, Kate E; Schoene, Daniel; Crotty, Maria; George, Stacey; Lannin, Natasha A; Sherrington, Catherine	Telerehabilitation services for stroke	Stroke	There is no clear evidence concerning the use of telerehabilitation after stroke.	10
2014	Nordheim, LV; Haavind, MT; Iversen, MM	Effect of telemedicine follow-up care of leg and foot ulcers: a systematic review	Ulcers	It is not possible to say whether telemedicine is an effective strategy for managing leg and foot ulcers.	1

6.2.4 Web-based interventions

The UK Office for National Statistics (ONS) reports that in 2016 87.9% of adults in the UK (45.9 million) had recently (in the last three months) used the internet, compared with 86.2% in 2015; and that almost all adults aged 16 to 24 years were recent internet users (99.2%) (this is in contrast with 38.7% of adults aged 75 years and over).²¹

Besides providing a way for the general public to obtain information, to transact, and to communicate, the Internet is increasingly felt to show great promise as a source of information, and a mechanism for providing social support, and support for decision-making and behaviour change among people living with particular health conditions. In particular, it is felt to be a valuable tool for enabling *self-management* among patients—encouraging their sense of empowerment, independence, and self-efficacy, and reducing their reliance on conventional models of healthcare delivery.

The emergence of what has come to be known as ‘Web 2.0’ – a stage of evolution of the Internet characterised by the increasing availability of dynamic, user-generated content, greater opportunity for interactivity and personalisation, and the growth of social media – is felt to offer particularly compelling opportunities where this is concerned—indeed, one of the reviews under consideration in this survey (Stellefson et al., 2013; see below) specifically examines the potential of facilities provided by ‘Web 2.0’ to support chronic disease management in older adults.

Given the opportunities offered, it came as no surprise to us in the course of this project that stakeholders expressed an interest in finding out more about the potential of web-based health and care interventions.

Overview of the evidence base

Our search criteria surfaced 26 reviews investigating the use of web-based interventions to support health and care. The publication dates of these reviews ranged from 2004 to 2016.

Some of these reviews focused on the general effectiveness of web-based interventions; others focused on more specific questions related, for instance, to the efficacy of such interventions to promote medicines adherence; to levels of reported patient satisfaction with particular approaches; or to the extent to which approaches to delivering web-based interventions that have been demonstrated to have beneficial outcomes for patients with one type of long-term condition could be generalised to another.

Most (12) of the reviews examined the use of web-based interventions in a mental health context; for instance, delivering, via a computer or Internet link, psychological therapies to people with depression, anxiety, sleep disorders, or addictions—so-called ‘tele-counselling’. Five of the reviews focused on diabetes, and one focused on heart disease. The remaining five reviews considered several different conditions.

There are multiple challenges where the evidence for web-based interventions is concerned.

Lack of descriptive detail

At the level of an individual review, it is not always possible to determine precisely what kind of web-based intervention was deployed because this level of detailed information on content and

²¹ Office for National Statistics (2016), *Internet users in the UK: 2016—statistical bulletin*, London: Crown Copyright, 20th May 2016.

procedure is not (or is only very vaguely) provided. Did the intervention provide information online, or did it incorporate other interactive functionality such as e-mail or a discussion forum, or did it use more novel engagement approaches such as so-called 'gamification'? Regrettably, it has not always been possible to discern this from the available study description.

A number of reviews comment on the lack of detailed descriptive information in source studies on the demographics of users of web-based interventions, and web-usage statistics, which would provide a useful additional source of data, and which are – after all – these days reasonably straightforward to collect.

In general, there is a paucity of information on the 'what' and the 'how' aspects of delivering web-based interventions. We recognise that this information would be of use to providers and commissioners seeking to establish and develop such services in line with best practice. Unfortunately, the evidence as it currently stands does not allow us to draw firm conclusions on such methodological and procedural matters.

Inconsistent nomenclature

Even in instances in which a particular approach is described in detail, when one looks across the evidence, it is clear that there is considerable heterogeneity in the evidence base in terms of what one considers a 'web-based intervention', and what such an intervention entails. There is such a variety of approaches in use – some using a specific online mechanism; others using a variety of technology tools; some augmenting online delivery with some kind of peer or professional support 'offline'; some combining web delivery with mobile phone functionality such as SMS text messaging; some delivering what would be considered conventional 'telemedicine' – that it makes it very difficult to draw reliable, generalizable conclusions.

Poor quality study design

A considerable number of the studies that comprise the reviews we have analysed did not use control groups. This makes it difficult to attribute possible improvements to the intervention per se, which – in turn – makes it difficult to draw reliable conclusions.

Are web-based interventions effective? Findings from the evidence

Many of the reviews examined are tentative in their conclusions, citing issues with heterogeneity of interventions addressed, and the reliability of conclusions presented in, the source studies.

It is difficult to identify generalizable findings from the evidence because the reviews conducted and the aims upon which the technology interventions are focused are so diverse: what may prove effective in impacting upon smoking cessation may not prove to be so for encouraging physical activity or medicines adherence in diabetes.

However, we can tentatively advance the following assertions based on the available evidence:

- The keen interest in using web-based interventions to deliver psychological therapies for people with mental health conditions appears to be warranted, with these interventions proving effective in reducing anxiety symptoms and accelerating the rate of remission. However, there is no evidence that web-based mental health interventions are effective in reducing depression symptom severity.
- The evidence of effectiveness of web-based interventions in diabetes management is mixed. Where improved glycaemic control was observed in diabetic patients, reductions in HbA1c were more pronounced among patients with Type 1 diabetes, who tend to be younger (Type 2

diabetes is more common in older adults, and it is worth noting that, compared with younger adults, older adults report greater anxiety about using computers, lower use of technology and less confidence in their technological abilities. Therefore, some patients may have found difficulties in dealing with the telemedicine applications, for example, to upload blood glucose results to the website or to access online educational materials).

- There is evidence to suggest that web-based interventions can be at least as effective as (not to mention more *cost-effective* than) interventions involving face-to-face contact with a healthcare professional (which has a relatively high implementation cost). However, further research needs to be conducted to understand whether such impacts manifest themselves only with certain constituencies of patient/types of condition.
- Only one of the reviews provided insights into the cost-effectiveness of web-based interventions but this was in the North American context, which presents challenges in terms of transferring findings to the NHS.
- Further research is almost always recommended to gather data in specific areas that will strengthen conclusions and enhance our understanding of what is effective in delivering web-based interventions.
- The pace of current web development is so rapid that ongoing research is needed to keep abreast of the potential beneficial impacts of ongoing innovation in this area.

Enablers and barriers

Irrespective of the health condition at which a web-based intervention is targeted, having an online experience that is **tailored** to the user, and that incorporates a degree of **interactivity** appear to be important ingredients in a solution's success.

- Where smoking cessation is concerned, for instance, Internet programmes that are interactive and tailored to individual responses lead to higher quit rates than usual care or written self-help at six months or longer (Civljak et al., 2013). Where the Internet programme was *not* tailored, this did *not* improve smoking outcomes (although it is also important to note that, interestingly, direct comparisons between interactive/tailored and non-interactive/non-tailored programmes *did not* show a difference between the two.)
- The more tailored to the user a web-based intervention is, the more likely that individual is to adhere to their regime of cardiovascular disease medication (Cutrona et al., 2010). And in general, interventions that direct the user to relevant, individually-tailored materials report longer website session times per visit and more visits (Wantland et al., 2004).

“The management of any chronic disease should be personalized to an individual, as the person is ultimately responsible for the success of the intervention [...] Web-based interventions should be designed to allow individuals to tailor the intervention to their specific needs. The flexibility to provide interactive and responsive programs for use on the Internet is increasing. This is conducive to the incorporation of interactive and continuous self-monitoring, feedback and information exchange that is certain to play an increasingly important role for this patient care need.” (Stellefson et al., 2013)

In general, it appears that web-based interventions are more effective and have greater impact when they are **delivered in conjunction with a range of other supporting measures**—which can include encounters with a healthcare professional, or reinforcement from mobile phone reminders, etc.

Although the power of social media is often felt to be in its *immediacy*, its offering the facility for *real-time* (often referred to as 'synchronous') communication; where healthcare-related information exchange is concerned it is '**asynchronous**' communication – the intermittent exchange of messages, with users reading and responding to posts instead *in their own time* – that is felt to deliver most benefit for patients. This is because it provides time for them to reflect upon new messages and respond in a more considered fashion.

A number of reviews indicate a trend in which web-based interventions decrease in their impact over time. This suggests that support and the generation of positive motivation should be intensified over time. Additionally, a more participatory design approach, involving target users in developing personalised web-based interventions, might enhance persistence in usage and adherence to treatment (this relates to the point about tailoring above).

List of reviews considered

A full breakdown of articles that formed part of this review follows below:

Publication Year	Author	Title	Condition	Summary	# of studies
2006	Griffiths, K M; Christensen, H	Review of randomised controlled trials of Internet interventions for mental disorders and related conditions	Mental illness, sleep disorders and addictions	Internet interventions for depression and anxiety disorders offer promise for use as self-help applications for consumers or as an adjunct to usual care.	15
2010	Whittaker, R; Borland, R; Bullen, C; Lin, RB; McRobbie, H; Rodgers, A	Mobile phone-based interventions for smoking cessation	Mental illness, sleep disorders and addictions	Studies incorporating biochemical verification of quitting status demonstrated an even higher chance of smokers quitting.	12
2010	Tait, RJ; Christensen, H	Internet-based interventions for young people with problematic substance use: a systematic review	Mental illness, sleep disorders and addictions	Web interventions that targeted alcohol-related problems had an effect about equivalent to brief in-person interventions, but with the advantage that they could be delivered to a far larger proportion of the target population. Web-based preventative interventions in those who did not drink appeared to have minimal impact. There were insufficient data to assess the effectiveness of web-based interventions for tobacco use by adolescents.	16
2010	Griffiths, KM; Farrer, L; Christensen, H	The efficacy of internet interventions for depression and anxiety disorders: a review of randomised controlled trials	Mental illness, sleep disorders and addictions	Internet interventions for depression and anxiety disorders offer promise for use as self-help applications for consumers or as an adjunct to usual care.	29
2011	Riper, H; Spek, V; Boon, B; Conijn, B; Kramer, J; Martin-Abello, K; Smit, F	Effectiveness of E-self-help interventions for curbing adult problem drinking: a meta-analysis	Mental illness, sleep disorders and addictions	Web-based self-help interventions without professional contact are effective in curbing adult problem drinking in high-income countries. It is not clear whether web-based interventions that include professional contact are more effective against problem drinking than no-contact interventions and, if so, to what types of problem drinkers that might apply. No-contact web-based self-help interventions could be more cost-effective than other approaches (e.g. screening; brief face-to-face interventions) that have relatively high implementation costs. Studies that rigorously assess this proposition are not yet available, so further research is needed here.	9

Publication Year	Author	Title	Condition	Summary	# of studies
2011	Hutton, HE; Wilson, LM; Apelberg, BJ; Tang, EA; Odelola, O; Bass, EB; Chander, G	A systematic review of randomized controlled trials: web-based interventions for smoking cessation among adolescents, college students, and adults	Mental illness, sleep disorders and addictions	Evidence supporting the use of web-based interventions for smoking cessation was insufficient to moderate in adults and insufficient in college students and adolescents.	21
2012	Richards, D; Richardson, T	Computer-based psychological treatments for depression: a systematic review and meta-analysis	Mental illness, sleep disorders and addictions	Compared with controls (mainly waiting list or treatment as usual), there was a statistically significant effect on self-reported depression after treatment and at follow-up. Computer-based interventions were associated with a significant increase in the odds of clinical improvement in depression and recovery from depression. Analysis found statistically significant effects of treatment on self-reported measures of depression, except for those using a synchronous mode of communication.	40
2013	Dowling, M; Rickwood, D	Online counseling and therapy for mental health problems: a systematic review of individual synchronous interventions using chat	Mental illness, sleep disorders and addictions	Tentative support for the efficacy of individual synchronous online chat counselling and therapy. However, the evidence is not sufficient to draw definitive conclusions and further research is needed.	6
2013	Civljak, Marta; Stead, Lindsay F; Hartmann-Boyce, Jamie; Sheikh, Aziz; Car, Josip	Internet-based interventions for smoking cessation	Mental illness, sleep disorders and addictions	More evidence is needed to determine if programmes delivered over the Internet can help people to stop smoking. Internet programmes that are interactive and tailored to individual responses lead to higher quit rates than usual care or written self-help at six months or longer. The Internet may have an additional benefit when used alongside other interventions, such as nicotine replacement therapy or other pharmacotherapy. Innovative smoking cessation interventions delivered via the Internet may be more attractive to young people and to women who smoke, and less attractive to smokers reporting depression.	28
2014	Danielsson, AK; Eriksson, AK; Allebeck, P	Technology-based support via telephone or web: a systematic review of the effects on smoking, alcohol use and gambling	Mental illness, sleep disorders and addictions	Issues with lack of control groups in many studies, which makes it difficult to attribute possible improvements to the intervention per se. Also, studies do not report demographic characteristics so it is difficult to draw firm conclusions regarding which populations are more or less likely to benefit from technology-based intervention. Very seldom are the effects of possible additional help or complementary care examined and controlled for. More research is needed to gain insights into these areas.	74

Publication Year	Author	Title	Condition	Summary	# of studies
2014	Ye, X; Bapuji, SB; Winters, SE; Struthers, A; Raynard, M; Metge, C; Kreindler, SA; Charette, CJ; Lemaire, JA; Synyshyn, M; Sutherland, K	Effectiveness of internet-based interventions for children, youth, and young adults with anxiety and/or depression: a systematic review and meta-analysis	Mental illness, sleep disorders and addictions	Internet-based interventions are effective in reducing anxiety symptoms and increasing remission rate, but not effective in reducing depression symptom severity. Due to the small number of higher quality studies, more attention to this area of research is encouraged.	7
2016	Olthuis, Janine V; Watt, Margo C; Bailey, Kristen; Hayden, Jill A; Stewart, Sherry H	Therapist-supported Internet cognitive behavioural therapy for anxiety disorders in adults	Mental illness, sleep disorders and addictions	Very heterogeneous evidence base. More research needed comparing ICBT and face-to-face CBT, examine the importance of the role of the therapist in ICBT, and include effectiveness trials of ICBT in real-world settings. A timely update to this review is needed given the fast pace of this area of research. Therapist-supported ICBT is more efficacious than a waiting list, attention, information, or online discussion group- only control. It looks like there isn't a significant difference in outcome between unguided CBT and therapist-supported ICBT, but this finding needs to be confirmed. Therapist-supported ICBT may not be significantly different from face-to-face CBT in reducing anxiety.	38
2008	Dalton, JE	Web-based care for adults with type 2 diabetes	Diabetes	Included studies varied greatly. This inhibits the drawing of general conclusions about telediabetes programs. It seems likely that there is a promising future for telediabetes as a tool for service delivery, but dieticians must increase their knowledge, competency, advocacy and research efforts in this area.	9
2012	Yu, CH; Bahniwal, R; Laupacis, A; Leung, E; Orr, MS; Straus, SE	Systematic review and evaluation of web-accessible tools for management of diabetes and related cardiovascular risk factors by patients and healthcare providers	Diabetes	Mixed evidence on whether web-based self-management tools for patients with poorly controlled diabetes can reduce blood pressure and cholesterol. Nutrition and physical activity web sites generally led to reduction in measures of obesity. There is mixed evidence on whether online smoking prevention and cessation tools impact upon smoking rates. There was some evidence across tools that the more interactive tools resulted in greater clinical improvements.	57

Publication Year	Author	Title	Condition	Summary	# of studies
2013	Marcolino, MS; Maia, JX; Alkmim, MB; Boersma, E; Ribeiro, AL	Telemedicine application in the care of diabetes patients: systematic review and meta-analysis	Diabetes	Improved glycaemic control observed in diabetic patients with reductions in HbA1c more pronounced among patients with Type 1 diabetes. No clinically-relevant impact was observed on LDL-c and blood pressure. Some suggestion of BMI reduction in diabetes patients who used telemedicine, but these outcomes need to be further explored in future trials. Higher HbA1c reduction in interventions which lasted six months when compared to the ones that lasted at least one year. Although it did not reach statistical significance, it suggests a trend of decreasing intervention impact over time. This finding suggests that in clinical practice contact through telemedicine and positive motivation should be intensified over time, in order not to decrease the impact on glycaemic control. Additionally, a more participatory design approach, involving target users in developing personalized interventions, might enhance persistence in usage and adherence to treatment. Type 2 diabetes is more common in older adults. Compared with younger adults, older adults report greater anxiety about using computers, lower use of technology and less confidence in their technological abilities. Therefore, some patients may have found difficulties in dealing with the telemedicine applications, for example, to upload blood glucose results to the website or to access online educational materials.	13
2014	Harrison, S; Stadler, M; Ismail, K; Amiel, S; Herrmann-Werner, A	Are patients with diabetes mellitus satisfied with technologies used to assist with diabetes management and coping? A structured review	Diabetes	Positive user experience is correlated strongly with ease of use and improved diabetes management. Increased support was valued, and resulted from devices facilitating interaction with healthcare professionals peers. This support formed an important aspect of patient satisfaction and should be considered for future interventions.	26
2014	Pereira, K; Phillips, B; Johnson, C; Vorderstrasse, A	Internet delivered diabetes self-management education: a review	Diabetes	Web-based diabetes education resulted in significantly improved glycaemic control compared with usual care, but it does not appear to be significantly more effective than printed materials. It also resulted in improved clinic attendance compared with face-to-face education. Some studies also demonstrated improvements in self-efficacy, diabetes knowledge, exercise behaviours, and self-care behaviour. When Internet-based materials are used in conjunction with a face-to-face diabetes nurse educator, the added interaction leads to improved glycaemic control and diabetes knowledge. More research is needed on the cost-benefits of Internet diabetes education and best methods to maintain patient engagement, along with more studies assessing long-term impact.	14

Publication Year	Author	Title	Condition	Summary	# of studies
2004	Wantland, D J; Portillo, C J; Holzemer, W L; Slaughter, R; McGhee, E M	The effectiveness of Web-based vs. non-Web-based interventions: a meta-analysis of behavioral change outcomes (Structured abstract)	Multiple	Web-based interventions improve behavioural change outcomes (e.g. increased exercise time, increased knowledge of nutritional status, increased knowledge of asthma treatment, increased participation in healthcare, slower health decline, improved body shape perception, and 18-month weight loss maintenance). Those interventions that directed the participant to relevant, individually tailored materials reported longer Web site session times per visit and more visits. Additionally, those sites that incorporated the use of a chat room demonstrated increased social support scores. The long-term effects on individual persistence with chosen therapies and cost-effectiveness of the use of Web-based therapies and hardware and software development require continued evaluation.	22
2009	Stinson, J; Wilson, R; Gill, N; Yamada, J; Holt, J	A systematic review of internet-based self-management interventions for youth with health conditions	Multiple	The review evaluated the effectiveness of internet-based self-management interventions on health outcomes in children and adolescents with health conditions and found evidence for improvement in symptoms or disease control in obesity, recurrent pain, and encopresis and particularly for asthma. The review was relatively well conducted, but the evidence was limited and so the reliability of the authors' conclusions is unclear.	9
2013	Kuijpers, W; Groen, WG; Aaronson, NK; van Harten, WH	A systematic review of web-based interventions for patient empowerment and physical activity in chronic diseases: relevance for cancer survivors	Multiple	A recent review of Web-based interventions for type 2 diabetes indicated that interventions of longer duration (more than 12 weeks) resulted in better outcomes, and it is likely that the same is valid for cancer survivors. However, future studies need to confirm this. The study identified seven elements common to effective web-based interventions, but these were used in different combinations and were adapted to the specific patient population under consideration. It is therefore not possible to make a judgment about the individual contribution of these elements to intervention outcomes.	19
2013	Beatty, L; Lambert, S	A systematic review of internet-based self-help therapeutic interventions to improve distress and disease-control among adults with chronic health conditions	Multiple	Evidence of improvement in symptom or disease control in most of the health conditions under consideration. However, there is limited evidence regarding their impact on health care utilization (some evidence with asthma), knowledge and quality of life outcomes. Unable to determine the effectiveness of internet interventions on self-efficacy, social support or emotional well-being. The review was unable to conclude definitively whether self-management interventions delivered through the internet are as effective as face-to-face therapies. This was because most of the studies used usual care or wait-list control comparison groups.	24

Publication Year	Author	Title	Condition	Summary	# of studies
2013	Stellefson, M; Chaney, B; Barry, AE; Chavarria, E; Tennant, B; Walsh-Childers, K; Sriram, PS; Zagora, J	Web 2.0 chronic disease self management for older adults: a systematic review	Multiple	Use of 'Web 2.0' functionality may be associated with improvements in health behaviours (e.g., physical activity) and health status (e.g., HRQoL). However, few studies indicated statistically significant improvements in medication adherence, biological outcomes, or health care utilization. Users felt greater self-efficacy for managing their disease(s) and benefitted from communicating with health care providers and/or website moderators to receive feedback and social support. There is need for a greater understanding of the costs and benefits associated with using patient-centred Web 2.0 technologies for chronic disease self-management. More research is needed to determine whether the long-term effectiveness of these programs is sustainable among larger, more diverse samples of chronically ill patients.	14
2010	Cutrona, SL; Choudhry, NK; Fischer, MA; Servi, A; Liberman, JN; Brennan, TA; Shrank, WH	Modes of delivery for interventions to improve cardiovascular medication adherence	Heart disease	Electronic interventions - particularly those that are tailored - contribute to improved adherence to cardiovascular disease medications (but so do in-person pharmacist interventions held at the site of medication dispensing and in-person interventions at the point of hospital discharge). Home automatic blood pressure monitoring and programmable pill caps with reminder cues demonstrate promising results. Future studies should explore new electronic approaches and in-person interventions at the site of medication distribution. A focus on identifying times of increased patient receptivity to the adherence message will also be important.	51
2012	Pellowski, JA; Kalichman, SC	Recent advances (2011-2012) in technology-delivered interventions for people living with HIV	HIV/AIDS	Despite the well-recognized need of one-third of HIV positive individuals not in treatment, there was no evidence supporting the use of technology to improve engagement and retention in care.	12
2012	Hong, Y; Pena-Purcell, NC; Ory, MG	Outcomes of online support and resources for cancer survivors: a systematic literature review	Cancer	Existing studies of online cancer support and resources have demonstrated preliminary but inconclusive evidence for positive outcomes. We call for additional studies with rigorous study designs and the inclusion of more diverse participants and cancer conditions.	24
2014	Zhao, J; Zhai, YK; Zhu, WJ; Sun, DX	Effectiveness of telemedicine for controlling asthma symptoms: a systematic review and meta-analysis	Asthma	Telemedicine interventions do not appear to improve asthma function scores, but other benefits may be present.	11

6.2.5 Mobile phone digital health ‘apps’

Overview of the evidence base

Only eight conforming articles made reference to using smartphone or mobile applications and, of those eight, two were excluded on the grounds of being written in a foreign language or a duplicate. A similar issue was encountered with these systematic reviews whereby ‘smartphone interventions’ were referred to as a group without details of which specific technologies, in this case apps, were in use. Only one article referenced smartphone applications and that was in relation to asthma (see findings section below). However, we consider it important to include a section on smartphone usage and its potential within the TECS area and implications for the future, including a discussion on other research outside of the results of our formal literature survey.

Are mobile health ‘apps’ effective? Findings from the evidence

From our review, the single article included in this section, which looked at mobile phone-based asthma self-management and included two RCTs with a total of 408 participants, concluded that “The current evidence base is not sufficient to advise clinicians, policy-makers and the general public with regards to the effectiveness of smartphone and tablet computer apps for the delivery of asthma self-management programmes” (Marcano Belisario et al., 2013). Therefore, it is not possible to recommend the use of smartphone applications as a healthcare delivery method at this point in time, based on the results of our review.

The authors of the article cited above did venture ideas as to how healthcare app usage could work and what the benefits could be:

“Health apps may be able to reach a large proportion of the population, particularly in settings where infrastructure and access to printed materials or face-to-face consultations is restricted (Masoli 2004). Most people tend to carry their mobile phones with them at all times, leaving them on even at night (Ofcom 2013). Ready access to apps running on a phone may promote engagement and reduce barriers to specific activities such as self monitoring. Unlike websites, apps can store login details and, by default, store the last used location within the app so that they can be resumed instantly. Apps can also alert an individual (or the clinical team) about the deterioration of asthma symptoms, prompting them to take timely action or seek timely care. Reminders linked to an electronic diary could help address non-adherence or non-attendance caused by forgetfulness.” (Marcano Belisario et al., 2013)

Having ascertained that there is not currently a significant body of evidence in favour of the effectiveness of smartphone and tablet applications in managing health conditions, it is important to note that other bodies of work do exist that report evidence for using smartphone applications to deliver healthcare. When looking at the grey literature and conducting informal searches of publications that deal with the topic of digital health and health apps, there is much discussion about this area. It could be there are too few studies out there to have warranted a systematic review at this stage. The following is an attempt to summarise the main points of discussion in the literature that we have uncovered as part of this evidence base review.

IMS Health, a global information and technology services company based in the USA, conducted an in-depth study on the existing evidence base for healthcare apps, or mHealth apps, as it interchangeably describes them in the report. The report concluded that the majority of studies published to date are assessments of app usage among user populations, rather than effectiveness

of the apps in improving health outcomes or delivering savings to healthcare providers²². IMS Health observes that, in line with our evaluation of the literature, existing app evidence is lumped in with other mobile phone-based interventions such as telemedicine and SMS-text messaging, but that app studies “are beginning to differentiate themselves”²³. IMS has identified several key areas in which mHealth studies have produced positive results:

Nutrition

- Increased adherence to diet monitoring and decreased effort to continue diet without app.

Wellness

- Results of healthy lifestyle indicators demonstrate the positive impact of using web-based app interventions.

Mental health

- Rapid improvements in work and social functioning with participants who had middle to moderate depression, anxiety and/or stress.

Perioperative care

- App used effectively in patients undergoing routine cardiac procedures to ensure 100% compliance with instructions along with excellent patient satisfaction scores.

IMS Health also noted that, based on a review of 113 quantitative studies related to healthcare apps, “the most notable and positive evidence generated to date is in the areas of:

- Type II diabetes
- Multiple sclerosis
- Cardiovascular disease
- Obesity”²⁴

Much more work needs to be done on the assessment of health apps, given their proliferation and popularity, in order to mitigate the potential negative consequences of patients using apps that have not been verified and which could provide misleading information or guidance that is actually harmful, as well raising concerns about privacy and usage of personal data. In New York recently (March 2017), developers of three different mobile health apps were fined a combined \$30,000 by the Attorney General’s office and required to make changes to their advertising language and privacy policies. There is a lack of regulation covering the mobile health industry at present.²⁵

²² IMS Health Institute for Healthcare Informatics, *Patient Adoption of mHealth: Use, Evidence and Remaining Barriers to Mainstream Acceptance*, September 2015. See: http://www.imshealth.com/files/web/IMSH%20Institute/Reports/Patient%20Adoption%20of%20mHealth/IIHI_Patient_Adoption_of_mHealth.pdf

²³ Ibid.

²⁴ Ibid.

²⁵ Molteni, M., ‘Wellness apps evade the FDA, only to land in court’, *Wired*, March 2017. See: <https://www.wired.com/2017/04/wellness-apps-evade-fda-land-court/>

Enablers and barriers

The pace of technological change and spread and adoption of new technologies in recent years is astounding. A 2012 review cited that smartphone penetration in the UK was 51%, whereas today 81% of the population own a smartphone, an incredible rise and making the smartphone the “most successful consumer electronics device of all time.”²⁶ No other device has the potential of the smartphone to reach as many people and transform consumer behaviour – adoption of other devices, including those that have potential to be used in a healthcare context, pales in comparison: “fitness bands, smart home appliances, smart lighting and smart watches [are owned by] under ten per cent” of the population.²⁷

Simon Stevens, NHS England’s Chief Executive, “wants people who already use apps such as Uber or Airbnb to show the same willingness to embrace digital technology that could alert them to the possible onset of a stroke, heart attack or deadly infection.”²⁸

If this comes to pass, as the general trend appears to indicate, the results for health will be transformative. However, given the very recent nature of the incredible spread in smartphone ownership, quality evidence in this area appears to be lacking. In addition, given the personal nature of smartphone usage, in that smartphones are multipurpose devices which are not used solely for health, there are associated difficulties in designing and conducting truly objective RCTs as each individual uses their smartphone differently.

The difference in app usage among different parts of the population must be taken into account. A lot of work has been carried out in the area of elderly care. IMS Health identified that, ‘of the mHealth app clinical trials recruiting over 2000 patients, 53% are directed at the senior population’ which they describe as ‘a key population that requires healthcare management and is targeted for mHealth app utilisation growth in the near future.’²⁹

List of reviews considered

A full breakdown of the articles that formed part of this review follows below:

²⁶ Deloitte, *Global Mobile Consumer Survey 2016:UK Cut*, 2016. See: <https://www.deloitte.co.uk/mobileuk/assets/pdf/Deloitte-Mobile-Consumer-2016-There-is-no-place-like-phone.pdf>

²⁷ Ibid.

²⁸ The Guardian, *NHS to offer free devices and apps to help people manage illnesses*, June 2016. See: <https://www.theguardian.com/society/2016/jun/17/nhs-to-offer-free-devices-and-apps-to-help-people-manage-illnesses>

²⁹ IMS Health, 2015. Op. cit, p.20.

Published	Author	Title	Condition	Summary
2013	Marcano Belisario, José S; Huckvale, Kit; Greenfield, Geva; Car, Josip; Gunn, Laura H	Smartphone and tablet self-management apps for asthma	Asthma	Two RCTs evaluated the effect of a mobile phone-based asthma self-management intervention on asthma control by comparing it to traditional, paper-based asthma self-management. One study showed that the use of a smartphone app for the delivery of an asthma self-management programme had no statistically significant effect on asthma symptom scores, asthma-related quality of life, unscheduled visits to the emergency department or frequency of hospital admissions. The other included study found that the use of a smartphone app resulted in higher asthma-related quality of life scores at six-month follow-up. However, overall, the results were inconclusive.

7. Conclusions and recommendations

Given the limitations of the evidence base discussed above, it has been challenging to identify reliable, generalisable conclusions. However, in the spirit of pragmatism that has characterised this review, and in the interests of giving providers and commissioners a steer on where to focus their planning discussions, we conclude the following:

7.1 WHICH TECHNOLOGIES SHOULD VANGUARDS AND COMMISSIONERS INVEST IN?

SMS text messaging

- There is consistent evidence that text message interventions have beneficial effects on HbA1C and glycaemic control in diabetes care, and that patients are accepting of the technology.
- There is consistent evidence that text messages are effective in supporting short-term smoking cessation.
- The evidence is clear that text messaging is an effective mechanism for the delivery of substance misuse interventions, notable for its ability to reach a larger number of people that would be possible in a face-to-face setting.
- Weekly text messages can enhance adherence to antiretroviral medicine for the treatment of HIV/AIDS, and increase HIV viral load suppression
- Evidence shows that text messages can improve medication adherence for the treatment of skin conditions such as acne.

Telemonitoring

- Telemonitoring is recommended for the care of patients with diabetes. Self-monitoring of blood glucose is recommended pre- and post-meal to show patients the effect of diet on glucose levels. Patients should be educated in the use of technology to measure (e.g., glucometer) and to share (e.g., online database) data.
- Telemonitoring is recommended for the monitoring of Heart Disease patients. Patients should record and share blood pressure with a cardiac nurse and/or overlooked by a physician. The healthcare professional should have very active involvement with the patient.
- Telemonitoring is recommended for the treatment of COPD patients only as a means to reduce the use of health services (e.g. Telemonitoring leads to a reduction in hospitalisation rates). There is insufficient evidence that telemonitoring has health benefits for COPD patients. None of the evidence observed showed that telemonitoring caused harm to COPD patients.

- Telemonitoring is recommended to improve blood pressure control in patients living with Hypertension.

Video consultation

- There is a significant critical mass of evidence for video calls to be effective in treating mental illness – to provide consultation, short term support and counselling.
- Chronic illness: Remote video technology found “no differences in the quality indicators of medication compliance, knowledge of disease, or self-care ability; patient satisfaction; or service use”, indicating that video calling is an acceptable substitute for face-to-face care in this instance.
- The publication date range of the articles reviewed is an important consideration as quality of video calls will have improved significantly in recent years and associated costs will have fallen.

Web-based interventions

- Further research is needed involving control groups to enable the more precise identification of impact, and providing information on the ‘what’ and ‘how’ aspects of delivery.
- Although beneficial as a standalone intervention, to maximise effectiveness, web-based interventions should be delivered in conjunction with other measures—including face-to-face contact with healthcare professionals. This may help to promote adherence, and mitigate the phenomenon observed in a number of reviews in which there is a diminution of intervention impact over time.

Digital health apps

- The most positive evidence of effectiveness to date is in the areas of Type 2 Diabetes, Multiple Sclerosis, Cardiovascular Disease, and Obesity.
- Other, non-peer reviewed, sources of evidence indicate positive effect in the areas of nutrition, wellness, mental health, and perioperative care.
- Somewhat unhelpfully, evidence on digital health apps’ effectiveness is often aggregated with that for other mobile phone-based interventions, e.g., telemedicine and SMS text messaging.

8. Limitations of this research; opportunities for further work in this area

As we have already mentioned, many of the systematic reviews that we have considered in the course of this piece of work call for further research to address the manifold methodological issues present in existing studies, or to keep abreast of the rapid pace of innovation in and implementation of TECS.

There are many innovations that we have not been able to cover in this review on account of the fact that they are so new – or, where they have been deployed, it is too early in the process of adoption for their impacts and outcomes to show – to appear in the published evidence. This is a situation that will, of course, change over time, as these modalities are demonstrated to deliver benefit (or not).

For instance, where messaging applications are concerned, it could be considered a limitation of this research that we have not covered the use of applications such as WhatsApp, Facebook Messenger, and direct/private messenger functions on social media platforms such as Snapchat and Twitter— simply because these did not surface in any of the reviews. The rise in popularity and ubiquity among certain demographic segments, potential extended reach, and their potential utility in supporting patient care means that, in future, these services may contribute to the effectiveness of messaging as a health intervention. That will be for future reviews of this kind to determine.

Another area of interest that we have not been able to cover adequately on account of the limited available evidence is the provision of TECS solutions across *multiple* health and care settings. This seems to present an opportunity for significant efficiency savings and improvements to patient and service user experience, but we have yet to find any published evidence that suggests that this degree of integration is taking place.

9. Additional resources

There is a large and growing body of material designed to provide practical guidance to providers and commissioners interested in establishing and developing TECS provision. Some of these have come to our attention relatively recently and therefore we have been unable to give them full consideration in the course of this review.

In the interests of signposting colleagues to sources of information that could prove helpful to them in local discussions about TECS, we include these resources here:

CECOPS *International Code of Practice for Planning, Commissioning and Providing Technology Enabled Care Services*, April 2017 [<http://www.cecops.org.uk/code-of-practice-scheme/scope-of-technology-enabled-care-services-code/>]. Please note: this publication is not free, and can be purchased on the CECOPS website.

Greenhalgh, T., et al., 'What is quality in assisted living technology? The ARCHIE framework for effective telehealth and telecare services', *BMC Medicine*, 2015.

NHS Commissioning Assembly, *TECS Resources for commissioners*, January 2015.
[<https://www.england.nhs.uk/ourwork/qual-clin-lead/tecs/>]

Telecare Learning and Improvement Network (Telecare LIN) [<http://www.telecarelin.org.uk/>]. The Telecare LIN's Monthly newsletters, a rich resource detailing wide-ranging current developments in TECS, can be found here: <http://www.telecarelin.org.uk/news/>

10. Appendices

10.1 EVIDENCE REVIEW BIBLIOGRAPHY

N.B. Of the 411 reviews extracted in our first-pass search, 246 were reviewed.

- Abdel-Aleem, H., El-Gibaly, O.M., EL-Gazzar, A.F.-S., Al-Attar, G.S., 2016. Mobile clinics for women's and children's health, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- AbuDagga, A., Resnick, H., Alwan, M., 2010. Impact of blood pressure telemonitoring on hypertension outcomes: a literature review (Provisional abstract). *Telemedicine and e-Health* 16, 830–838.
- Aguilar-Martinez, A., Sole-Sedeno, J., Mancebo-Moreno, G., Medina, F., Carreras-Collado, R., Saigi-Rubio, F., 2014. Use of mobile phones as a tool for weight loss: a systematic review (Provisional abstract). *Journal of Telemedicine and Telecare* 339–349.
- Alexander, S., Boulvain, M., Ceysens, G., Haelterman, E., Zhang, W.-H., 2010. Repeat digital cervical assessment in pregnancy for identifying women at risk of preterm labour, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Ali, M., Shah, S., Tandon, N., 2011. Review of electronic decision-support tools for diabetes care: a viable option for low- and middle-income countries? (Provisional abstract). *Journal of Diabetes Science and Technology* 5, 553–570.
- Atherton, H., Sawmynaden, P., Sheikh, A., Majeed, A., Car, J., 2012. Email for clinical communication between patients/caregivers and healthcare professionals, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Athikarisamy, S., Patole, S., Lam, G., Dunstan, C., Rao, S., 2014. Screening for retinopathy of prematurity (ROP) using wide-angle digital retinal photography by non-ophthalmologists: a systematic review (Provisional abstract). *British Journal of Ophthalmology* epub.
- Aubin, M., Giguère, A., Martin, M., Verreault, R., Fitch, M.I., Kazanjian, A., Carmichael, P.-H., 2012. Interventions to improve continuity of care in the follow-up of patients with cancer, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Bacigalupo, R., Cudd, P., Littlewood, C., Bissell, P., Hawley, M., Buckley Woods, H., 2013. Interventions employing mobile technology for overweight and obesity: an early systematic review of randomized controlled trials (Structured abstract). *Obesity Reviews* 14, 279–291.
- Bahr, S., Solverson, S., Schlidt, A., Hack, D., Smith, J., Ryan, P., 2014. Integrated literature review of postdischarge telephone calls (Provisional abstract). *Western Journal of Nursing Research* 36, 84–104.
- Balas, E.A., Jaffrey, F., Kuperman, G.J., Boren, S.A., Brown, G.D., Pinciroli, F., Mitchell, J.A., 1997. Electronic communication with patients: evaluation of distance medicine technology (Structured abstract). *JAMA* 278, 152–159.
- Balas, E.A., Krishna, S., Kretschmer, R.A., Cheek, T.R., Lobach, D.F., Boren, S.A., 2004. Computerized knowledge management in diabetes care (Structured abstract). *Medical Care* 42, 610–621.

- Ballini, L., Negro, A., Maltoni, S., Vignatelli, L., Flodgren, G., Simera, I., Holmes, J., Grilli, R., 2015. Interventions to reduce waiting times for elective procedures, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Barker, F., Mackenzie, E., Elliott, L., Jones, S., de Lusignan, S., 2016. Interventions to improve hearing aid use in adult auditory rehabilitation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Barley, E.A., Borschmann, R.D., Walters, P., Tylee, A., 2016. Interventions to encourage uptake of cancer screening for people with severe mental illness, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Barlow, J., Singh, D., Bayer, S., Curry, R., 2007. A systematic review of the benefits of home telecare for frail elderly people and those with long-term conditions (Structured abstract). *Journal of Telemedicine and Telecare* 13, 172–179.
- Baron, J., McBain, H., Newman, S., 2012. The impact of mobile monitoring technologies on glycosylated hemoglobin in diabetes: a systematic review (Provisional abstract). *Journal of Diabetes Science and Technology* 6, 1185–1196.
- Bartels, E.M., Juhl, C.B., Christensen, R., Hagen, K.B., Danneskiold-Samsøe, B., Dagfinrud, H., Lund, H., 2016. Aquatic exercise for the treatment of knee and hip osteoarthritis, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Barth, J., Jacob, T., Daha, I., Critchley, J.A., 2015. Psychosocial interventions for smoking cessation in patients with coronary heart disease, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Baxi, R., Sharma, M., Roseby, R., Polnay, A., Priest, N., Waters, E., Spencer, N., Webster, P., 2014. Family and carer smoking control programmes for reducing children’s exposure to environmental tobacco smoke, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Beatty, L., Lambert, S., 2013. A systematic review of internet-based self-help therapeutic interventions to improve distress and disease-control among adults with chronic health conditions (Structured abstract). *Clinical Psychology Review* 33, 609–622.
- Bennett, G., Steinberg, D., Stoute, C., Lanpher, M., Lane, I., Askew, S., Foley, P., Baskin, M., 2014. Electronic health (eHealth) interventions for weight management among racial/ethnic minority adults: a systematic review (Provisional abstract). *Obesity Reviews* 146–158.
- Bennett, S., Pigott, A., Beller, E.M., Haines, T., Meredith, P., Delaney, C., 2016. Educational interventions for the management of cancer-related fatigue in adults, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Biem, H.J., Turnell, R.W., D’Arcy, C., 2003. Computer telephony: automated calls for medical care (Structured abstract). *Clinical and Investigative Medicine* 26, 259–268.
- Birns, J., Roots, A., Bhalla, A., 2013. Role of telemedicine in the management of acute ischemic stroke (Provisional abstract). *Clinical Practice* 10, 189–200.
- Bittner, A.K., Wykstra, S.L., Yoshinaga, P.D., Li, T., 2015. Telerehabilitation for people with low vision, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Blaya, J., Fraser, H., Holt, B., 2010. E-health technologies show promise in developing countries (Provisional abstract). *Health Affairs* 29, 244–251.

- Bloomfield, G., Vedanthan, R., Vasudevan, L., Kithei, A., Were, M., Velazquez, E., 2014. Mobile health for non-communicable diseases in sub-Saharan Africa: a systematic review of the literature and strategic framework for research (Provisional abstract). *Globalization and Health* 49.
- Boisvert, M., Lang, R., Andrianopoulos, M., Boscardin, M., 2010. Telepractice in the assessment and treatment of individuals with autism spectrum disorders: a systematic review (Provisional abstract). *Developmental Neurorehabilitation* 13, 423–432.
- Bolton, C., Waters, C., Peirce, S., Elwyn, G., 2011. Insufficient evidence of benefit: a systematic review of home telemonitoring for COPD (Structured abstract). *Journal of Evaluation in Clinical Practice* 17, 1216–1222.
- Booth, V., Masud, T., Connell, L., Bath-Hextall, F., 2014. The effectiveness of virtual reality interventions in improving balance in adults with impaired balance compared with standard or no treatment: a systematic review and meta-analysis (Provisional abstract). *Clinical Rehabilitation* 28, 419–431.
- Borschmann, R., Henderson, C., Hogg, J., Phillips, R., Moran, P., 2012. Crisis interventions for people with borderline personality disorder, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Bowles, K.H., Baugh, A.C., 2007. Applying research evidence to optimize telehomecare (Structured abstract). *Journal of Cardiovascular Nursing* 22, 5–15.
- Boyle, R., Solberg, L., Fiore, M., 2014. Use of electronic health records to support smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Bradt, J., Dileo, C., Magill, L., Teague, A., 2016. Music interventions for improving psychological and physical outcomes in cancer patients, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Bradt, J., Shim, M., Goodill, S.W., 2015. Dance/movement therapy for improving psychological and physical outcomes in cancer patients, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Brannon, E., Cushing, C., 2014. Is there an app for that? Translational science of pediatric behavior change for physical activity and dietary interventions: a systematic review (Provisional abstract). *Journal of Pediatric Psychology* epub.
- Brewster, L., Mountain, G., Wessels, B., Kelly, C., Hawley, M., 2013. Factors affecting front line staff acceptance of telehealth technologies: a mixed-method systematic review (Structured abstract). *Journal of Advanced Nursing* 70, 21–33.
- Brown, J., 2013. A review of the evidence on technology-based interventions for the treatment of tobacco dependence in college health (Provisional abstract). *Worldviews on Evidence-Based Nursing* 10, 150–162.
- Brown, N., 2000. Exploration of diagnostic techniques for malignant melanoma: an integrative review (Structured abstract). *Clinical Excellence for Nurse Practitioners* 4, 263–271.
- Brueton, V.C., Tierney, J., Stenning, S., Harding, S., Meredith, S., Nazareth, I., Rait, G., 2013. Strategies to improve retention in randomised trials, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Buchholz, S.W., Wilbur, J., Ingram, D., Fogg, L., 2013. Physical Activity Text Messaging Interventions in Adults: A Systematic Review. *Worldviews on Evidence-Based Nursing* 10, 163–173. doi:10.1111/wvn.12002

- Bunn, F., Byrne, G., Kendall, S., 2005. The effects of telephone consultation and triage on healthcare use and patient satisfaction: a systematic review (Structured abstract). *British Journal of General Practice* 55, 956–961.
- Bunn, F., Byrne, G., Kendall, S., 2004. Telephone consultation and triage: effects on health care use and patient satisfaction, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Cahill, K., Lancaster, T., Green, N., 2010. Stage-based interventions for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Campbell Burton, C.A., Holmes, J., Murray, J., Gillespie, D., Lightbody, C.E., Watkins, C.L., Knapp, P., 2011. Interventions for treating anxiety after stroke, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Campbell, F., Biggs, K., Aldiss, S.K., O'Neill, P.M., Clowes, M., McDonagh, J., While, A., Gibson, F., 2016. Transition of care for adolescents from paediatric services to adult health services, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Campbell, L.A., Kisely, S.R., 2009. Advance treatment directives for people with severe mental illness, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Campbell, N.D., Ritchie, L.D., Cassidy, J., Little, J., 1999. Systematic review of cancer treatment programmes in remote and rural areas (Structured abstract). *British Journal of Cancer* 80, 1275–1280.
- Capurro, D., Ganzinger, M., Perez-Lu, J., Knaup, P., 2014. Effectiveness of ehealth interventions and information needs in palliative care: a systematic literature review (Provisional abstract). *Journal of Medical Internet Research* 16, e72.
- Car, J., Lang, B., Colledge, A., Ung, C., Majeed, A., 2011. Interventions for enhancing consumers' online health literacy, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Carson, K.V., Brinn, M.P., Peters, M., Veale, A., Esterman, A.J., Smith, B.J., 2012. Interventions for smoking cessation in Indigenous populations, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Cassimatis, M., Kavanagh, David, J., 2012. Effects of type 2 diabetes behavioural telehealth interventions on glycaemic control and adherence: a systematic review (Provisional abstract). *Journal of Telemedicine and Telecare* 18, 447–450.
- Chang, T., Chopra, V., Zhang, C., Woolford, S., 2013. The role of social media in online weight management: systematic review (Provisional abstract). *Journal of Medical Internet Research* e262.
- Chapman, E., Reveiz, L., Illanes, E., Bonfill Cosp, X., 2014. Antibiotic regimens for management of intra-amniotic infection, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Chaudhry, S.I., Phillips, C.O., Stewart, S.S., Riegel, B., Mattera, J.A., Jerant, A.F., Krumholz, H.M., 2007. Telemonitoring for patients with chronic heart failure: a systematic review (Provisional abstract). *Journal of Cardiac Failure* 13, 56–62.
- Chen, S., Wu, T., Kong, X., Yuan, H., 2011. Chinese medicinal herbs for measles, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Chen, X., Deng, L., Jiang, X., Wu, T., 2016. Chinese herbal medicine for oesophageal cancer, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Chen, Y., Li, K., Pu, H., Wu, T., 2011. Corticosteroids for pneumonia, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Chen, Y., Madan, J., Welton, N., Yahaya, I., Aveyard, P., Bauld, L., Wang, D., Fry-Smith, A., Munafo, M., 2012. Effectiveness and cost-effectiveness of computer and other electronic aids for smoking cessation: a systematic review and network meta-analysis (Structured abstract). *Health Technology Assessment* 16, 1–205.
- Cheng, S., Dizon, J., 2012. Computerised cognitive behavioural therapy for insomnia: a systematic review and meta-analysis (Structured abstract). *Psychotherapy and Psychosomatics* 81, 206–216.
- Ciciriello, S., Johnston, R.V., Osborne, R.H., Wicks, I., deKroo, T., Clerehan, R., O’Neill, C., Buchbinder, R., 2013. Multimedia educational interventions for consumers about prescribed and over-the-counter medications, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Ciere, Y., Cartwright, M., Newman, Stanton, P., 2012. A systematic review of the mediating role of knowledge, self-efficacy and self-care behaviour in telehealth patients with heart failure (Provisional abstract). *Journal of Telemedicine and Telecare* 18, 384–391.
- Civljak, M., Stead, L.F., Hartmann-Boyce, J., Sheikh, A., Car, J., 2013. Internet-based interventions for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Clark, R.A., Inglis, S.C., McAlister, F.A., Cleland, J.G., Stewart, S., 2007. Telemonitoring or structured telephone support programmes for patients with chronic heart failure: systematic review and meta-analysis (Structured abstract). *BMJ* 334, 942.
- Cohen, J.E., Wakefield, C.E., Cohn, R.J., 2016. Nutritional interventions for survivors of childhood cancer, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Cole-Lewis, H., Kershaw, T., 2010. Text messaging as a tool for behavior change in disease prevention and management (Structured abstract). *Epidemiologic Reviews* 32, 56–69.
- Coulter, A., Entwistle, V.A., Eccles, A., Ryan, S., Shepperd, S., Perera, R., 2015. Personalised care planning for adults with chronic or long-term health conditions, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Cox, K., Wilson, E., 2003. Follow-up for people with cancer: nurse-led services and telephone interventions (Provisional abstract). *Journal of Advanced Nursing* 43, 51–61.
- Cox, N., Alison, J., Rasekaba, T., Holland, A., 2012. Telehealth in cystic fibrosis: a systematic review (Structured abstract). *Journal of Telemedicine and Telecare* 18, 72–78.
- Cox, N.S., Alison, J.A., Holland, A.E., 2013. Interventions for promoting physical activity in people with cystic fibrosis, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Crawford, F., Welch, K., Andras, A., Chappell, F.M., 2016. Ankle brachial index for the diagnosis of lower limb peripheral arterial disease, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Crocker, JB, Crocker, JT, Greenwald, J., 2012. Telephone follow-up as a primary care intervention for postdischarge outcomes improvement: a systematic review (Structured abstract). *American Journal of Medicine* 125, 915–921.
- Cruz, J., Brooks, D., Marques, A., 2014a. Home telemonitoring effectiveness in COPD: a systematic review (Provisional abstract). *International Journal of Clinical Practice* epub.
- Cruz, J., Brooks, D., Marques, A., 2014b. Home telemonitoring in COPD: a systematic review of methodologies and patients’ adherence (Provisional abstract). *International Journal of Medical Informatics* 249–263.

- Cushing, C., Steele, R., 2010. A meta-analytic review of eHealth interventions for pediatric health promoting and maintaining behaviors (Structured abstract). *Journal of Pediatric Psychology* 35, 937–949.
- Cutrona, S., Choudhry, N., Fischer, M., Servi, A., Liberman, J., Brennan, T., Shrank, W., 2010. Modes of delivery for interventions to improve cardiovascular medication adherence (Structured abstract). *American Journal of Managed Care* 16, 929–942.
- Dahabreh, I., Chung, M., Balk, E., Yu, W., Mathew, P., Lau, J., Ip, S., 2012. Active surveillance in men with localized prostate cancer: a systematic review (Structured abstract). *Annals of Internal Medicine* 156, 582–590.
- Daker-White, G., Rogers, A., 2013. What is the potential for social networks and support to enhance future telehealth interventions for people with a diagnosis of schizophrenia? A critical interpretive synthesis (Provisional abstract). *BMC Psychiatry* 13, 279.
- Dale, J., Caramlau, I.O., Lindenmeyer, A., Williams, S.M., 2008. Peer support telephone calls for improving health, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Dalton, J., 2008. Web-based care for adults with type 2 diabetes (Structured abstract). *Canadian Journal of Dietetic Practice and Research* 69, 185–191.
- Daniel, S., Wu, L., Kumar, S., 2013. Teledentistry: a systematic review of clinical outcomes, utilization and costs (Provisional abstract). *Journal of Dental Hygiene* 87, 345–352.
- Danielsson, A., Eriksson, A., Allebeck, P., 2014. Technology-based support via telephone or web: a systematic review of the effects on smoking, alcohol use and gambling (Provisional abstract). *Addictive Behaviors* 1846–1868.
- Davey, S., Davey, A., Singh, J., 2014. Mobile-health approach: a critical look on its capacity to augment health system of developing countries (Provisional abstract). *Indian Journal of Community Medicine* 178–182.
- Davies, A., Rixon, L., Newman, S., 2013. Systematic review of the effects of telecare provided for a person with social care needs on outcomes for their informal carers (Provisional abstract). *Health and Social Care in the Community* 21, 582–597.
- de Jongh, T., Gurol-Urganci, I., Vodopivec-Jamsek, V., Car, J., Atun, R., 2012. Mobile phone messaging for facilitating self-management of long-term illnesses, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- de Joode, E., van Heugten, C., Verhey, F., van Boxtel, M., 2010. Efficacy and usability of assistive technology for patients with cognitive deficits: a systematic review (Provisional abstract). *Clinical Rehabilitation* 24, 701–714.
- de Lusignan, S., Mold, F., Sheikh, A., Majeed, A., Wyatt, J., Quinn, T., Cavill, M., Gronlund, T., Franco, C., Chauhan, U., Blakey, H., Kataria, N., Barker, F., Ellis, B., Koczan, P., Arvanitis, T., McCarthy, M., Jones, S., Rafi, I., 2014. Patients' online access to their electronic health records and linked online services: a systematic interpretative review (Provisional abstract). *BMJ Open* e006021.
- de Waure, C., Cadeddu, C., Gualano, M., Ricciardi, W., 2012. Telemedicine for the reduction of myocardial infarction mortality: a systematic review and a meta-analysis of published studies (Structured abstract). *Telemedicine and e-Health* 18, 323–328.
- DelliFraine, J.L., Dansky, K.H., 2008. Home-based telehealth: a review and meta-analysis (Structured abstract). *Journal of Telemedicine and Telecare* 14, 62–66.

- Denhaerynck, K., Lesaffre, E., Baele, J., Cortebeeck, K., Van Overstraete, E., Buntinx, F., 2003. Mammography screening attendance: meta-analysis of the effect of direct-contact invitation (Provisional abstract). *American Journal of Preventive Medicine* 25, 195–203.
- Dennis, C., Kingston, D., 2008. A systematic review of telephone support for women during pregnancy and the early postpartum period (Structured abstract). *Journal of Obstetric, Gynecologic and Neonatal Nursing* 37, 301–314.
- Dennis, C.-L., Dowswell, T., 2013. Psychosocial and psychological interventions for preventing postpartum depression, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- DeSmet, A., Van Ryckeghem, D., Compernelle, S., Baranowski, T., Thompson, D., Crombez, G., Poels, K., Van Lippevelde, W., Bastiaensens, S., Van Cleemput, K., Vandebosch, H., De Bourdeaudhuij, I., 2014. A meta-analysis of serious digital games for healthy lifestyle promotion (Provisional abstract). *Preventive Medicine* 95–107.
- Desroches, S., Lapointe, A., Ratté, S., Gravel, K., Légaré, F., Turcotte, S., 2013. Interventions to enhance adherence to dietary advice for preventing and managing chronic diseases in adults, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Divall, P., Camosso-Stefinovic, J., Baker, R., 2013. The use of personal digital assistants in clinical decision making by health care professionals: a systematic review (Structured abstract). *Health Informatics Journal* 19, 16–28.
- Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M., Christensen, H., 2013. Smartphones for smarter delivery of mental health programs: a systematic review (Provisional abstract). *Journal of Medical Internet Research* 15, e247.
- Dorstyn, D., Mathias, J., Denson, L., 2013. Applications of telecounseling in spinal cord injury rehabilitation: a systematic review with effect sizes (Provisional abstract). *Clinical Rehabilitation* 27, 1072–1083.
- Dorstyn, D., Mathias, J., Denson, L., 2011. Psychosocial outcomes of telephone-based counseling for adults with an acquired physical disability: a meta-analysis (Structured abstract). *Rehabilitation Psychology* 56, 1–14.
- Dorstyn, D.S., Saniotis, A., Sobhanian, F., 2013. A systematic review of telecounseling and its effectiveness in managing depression amongst minority ethnic communities (Provisional abstract). *Journal of Telemedicine and Telecare* 19, 338–346.
- dos Santos, M., Moura, S., Gomes, L., Lima, A., Moreira, R., Silva, C., Guimaraes, E., 2014. Telehealth application on the rehabilitation of children and adolescents (Provisional abstract). *Revista Paulista de Pediatria* 32, 136–143.
- Dowling, M., Rickwood, D., 2013. Online counseling and therapy for mental health problems: a systematic review of individual synchronous interventions using chat (Structured abstract). *Journal of Technology in Human Services* 31, 1–21.
- Duffy, J.R., Hoskins, L.M., Chen, M., 2004. Nonpharmacological strategies for improving heart failure outcomes in the community: a systematic review (Structured abstract). *Journal of Nursing Care Quality* 19, 349–360.
- Durrani, H., Khoja, S., 2009. A systematic review of the use of telehealth in Asian countries (Structured abstract). *Journal of Telemedicine and Telecare* 15, 175–181.
- Eakin, E.G., Lawler, S.P., Vandelanotte, C., Owen, N., 2007. Telephone interventions for physical activity and dietary behavior change: a systematic review (Structured abstract). *American Journal of Preventive Medicine* 32, 419–434.

- Ebbert, J.O., Elrashidi, M.Y., Stead, L.F., 2015. Interventions for smokeless tobacco use cessation, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Eccleston, C., Palermo, T.M., Williams, A.C. de C., Lewandowski Holley, A., Morley, S., Fisher, E., Law, E., 2014. Psychological therapies for the management of chronic and recurrent pain in children and adolescents, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Ehrenreich, B., Righter, B., Rocke, D., Dixon, L., Himelhoch, S., 2011. Are mobile phones and handheld computers being used to enhance delivery of psychiatric treatment? A systematic review (Structured abstract). *Journal of Nervous and Mental Disease* 199, 886–891.
- Eland-de Kok, P., van Os-Medendorp, H., Vergouwe-Meijer, A., Bruijnzeel-Koomen, C., Ros, W., 2011. A systematic review of the effects of e-health on chronically ill patients (Structured abstract). *Journal of Clinical Nursing* 20, 2997–3010.
- El-Gayar, O., Timsina, P., Nawar, N., Eid, W., 2013. A systematic review of IT for diabetes self-management: are we there yet? (Structured abstract). *International Journal of Medical Informatics* 82, 637–652.
- Eysenbach, G., Powell, J., Englesakis, M., Rizo, C., Stern, A., 2004. Health related virtual communities and electronic support groups: systematic review of the effects of online peer to peer interactions (Structured abstract). *BMJ* 328, 1166–1170.
- Fanning, J., Mullen, S., McAuley, E., 2012. Increasing physical activity with mobile devices: a meta-analysis (Provisional abstract). *Journal of Medical Internet Research* 14, e161.
- Farmer, A., Gibson, O.J., Tarassenko, L., Neil, A., 2005. A systematic review of telemedicine interventions to support blood glucose self-monitoring in diabetes (Provisional abstract). *Diabetic Medicine* 22, 1372–1378.
- Feltner, C., Jones, C., Cene, C., Zheng, Z., Sueta, C., Coker-Schwimmer, E., Arvanitis, M., Lohr, K., Middleton, J., Jonas, D., 2014. Transitional care interventions to prevent readmissions for persons with heart failure: a systematic review and meta-analysis (Provisional abstract). *Annals of Internal Medicine* 774–784.
- Ferrandiz Pulido, L., Moreno Ramirez, D., Nieto, A., Villegas Portero, R., 2006. Teledermatology: systematic review and economic assessment (Provisional abstract). *Agencia de Evaluacion de Tecnologias Sanitarias de Andalucia (AETSA)* 143.
- Ferreira da Mata, L., da Silva, A., da Graca Pereira, M., Campos de Carvalho, E., 2014. Telephone follow-up of patients after radical prostatectomy: a systematic review (Provisional abstract). *Revista Latino-Americana de Enfermagem* 337–345.
- Feyi-Waboso, A., Ejere, H.O., 2012. Needling for encapsulated trabeculectomy filtering blebs, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Fiander, M., McGowan, J., Grad, R., Pluye, P., Hannes, K., Labrecque, M., Roberts, N.W., Salzwedel, D.M., Welch, V., Tugwell, P., 2015. Interventions to increase the use of electronic health information by healthcare practitioners to improve clinical practice and patient outcomes, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Finitsis, D., Pellowski, J., Johnson, B., 2014. Text message intervention designs to promote adherence to antiretroviral therapy (ART): a meta-analysis of randomized controlled trials (Provisional abstract). *PLOS ONE* 9, e88166.
- Fisher, E., Law, E., Palermo, T.M., Eccleston, C., 2015. Psychological therapies (remotely delivered) for the management of chronic and recurrent pain in children and adolescents, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.

- Fjeldsoe, B.S., Marshall, A.L., Miller, Y.D., 2009. Behavior change interventions delivered by mobile telephone short-message service (Structured abstract). *American Journal of Preventive Medicine* 36, 165–173.
- Fleming, P.S., Strydom, H., Katsaros, C., MacDonald, L., Curatolo, M., Fudalej, P., Pandis, N., 2016. Non-pharmacological interventions for alleviating pain during orthodontic treatment, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Flodgren, G., Rachas, A., Farmer, A.J., Inzitari, M., Shepperd, S., 2015. Interactive telemedicine: effects on professional practice and health care outcomes, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Foster, C., Richards, J., Thorogood, M., Hillsdon, M., 2013. Remote and web 2.0 interventions for promoting physical activity, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., Patel, V., Haines, A., 2013a. The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review (Structured abstract). *PLOS Medicine* 10, e1001362.
- Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., Patel, V., Haines, A., 2013b. The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis (Structured abstract). *PLOS Medicine* 10.
- Furmaniak, A.C., Menig, M., Markes, M.H., 2016. Exercise for women receiving adjuvant therapy for breast cancer, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Furuya, R., Mata, L., Veras, V., Appoloni, A., Dantas, R., Silveira, R., Rossi, L., 2013. Telephone follow-up for patients after myocardial revascularization: a systematic review (Provisional abstract). *American Journal of Nursing* 113, 28–39.
- Gagnon, M.-P., Légaré, F., Labrecque, M., Frémont, P., Pluye, P., Gagnon, J., Car, J., Pagliari, C., Desmartis, M., Turcot, L., Gravel, K., 2009. Interventions for promoting information and communication technologies adoption in healthcare professionals, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Galway, K., Black, A., Cantwell, M., Cardwell, C.R., Mills, M., Donnelly, M., 2012. Psychosocial interventions to improve quality of life and emotional wellbeing for recently diagnosed cancer patients, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Garcia-Lizana, F., Munoz-Mayorga, I., 2010. Telemedicine for depression: a systematic review (Structured abstract). *Perspectives in Psychiatric Care* 46, 119–126.
- Garcia-Lizana, F., Sarria-Santamera, A., 2007. New technologies for chronic disease management and control: a systematic review (Provisional abstract). *Journal of Telemedicine and Telecare* 13, 62–68.
- Gentry, S., van-Velthoven, M.H., Tudor Car, L., Car, J., 2013. Telephone delivered interventions for reducing morbidity and mortality in people with HIV infection, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Geraedts, H., Zijlstra, A., Bulstra, S., Stevens, M., Zijlstra, W., 2013. Effects of remote feedback in home-based physical activity interventions for older adults: a systematic review (Structured abstract). *Patient Education and Counseling* 91, 14–24.
- Ghorai, K., Akter, S., Khatun, F., Ray, P., 2014. mHealth for smoking cessation programs: a systematic review (Provisional abstract). *Journal of Personalized Medicine* 412–423.

- Giamouzis, G., Mastrogiannis, D., Koutrakis, K., Karayannis, G., Parisis, C., Rountas, C., Adreanides, E., Dafoulas, G., Stafylas, P., Skoularigis, J., Giacomelli, S., Olivari, Z., Triposkiadis, F., 2012. Telemonitoring in chronic heart failure: a systematic review (Structured abstract). *Cardiology Research and Practice* 1, 410820.
- Glueckauf, R., Lustria, M., 2009. E-health self-care interventions for persons with chronic illnesses: review and future directions (Structured abstract). Springer Publishing Company 151–242.
- Goode, A., Reeves, M., Eakin, E., 2012. Telephone-delivered interventions for physical activity and dietary behavior change: an updated systematic review (Provisional abstract). *American Journal of Preventive Medicine* 42, 81–88.
- Gorst, S., Armitage, C., Brownsell, S., Hawley, M., 2014. Home telehealth uptake and continued use among heart failure and chronic obstructive pulmonary disease patients: a systematic review (Provisional abstract). *Annals of Behavioral Medicine* 323–336.
- Graziano, J., Gross, C., 2009. The effects of isolated telephone interventions on glycemic control in type 2 diabetes: a literature review (Structured abstract). *Advances in Nursing Science* 32, E28–E41.
- Greenwood, D., Young, H., Quinn, C., 2014. Telehealth remote monitoring systematic review: structured self-monitoring of blood glucose and impact on A1C (Provisional abstract). *Journal of Diabetes Science and Technology* 378–389.
- Griffiths, K., Farrer, L., Christensen, H., 2010. The efficacy of internet interventions for depression and anxiety disorders: a review of randomised controlled trials (Structured abstract). *Medical Journal of Australia* 192, S4–S11.
- Griffiths, K.M., Christensen, H., 2006. Review of randomised controlled trials of Internet interventions for mental disorders and related conditions (Provisional abstract). *Clinical Psychologist* 10, 16–29.
- Grimes, D.A., Lopez, L.M., Schulz, K.F., 1999. Antibiotic prophylaxis for intrauterine contraceptive device insertion, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Grustam, A., Severens, J., van Nijnatten, J., Koymans, R., Vrijhoef, H., 2014. Cost-effectiveness of telehealth interventions for chronic heart failure patients: a literature review (Provisional abstract). *International Journal of Technology Assessment in Health Care* 30, 59–68.
- Guise, V., Anderson, J., Wiig, S., 2014. Patient safety risks associated with telecare: a systematic review and narrative synthesis of the literature (Provisional abstract). *BMC Health Services Research* 588.
- Gupta, S., Carmichael, C., Simpson, C., Clarke, M.J., Allen, C., Gao, Y., Chan, E.Y.Y., Murray, V., 2012. Electric fans for reducing adverse health impacts in heatwaves, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Gurol-Urganci, I., de Jongh, T., Vodopivec-Jamsek, V., Atun, R., Car, J., 2013. Mobile phone messaging reminders for attendance at healthcare appointments, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Gurol-Urganci, I., de Jongh, T., Vodopivec-Jamsek, V., Car, J., Atun, R., 2012. Mobile phone messaging for communicating results of medical investigations, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Guse, K., Levine, D., Martins, S., Lira, A., Gaarde, J., Westmorland, W., Gilliam, M., 2012. Interventions using new digital media to improve adolescent sexual health: a systematic review (Structured abstract). *Journal of Adolescent Health*.

- Hailey, D., Ohinmaa, A., Roine, R., 2004. Evidence for the benefits of telecardiology applications: a systematic review (Provisional abstract). Title to be Checked 60.
- Hailey, D., Ohinmaa, A., Roine, R., 2003. Recent studies on assessment of telemedicine: systematic review of study quality and evidence of benefit (Provisional abstract). Title to be Checked 34.
- Hailey, D., Paquin, M.J., Maciejewski, O., Harris, L., Casebeer, A., Fick, G., Taschuk, P., Fields, A., 2007. The use and benefits of teleoncology (Structured abstract). Title to be Checked 162.
- Hailey, D., Roine, R., Ohinmaa, A., 2008. The effectiveness of telemental health applications: a review (Structured abstract). *Canadian Journal of Psychiatry* 53, 769–778.
- Hailey, D., Roine, R., Ohinmaa, A., 2001. Assessments of telemedicine applications: an update (Provisional abstract). Title to be Checked 45.
- Hailey, D., Roine, R., Ohinmaa, A., Dennett, L., 2011. Evidence of benefit from telerehabilitation in routine care: a systematic review (Provisional abstract). *Journal of Telemedicine and Telecare* 17, 281–287.
- Hall, C., Fottrell, E., Wilkinson, S., Byass, P., 2014. Assessing the impact of mHealth interventions in low- and middle-income countries – what has been shown to work? (Provisional abstract). *Global Health Action* 25606.
- Halpern, V., Lopez, L.M., Grimes, D.A., Stockton, L.L., Gallo, M.F., 2013. Strategies to improve adherence and acceptability of hormonal methods of contraception, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Handford, C., Tynan, A.-M., Rackal, J.M., Glazier, R., 2006. Setting and organization of care for persons living with HIV/AIDS, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Harding, S.E., Tingey, P.C., Pope, J., Fenlon, D., Furst, D., Shea, B., Silman, A., Thompson, A., Wells, G.A., 1998. Prazosin for Raynaud’s phenomenon in progressive systemic sclerosis, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Harrison, S., Stadler, M., Ismail, K., Amiel, S., Herrmann-Werner, A., 2014. Are patients with diabetes mellitus satisfied with technologies used to assist with diabetes management and coping? A structured review (Provisional abstract). *Diabetes Technology and Therapeutics* 771–783.
- Hartmann-Boyce, J., Lancaster, T., Stead, L.F., 2014. Print-based self-help interventions for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Hartmann-Boyce, J., McRobbie, H., Bullen, C., Begh, R., Stead, L.F., Hajek, P., 2016. Electronic cigarettes for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Hasselberg, M., Beer, N., Blom, L., Wallis, L., Laflamme, L., 2014. Image-based medical expert teleconsultation in acute care of injuries. A systematic review of effects on information accuracy, diagnostic validity, clinical outcome, and user satisfaction (Provisional abstract). *PLOS ONE* e98539.
- Haug, S., Sannemann, J., Meyer, C., John, U., 2012. Internet and mobile phone interventions to decrease alcohol consumption and to support smoking cessation in adolescents: a review. (Provisional abstract). *Gesundheitswesen* 74, 160–177.
- Hawton, K., Witt, K.G., Taylor Salisbury, T.L., Arensman, E., Gunnell, D., Hazell, P., Townsend, E., van Heeringen, K., 2016. Psychosocial interventions for self-harm in adults, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Head, K., Noar, S., Iannarino, N., Grant Harrington, N., 2013. Efficacy of text messaging-based interventions for health promotion: a meta-analysis (Provisional abstract). *Social Science and Medicine* 97, 41–48.
- Health Quality Ontario, 2013. Electronic tools for health information exchange: an evidence-based analysis (Provisional abstract). *Health Quality Ontario* 1.
- Herbert, L., Owen, V., Pascarella, L., Streisand, R., 2013. Text message interventions for children and adolescents with type 1 diabetes: a systematic review (Provisional abstract). *Diabetes Technology and Therapeutics* 15, 362–370.
- Hersch, W.R., Wallace, J.A., Patterson, P.K., Kraemer, D.F., Nichol, W.P., Greenlick, M.R., Krages, K.P., Helfand, M., 2001. Telemedicine for the Medicare population: pediatric, obstetric and clinician-indirect home interventions (Structured abstract). *Agency for Healthcare Research and Quality* 106.
- Hersh, W.R., Hickam, D.H., Severance, A.M., Dana, T.L., Krages, K.P., Helfand, M., 2006. Telemedicine for the Medicare population: update (Provisional abstract). Title to be Checked 41.
- Hersh, W.R., Hickman, D.H., Severance, S.M., Dana, T.L., Krages, K.P., Helfand, M., 2001. Telemedicine for the Medicare population (Structured abstract). *Agency for Healthcare Research and Quality* 196.
- Hewitt, N., Bucknall, T., Faraone, N.M., 2016. Lateral positioning for critically ill adult patients, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Hoey, L., Leropoli, S., White, V., Jefford, M., 2008. Systematic review of peer-support programs for people with cancer (Structured abstract). *Patient Education and Counseling* 70, 315–337.
- Hong, Y., Pena-Purcell, N., Ory, M., 2012. Outcomes of online support and resources for cancer survivors: a systematic literature review (Provisional abstract). *Patient Education and Counseling* 86, 288–296.
- Hoogendam, A., Buntinx, F., de Vet, H.C., 1999. The diagnostic value of digital rectal examination in primary care screening for prostate cancer: a meta-analysis (Structured abstract). *Family Practice* 16, 621–626.
- Horey, D., Kealy, M., Davey, M.-A., Small, R., Crowther, C.A., 2013. Interventions for supporting pregnant women’s decision-making about mode of birth after a caesarean, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Horvath, T., Azman, H., Kennedy, G.E., Rutherford, G.W., 2012. Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Hu, C., Kung, S., Rummans, T., Clark, M., Lapid, M., 2014. Reducing caregiver stress with internet-based interventions: a systematic review of open-label and randomized controlled trials (Provisional abstract). *Journal of the American Medical Informatics Association* epub.
- Huang, K., Liu, W., He, D., Huang, B., Xiao, D., Peng, Y., He, Y., Hu, H., Chen, M., Huang, D., 2014. Telehealth interventions versus center-based cardiac rehabilitation of coronary artery disease: a systematic review and meta-analysis (Provisional abstract). *European Journal of Preventive Cardiology* epub.
- Huang, V., Reich, K., Fedorak, R., 2014. Distance management of inflammatory bowel disease: systematic review and meta-analysis (Provisional abstract). *World Journal of Gastroenterology* 20, 829–842.

- Huang, Z., Tao, H., Meng, Q., Jiang, L., 2014. Management of endocrine disease: effects of telecare intervention for glycemic control in type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials (Provisional abstract). *European Journal of Endocrinology* epub.
- Husebo, A., Storm, M., 2014. Virtual visits in home health care for older adults (Provisional abstract). *Scientific World Journal* 689873.
- Hutchinson, A.B., Branson, B.M., Kim, A., Farnham, P.G., 2006. A meta-analysis of the effectiveness of alternative HIV counseling and testing methods to increase knowledge of HIV status (Structured abstract). *AIDS* 20, 1597–1604.
- Hutchison, A., Breckon, J., 2011. A review of telephone coaching services for people with long-term conditions (Provisional abstract). *Journal of Telemedicine and Telecare* 17, 451–8.
- Hutton, H., Wilson, L., Apelberg, B., Tang, E., Odelola, O., Bass, E., Chander, G., 2011. A systematic review of randomized controlled trials: web-based interventions for smoking cessation among adolescents, college students, and adults (Structured abstract). *Nicotine and Tobacco Research* 13, 227–238.
- Hyder, S.E., Gangure, D.P., Batchelder, S.T., 2005. Can telepsychiatry replace in-person psychiatric assessments: a review and meta-analysis of comparison studies (Provisional abstract). *CNS Spectrums* 10, 403–413.
- Ilic, D., Neuberger, M.M., Djulbegovic, M., Dahm, P., 2013. Screening for prostate cancer, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Inglis, S.C., Clark, R.A., Dierckx, R., Prieto-Merino, D., Cleland, J.G., 2015. Structured telephone support or non-invasive telemonitoring for patients with heart failure, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Jaana, M., Pare, G., 2007. Home telemonitoring of patients with diabetes: a systematic assessment of observed effects (Structured abstract). *Journal of Evaluation in Clinical Practice* 13, 242–253.
- Jaana, M., Pare, G., Sicotte, C., 2007. Hypertension home telemonitoring: current evidence and recommendations for future studies (Provisional abstract). *Disease Management and Health Outcomes* 15, 19–31.
- Jacobs, R., Lou, J., Ownby, R., Caballero, J., 2014. A systematic review of eHealth interventions to improve health literacy (Provisional abstract). *Health Informatics Journal* epub.
- Jacobson Vann, J.C., Szilagyi, P., 2005. Patient reminder and recall systems to improve immunization rates, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Jenkins, A., Christensen, H., Walker, J., Dear, K., 2009. The effectiveness of distance interventions for increasing physical activity: a review (Structured abstract). *American Journal of Health Promotion* 24, 102–117.
- Jennett, P.A., Affleck Hall, L., Hailey, D., Ohinmaa, A., Anderson, C., Thomas, R., Young, B., Lorenzetti, D., Scott, R.E., 2003. The socio-economic impact of telehealth: a systematic review (Provisional abstract). *Journal of Telemedicine and Telecare* 9, 311–320.
- Jennings, L., Gagliardi, L., 2013. Influence of mhealth interventions on gender relations in developing countries: a systematic literature review (Provisional abstract). *International Journal for Equity in Health* 12, 85.
- Jimbo, M., Nease, D.E., Ruffin, M.T., Rana, G.K., 2006. Information technology and cancer prevention (Structured abstract). *CA: a Cancer Journal for Clinicians* 56, 26–36.
- Jing, Z., Yang, X., Ismail, K.M., Chen, X.Y., Wu, T., 2009. Chinese herbal medicine for premenstrual syndrome, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Johansson, T., Wild, C., 2010. Telemedicine in acute stroke management: systematic review (Structured abstract). *International Journal of Technology Assessment in Health Care* 26, 149–155.
- Jones, J.F., Brennan, P.F., 2002. Telehealth interventions to improve clinical nursing of elders (Structured abstract). *Springer* 293–322.
- Jones, K., Eathington, P., Baldwin, K., Sipsma, H., 2014. The impact of health education transmitted via social media or text messaging on adolescent and young adult risky sexual behavior: a systematic review of the literature (Provisional abstract). *Sexually Transmitted Diseases* 413–419.
- Jongstra, S., Harrison, J.K., Quinn, T.J., Richard, E., 2016. Antihypertensive withdrawal for the prevention of cognitive decline, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Josephson, C.B., White, P.M., Krishan, A., Al-Shahi Salman, R., 2014. Computed tomography angiography or magnetic resonance angiography for detection of intracranial vascular malformations in patients with intracerebral haemorrhage, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Kairy, D., Lehoux, P., Vincent, C., Visintin, M., 2009. A systematic review of clinical outcomes, clinical process, healthcare utilization and costs associated with telerehabilitation (Structured abstract). *Disability and Rehabilitation* 31, 427–447.
- Kamei, T., Yamamoto, Y., Kajii, F., Nakayama, Y., Kawakami, C., 2013. Systematic review and meta-analysis of studies involving telehome monitoring-based telenursing for patients with chronic obstructive pulmonary disease (Provisional abstract). *Japan Journal of Nursing Science* 10, 180–192.
- Kannisto, K., Koivunen, M., Valimäki, M., 2014. Use of mobile phone text message reminders in health care services: a narrative literature review (Provisional abstract). *Journal of Medical Internet Research* e222.
- Kauppi, K., Välimäki, M., Hätönen, H.M., Kuosmanen, L.M., Warwick-Smith, K., Adams, C.E., 2014. Information and communication technology based prompting for treatment compliance for people with serious mental illness, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Kew, K.M., Cates, C.J., 2016a. Remote versus face-to-face check-ups for asthma, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Kew, K.M., Cates, C.J., 2016b. Home telemonitoring and remote feedback between clinic visits for asthma, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Khan, F., Amatya, B., Kesselring, J., Galea, M., 2015. Telerehabilitation for persons with multiple sclerosis, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Klersy, C., De Silvestri, A., Gabutti, G., Regoli, F., Auricchio, A., 2009. A meta-analysis of remote monitoring of heart failure patients (Structured abstract). *Journal of the American College of Cardiology* 54, 1683–1694.
- Kodama, S., Saito, K., Tanaka, S., Horikawa, C., Fujiwara, K., Hirasawa, R., Yachi, Y., Iida, K., Shimano, H., Ohashi, Y., Yamada, N., Sone, H., 2012. Effect of web-based lifestyle modification on weight control: a meta-analysis (Structured abstract). *International Journal of Obesity* 36, 675–685.

- Kosse, N., Brands, K., Bauer, J., Hortobagyi, T., Lamoth, C., 2013. Sensor technologies aiming at fall prevention in institutionalized old adults: a synthesis of current knowledge (Provisional abstract). *International Journal of Medical Informatics* 82, 743–752.
- Kotb, A., Hsieh, S., Wells, G., 2014. The effect of telephone support interventions on coronary artery disease (CAD) patient outcomes during cardiac rehabilitation: a systematic review and meta-analysis (Provisional abstract). *PLOS ONE* e96581.
- Kraai, I., Luttik, M., de Jong, R., Jaarsma, T., Hillege, H., 2011. Heart failure patients monitored with telemedicine: patient satisfaction, a review of the literature (Provisional abstract). *Journal of Cardiac Failure* 17, 684–690.
- Krishna, S., Boren, S., Balas, E., 2009. Healthcare via cell phones: a systematic review (Structured abstract). *Telemedicine and e-Health* 15, 231–240.
- Kuijpers, W., Groen, W., Aaronson, N., van Harten, W., 2013. A systematic review of web-based interventions for patient empowerment and physical activity in chronic diseases: relevance for cancer survivors (Provisional abstract). *Journal of Medical Internet Research* 15, e37.
- Lancaster, T., Stead, L.F., 2005. Individual behavioural counselling for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Lassi, Z.S., Kumar, R., Das, J.K., Salam, R.A., Bhutta, Z.A., 2014. Antibiotic therapy versus no antibiotic therapy for children aged two to 59 months with WHO-defined non-severe pneumonia and wheeze, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Lauriks, S., Reinersmann, A., Van der Roest, H.G., Meiland, F.J., Davies, R.J., Moelaert, F., Mulvenna, M.D., Nugent, C.D., Droes, R.M., 2007. Review of ICT-based services for identified unmet needs in people with dementia (Provisional abstract). *Ageing Research Reviews* 6, 223–246.
- Lavender, T., Richens, Y., Milan, S.J., Smyth, R.M., Dowswell, T., 2013. Telephone support for women during pregnancy and the first six weeks postpartum, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Laver, K.E., Schoene, D., Crotty, M., George, S., Lannin, N.A., Sherrington, C., 2013. Telerehabilitation services for stroke, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Leach, L.S., Christensen, H., 2006. A systematic review of telephone-based interventions for mental disorders (Structured abstract). *Journal of Telemedicine and Telecare* 12, 122–129.
- Leibowitz, R., Day, S., Dunt, D., 2003. A systematic review of the effect of different models of after-hours primary medical care services on clinical outcome, medical workload, and patient and GP satisfaction (Structured abstract). *Family Practice* 20, 311–317.
- Leite, F.M., Atallah, Á.N., El Dib, R.P., Grossmann, E., Januzzi, E., Andriolo, R.B., da Silva, E.M., 2009. Cyclobenzaprine for the treatment of myofascial pain in adults, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Levack, W.M., Weatherall, M., Hay-Smith, E.J.C., Dean, S.G., McPherson, K., Siegert, R.J., 2015. Goal setting and strategies to enhance goal pursuit for adults with acquired disability participating in rehabilitation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Liang, X., Wang, Q., Yang, X., Cao, J., Chen, J., Mo, X., Huang, J., Wang, L., Gu, D., 2011. Effect of mobile phone intervention for diabetes on glycaemic control: a meta-analysis (Structured abstract). *Diabetic Medicine* 28, 455–463.
- Lin, H., Wu, X., 2014. Intervention strategies for improving patient adherence to follow-up in the era of mobile information technology: a systematic review and meta-analysis (Provisional abstract). *PLOS ONE* e104266.

- Lindson-Hawley, N., Thompson, T.P., Begh, R., 2015. Motivational interviewing for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Linn, A., Vervloet, M., van Dijk, L., Smit, E., Van Weert, J., 2011. Effects of eHealth interventions on medication adherence: a systematic review of the literature (Provisional abstract). *Journal of Medical Internet Research* 13, e103.
- Lins, S., Hayder-Beichel, D., Rücker, G., Motschall, E., Antes, G., Meyer, G., Langer, G., 2014. Efficacy and experiences of telephone counselling for informal carers of people with dementia, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Liss, H.J., Glueckauf, R.L., Ecklund-Johnson, E.P., 2002. Research on telehealth and chronic medical conditions: critical review, key issues, and future directions (Provisional abstract). *Rehabilitation Psychology* 47, 8–30.
- Liu, Q., Abba, K., Alejandria, M.M., Sinclair, D., Balanag, V.M., Lansang, M.A.D., 2014. Reminder systems to improve patient adherence to tuberculosis clinic appointments for diagnosis and treatment, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Lizana, F.G., Santamera, A.S., 2005. Utilization of information and communication technology in managing chronic diseases: a systematic review (Provisional abstract). Title to be Checked 56.
- Lockhart, K., Dosser, I., Cruickshank, S., Kennedy, C., 2007. Methods of communicating a primary diagnosis of breast cancer to patients, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Louis, A.A., Turner, T., Gretton, M., Baksh, A., Cleland, J.G., 2003. A systematic review of telemonitoring for the management of heart failure (Provisional abstract). *European Journal of Heart Failure* 5, 583–590.
- Lovell, K., Bee, P., 2011. Optimising treatment resources for OCD: a review of the evidence base for technology-enhanced delivery (Provisional abstract). *Journal of Mental Health* 20, 525–542.
- Low, M.S.Y., Speedy, J., Styles, C.E., De-Regil, L.M., Pasricha, S.-R., 2016. Daily iron supplementation for improving anaemia, iron status and health in menstruating women, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Lumbiganon, P., Martis, R., Laopaiboon, M., Festin, M.R., Ho, J.J., Hakimi, M., 2016. Antenatal breastfeeding education for increasing breastfeeding duration, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Lyzwinski, L., 2014. A systematic review and meta-analysis of mobile devices and weight loss with an intervention content analysis (Provisional abstract). *Journal of Personalized Medicine* 311–385.
- Ma, C., Kuang, A., Xie, J., Liu, G.J., 2008. Radioiodine treatment for pediatric Graves' disease, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Mair, F., Whitten, P., 2000. Systematic review of studies of patient satisfaction with telemedicine (Structured abstract). *BMJ* 320, 1517–1520.
- Marcano Belisario, J.S., Huckvale, K., Greenfield, G., Car, J., Gunn, L.H., 2013. Smartphone and tablet self management apps for asthma, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Marcano Belisario, J.S., Jamsek, J., Huckvale, K., O'Donoghue, J., Morrison, C.P., Car, J., 2015. Comparison of self-administered survey questionnaire responses collected using mobile apps versus other methods, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Marcolino, M., Maia, J., Alkmim, M., Boersma, E., Ribeiro, A., 2013. Telemedicine application in the care of diabetes patients: systematic review and meta-analysis (Provisional abstract). *PLOS ONE* 8, e79246.
- Maric, B., Kaan, A., Ignaszewski, A., Lear, S., 2009. A systematic review of telemonitoring technologies in heart failure (Structured abstract). *European Journal of Heart Failure* 11, 506–517.
- Marino, R., Ghanim, A., 2013. Teledentistry: a systematic review of the literature (Provisional abstract). *Journal of Telemedicine and Telecare* 179–183.
- Martin, A., Saunders, D.H., Shenkin, S.D., Sproule, J., 2014. Lifestyle intervention for improving school achievement in overweight or obese children and adolescents, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Martin, S., Kelly, G., Kernohan, W.G., McCreight, B., Nugent, C., 2008. Smart home technologies for health and social care support, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Martin, S., Sutcliffe, P., Griffiths, F., Sturt, J., Powell, J., Adams, A., Dale, J., 2011. Effectiveness and impact of networked communication interventions in young people with mental health conditions: a systematic review (Provisional abstract). *Patient Education and Counseling* 85, e108–e119.
- Mason, M., Ola, B., Zaharakis, N., Zhang, J., 2014. Text messaging interventions for adolescent and young adult substance use: a meta-analysis (Provisional abstract). *Prevention Science* epub.
- Massy-Westropp, N., Johnston, R.V., Hill, C.L., 2008. Post-operative therapy for metacarpophalangeal arthroplasty, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- McDonald, K., Matesic, B., Contopoulos-Ioannidis, D., Lonhart, J., Schmidt, E., Pineda, N., Ioannidis, J., 2013. Patient safety strategies targeted at diagnostic errors: a systematic review (Structured abstract). *Annals of Internal Medicine* 158, 381–389.
- McLean, S., Chandler, D., Nurmatov, U., Liu, J., Pagliari, C., Car, J., Sheikh, A., 2011. Telehealthcare for asthma: a Cochrane review (Structured abstract). *CMAJ: Canadian Medical Association Journal* 183, E733–E742.
- McLean, S., Chandler, D., Nurmatov, U., Liu, J.L., Pagliari, C., Car, J., Sheikh, A., 2010. Telehealthcare for asthma, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- McLean, S., Nurmatov, U., Liu, J., Pagliari, C., Car, J., Sheikh, A., 2012. Telehealthcare for chronic obstructive pulmonary disease: Cochrane review and meta-analysis (Structured abstract). *British Journal of General Practice* 62, e739–e749.
- McLean, Susannah, Nurmatov, U., Liu, J.L., Pagliari, C., Car, J., Sheikh, A., 2011. Telehealthcare for chronic obstructive pulmonary disease, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Medical Advisory Secretariat, 2009. Home telemonitoring for type 2 diabetes: an evidence-based analysis (Provisional abstract). Title to be Checked 1.
- Merriel, S., Andrews, V., Salisbury, C., 2014. Telehealth interventions for primary prevention of cardiovascular disease: a systematic review and meta-analysis (Structured abstract). *Preventive Medicine* 88–95.
- Meyer, B., Atherton, H., Sawmynaden, P., Car, J., 2012. Email for communicating results of diagnostic medical investigations to patients, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Middleton, P., Crowther, C.A., 2014. Reminder systems for women with previous gestational diabetes mellitus to increase uptake of testing for type 2 diabetes or impaired glucose tolerance, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Middleton, P., Shepherd, E., Flenady, V., McBain, R.D., Crowther, C.A., 2017. Planned early birth versus expectant management (waiting) for prelabour rupture of membranes at term (37 weeks or more), in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Mignerat, M., Lapointe, L., Vedel, I., 2014. Using telecare for diabetic patients: a mixed systematic review (Provisional abstract). *Health Policy and Technology* 90–112.
- Milani, P., Coccetta, C., Rabini, A., Sciarra, T., Massazza, G., Ferriero, G., 2014. Mobile smartphone applications for body position measurement in rehabilitation: a review of goniometric tools (Provisional abstract). *PM and R epub*.
- Militello, L., Kelly, S., Melnyk, B., 2012. Systematic review of text-messaging interventions to promote healthy behaviors in pediatric and adolescent populations: implications for clinical practice and research (Structured abstract). *Worldviews on Evidence-Based Nursing* 9, 66–77.
- Miller, E.A., 2001. Telemedicine and doctor-patient communication: an analytical survey of the literature (Structured abstract). *Journal of Telemedicine and Telecare* 7, 1–17.
- M'Imunya, J.M., Kredo, T., Volmink, J., 2012. Patient education and counselling for promoting adherence to treatment for tuberculosis, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Mistiaen, P., Poot, E., 2006. Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Mohr, D.C., Vella, L., Hart, S., Heckman, T., Simon, G., 2008. The effect of telephone-administered psychotherapy on symptoms of depression and attrition: a meta-analysis (Structured abstract). *Clinical Psychology: Science and Practice* 15, 243–253.
- Montori, V.M., Helgemoe, P.K., Guyatt, G.H., Dean, D.S., Leung, T.W., Smith, S.A., Kudva, Y.C., 2004. Telecare for patients with type 1 diabetes and inadequate glycemic control: a randomized controlled trial and meta-analysis (Provisional abstract). *Diabetes Care* 27, 1088–1094.
- Moorhead, S., Hazlett, D., Harrison, L., Carroll, J., Irwin, A., Hoving, C., 2013. A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication (Structured abstract). *Journal of Medical Internet Research* 15, e85.
- Moschetti, I., Cinquini, M., Lambertini, M., Levaggi, A., Liberati, A., 2016. Follow-up strategies for women treated for early breast cancer, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Moy, F.M., Ray, A., Buckley, B.S., 2014. Techniques of monitoring blood glucose during pregnancy for women with pre-existing diabetes, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Mujezinovic, F., Prosnik, A., Alfirovic, Z., 2010. Different communication strategies for disclosing results of diagnostic prenatal testing, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Muller, I., Yardley, L., 2011. Telephone-delivered cognitive behavioural therapy: a systematic review and meta-analysis (Structured abstract). *Journal of Telemedicine and Telecare* 17, 177–184.

- Murray, E., Burns, J., See Tai, S., Lai, R., Nazareth, I., 2005. Interactive Health Communication Applications for people with chronic disease, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Musiat, P., Tarrier, N., 2014. Collateral outcomes in e-mental health: a systematic review of the evidence for added benefits of computerized cognitive behavior therapy interventions for mental health (Provisional abstract). *Psychological Medicine* 3137–3150.
- Nakamura, N., Koga, T., Iseki, H., 2013. A meta-analysis of remote patient monitoring for chronic heart failure patients (Provisional abstract). *Journal of Telemedicine and Telecare* 11–17.
- Neubeck, L., Redfern, J., Fernandez, R., Briffa, T., Bauman, A., Freedman, S., 2009. Telehealth interventions for the secondary prevention of coronary heart disease: a systematic review (Structured abstract). *European Journal of Cardiovascular Prevention and Rehabilitation* 16, 281–289.
- Neve, M., Morgan, P., Jones, P., Collins, C., 2010. Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis (Structured abstract). *Obesity Reviews* 11, 306–321.
- Nglazi, M., Bekker, L., Wood, R., Hussey, G., Wiysonge, C., 2013. Mobile phone text messaging for promoting adherence to anti-tuberculosis treatment: a systematic review (Provisional abstract). *BMC Infectious Diseases* 13, 566.
- Nhavoto, J., Gronlund, A., 2014. Mobile technologies and geographic information systems to improve health care systems: a literature review (Provisional abstract). *JMIR mHealth and uHealth* e21.
- Nieuwenhuijsen, K., Faber, B., Verbeek, J.H., Neumeyer-Gromen, A., Hees, H.L., Verhoeven, A.C., van der Feltz-Cornelis, C.M., Bültmann, U., 2014. Interventions to improve return to work in depressed people, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Nilsen, E.S., Myrhaug, H.T., Johansen, M., Oliver, S., Oxman, A.D., 2006. Methods of consumer involvement in developing healthcare policy and research, clinical practice guidelines and patient information material, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.
- Nordheim, L., Haavind, M., Iversen, M., 2014. Effect of telemedicine follow-up care of leg and foot ulcers: a systematic review (Provisional abstract). *BMC Health Services Research* 565.
- Norman, G.J., Zabinski, M.F., Adams, M.A., Rosenberg, D.E., Yaroch, A.L., Atienza, A.A., 2007. A review of eHealth interventions for physical activity and dietary behavior change (Provisional abstract). *American Journal of Preventive Medicine* 33, 336–345.e16.
- Nose, M., Barbui, C., Gray, R., Tansella, M., 2003. Clinical interventions for treatment non-adherence in psychosis: meta-analysis (Structured abstract). *British Journal of Psychiatry* 183, 197–206.
- Odone, A., Ferrari, A., Spagnoli, F., Visciarelli, S., Shefer, A., Pasquarella, C., Signorelli, C., 2014. Effectiveness of interventions that apply new media to improve vaccine uptake and vaccine coverage: a systematic review (Provisional abstract). *Human Vaccines and Immunotherapeutics* epub.
- Ohinmaa, A., Hailey, D., Roine, R., 1999. The assessment of telemedicine: general principles and a systematic review (Structured abstract). *Finnish Office for Health Care Technology Assessment (FinOHTA)* 55.
- Olthuis, J.V., Watt, M.C., Bailey, K., Hayden, J.A., Stewart, S.H., 2016. Therapist-supported Internet cognitive behavioural therapy for anxiety disorders in adults, in: Cochrane Database of Systematic Reviews. John Wiley & Sons, Ltd.

- Omboni, S., Gazzola, T., Carabelli, G., Parati, G., 2013. Clinical usefulness and cost effectiveness of home blood pressure telemonitoring: meta-analysis of randomized controlled studies (Provisional abstract). *Journal of Hypertension* 31, 455–468.
- Omboni, S., Guarda, A., 2011. Impact of home blood pressure telemonitoring and blood pressure control: a meta-analysis of randomized controlled studies (Structured abstract). *American Journal of Hypertension* 24, 989–998.
- O'Reilly, G., Spruijt-Metz, D., 2013. Current mHealth technologies for physical activity assessment and promotion (Provisional abstract). *American Journal of Preventive Medicine* 45, 501–507.
- Osenbach, J., O'Brien, K., Mishkind, M., Smolenski, D., 2013. Synchronous telehealth technologies in psychotherapy for depression: a meta-analysis (Provisional abstract). *Depression and Anxiety* 30, 1058–1067.
- Pal, K., Eastwood, S., Michie, S., Farmer, A., Barnard, M., Peacock, R., Wood, B., Edwards, P., Murray, E., 2014. Computer-based interventions to improve self-management in adults with type 2 diabetes: a systematic review and meta-analysis (Structured abstract). *Diabetes Care* 1759–1766.
- Pal, K., Eastwood, S.V., Michie, S., Farmer, A.J., Barnard, M.L., Peacock, R., Wood, B., Inniss, J.D., Murray, E., 2013. Computer-based diabetes self-management interventions for adults with type 2 diabetes mellitus, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Pan, W., 2006. Proactive telephone counseling as an adjunct to minimal intervention for smoking cessation: a meta-analysis (Provisional abstract). *Health Education Research* 21, 416–427.
- Pandor, A., Thokala, P., Gomersall, T., Baalbaki, H., Stevens, J., Wang, J., Wong, R., Brennan, A., Fitzgerald, P., 2013. Home telemonitoring or structured telephone support programmes after recent discharge in patients with heart failure: systematic review and economic evaluation (Provisional abstract). *Health Technology Assessment* 17, 1–208.
- Pappas, Y., Wei, I., Car, J., Majeed, A., Sheikh, A., 2011. Computer-assisted versus oral-and-written family history taking for identifying people with elevated risk of type 2 diabetes mellitus, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Park, C., Kim, G., Patel, I., Chang, J., Tan, X., 2014. Improving adherence to acne treatment: the emerging role of application software (Provisional abstract). *Clinical, Cosmetic and Investigational Dermatology* 65–72.
- Park, L., Howie-Esquivel, J., Dracup, K., 2014. A quantitative systematic review of the efficacy of mobile phone interventions to improve medication adherence (Provisional abstract). *Journal of Advanced Nursing* 1932–1953.
- Peacock, S.C., Forbes, D.A., 2003. Interventions for caregivers of persons with dementia: a systematic review (Provisional abstract). *Canadian Journal of Nursing Research* 35, 88–107.
- Pega, F., Liu, S.Y., Walter, S., Lhachimi, S.K., 2015. Unconditional cash transfers for assistance in humanitarian disasters: effect on use of health services and health outcomes in low- and middle-income countries, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Pellowski, J., Kalichman, S., 2012. Recent advances (2011-2012) in technology-delivered interventions for people living with HIV (Provisional abstract). *Current HIV/AIDS Reports* 9, 326–334.
- Pereira, K., Phillips, B., Johnson, C., Vorderstrasse, A., 2014. Internet delivered diabetes self-management education: a review (Provisional abstract). *Diabetes Technology and Therapeutics* 55–63.

- Pesamaa, L., Ebeling, H., Kuusimaki, M.L., Winblad, I., Isohanni, M., Moilanen, I., 2004. Videoconferencing in child and adolescent telepsychiatry: a systematic review of the literature (Provisional abstract). *Journal of Telemedicine and Telecare* 10, 187–192.
- Peterson, A., 2014. Improving type 1 diabetes management with mobile tools: a systematic review (Provisional abstract). *Journal of Diabetes Science and Technology* 8, 859–864.
- Phillips, P., 2014. Telephone follow-up for patients eligible for cardiac rehab: a systematic review (Provisional abstract). *British Journal of Cardiac Nursing* 186–197.
- Pietrzak, E., Cotea, C., Pullman, S., Nasveld, P., 2013. Self-management and rehabilitation in osteoarthritis: is there a place for internet-based interventions? (Provisional abstract). *Telemedicine and e-Health* 800–805.
- Pitt, V., Lowe, D., Hill, S., Prictor, M., Hetrick, S.E., Ryan, R., Berends, L., 2013. Consumer-providers of care for adult clients of statutory mental health services, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Polisena, J., Tran, K., Cimon, K., Hutton, B., McGill, S., Palmer, K., 2009. Home telehealth for diabetes management: a systematic review and meta-analysis (Structured abstract). *Diabetes Obesity and Metabolism* 11, 913–930.
- Polisena, J., Tran, K., Cimon, K., Hutton, B., McGill, S., Palmer, K., Scott, R., 2010a. Home telehealth for chronic obstructive pulmonary disease: a systematic review and meta-analysis (Structured abstract). *Journal of Telemedicine and Telecare* 16, 120–127.
- Polisena, J., Tran, K., Cimon, K., Hutton, B., McGill, S., Palmer, K., Scott, R., 2010b. Home telemonitoring for congestive heart failure: a systematic review and meta-analysis (Structured abstract). *Journal of Telemedicine and Telecare* 16, 68–76.
- Pool, E.R., Dogar, O., Lindsay, R.P., Weatherburn, P., Siddiqi, K., 2016. Interventions for tobacco use cessation in people living with HIV and AIDS, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Pope, J., Fenlon, D., Thompson, A., Shea, B., Furst, D., Wells, G.A., Silman, A., 1998. Iloprost and cisaprost for Raynaud’s phenomenon in progressive systemic sclerosis, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Posadzki, P., Mastellos, N., Ryan, R., Gunn, L.H., Felix, L.M., Pappas, Y., Gagnon, M.-P., Julious, S.A., Xiang, L., Oldenburg, B., Car, J., 2016. Automated telephone communication systems for preventive healthcare and management of long-term conditions, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Purc-Stephenson, R., Thrasher, C., 2012. Patient compliance with telephone triage recommendations: a meta-analytic review (Structured abstract). *Patient Education and Counseling* 87, 135–142.
- Reda, S., Rowett, M., Makhoul, S., 2001. Prompts to encourage appointment attendance for people with serious mental illness, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Renfrew, M.J., McCormick, F.M., Wade, A., Quinn, B., Dowswell, T., 2012. Support for healthy breastfeeding mothers with healthy term babies, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Revere, D., Dunbar, P.J., 2001. Review of computer-generated outpatient health behavior interventions: clinical encounters “in absentia” (Structured abstract). *Journal of the American Medical Informatics Association* 8, 62–79.

- Richards, D., Richardson, T., 2012. Computer-based psychological treatments for depression: a systematic review and meta-analysis (Structured abstract). *Clinical Psychology Review* 32, 329–342.
- Richards, J., Thorogood, M., Hillsdon, M., Foster, C., 2013. Face-to-face versus remote and web 2.0 interventions for promoting physical activity, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Rietdijk, R., Togher, L., Power, E., 2012. Supporting family members of people with traumatic brain injury using telehealth: a systematic review (Provisional abstract). *Journal of Rehabilitation Medicine* 44, 913–921.
- Riper, H., Spek, V., Boon, B., Conijn, B., Kramer, J., Martin-Abello, K., Smit, F., 2011. Effectiveness of E-self-help interventions for curbing adult problem drinking: a meta-analysis (Structured abstract). *Journal of Medical Internet Research* 13, e42.
- Rueda, J.-R., Solà, I., Pascual, A., Subirana Casacuberta, M., 2011. Non-invasive interventions for improving well-being and quality of life in patients with lung cancer, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Russell-Minda, E., Jutai, J., Speechley, M., Bradley, K., Chudyk, A., Petrella, R., 2009. Health technologies for monitoring and managing diabetes: a systematic review (Structured abstract). *Journal of Diabetes Science and Technology* 3, 1460–1471.
- Saffari, M., Ghanizadeh, G., Koenig, H., 2014. Health education via mobile text messaging for glycemic control in adults with type 2 diabetes: a systematic review and meta-analysis (Provisional abstract). *Primary Care Diabetes* 275–285.
- Samoocha, D., Bruinvels, D., Elbers, N., Anema, J., van der Beek, A., 2010. Effectiveness of web-based interventions on patient empowerment: a systematic review and meta-analysis (Provisional abstract). *Journal of Medical Internet Research* 12, e23.
- Saragiotto, B.T., Maher, C.G., Yamato, T.P., Costa, L.O., Menezes Costa, L.C., Ostelo, R.W., Macedo, L.G., 2016. Motor control exercise for chronic non-specific low-back pain, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Schnall, R., Travers, J., Rojas, M., Carballo-Dieguez, A., 2014. eHealth interventions for HIV prevention in high-risk men who have sex with men: a systematic review (Provisional abstract). *Journal of Medical Internet Research* e134.
- Scott, D.A., Mills, M., Black, A., Cantwell, M., Campbell, A., Cardwell, C.R., Porter, S., Donnelly, M., 2013. Multidimensional rehabilitation programmes for adult cancer survivors, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Shahab, L., McEwen, A., 2009. Online support for smoking cessation: a systematic review of the literature (Structured abstract). *Addiction* 104, 1792–1804.
- Shaw, R., Bosworth, H., 2012. Short message service (SMS) text messaging as an intervention medium for weight loss: a literature review (Provisional abstract). *Health Informatics Journal* 18, 235–50.
- Shulman, R., O’Gorman, C., Palmert, M., 2010. The impact of telemedicine interventions involving routine transmission of blood glucose data with clinician feedback on metabolic control in youth with type 1 diabetes: a systematic review and meta-analysis (Provisional abstract). *International Journal of Pediatric Endocrinology* 2010:536957.

- Siopis, G., Chey, T., Allman-Farinelli, M., 2014. A systematic review and meta-analysis of interventions for weight management using text messaging (Provisional abstract). *Journal of Human Nutrition and Dietetics* epub.
- Sloan, D., Gallagher, M., Feinstein, B., Lee, D., Pruneau, G., 2011. Efficacy of telehealth treatments for posttraumatic stress-related symptoms: a meta-analysis (Structured abstract). *Cognitive Behaviour Therapy* 40, 111–125.
- Small, N., Blickem, C., Blakeman, T., Panagioti, M., Chew-Graham, C., Bower, P., 2013. Telephone based self-management support by “lay health workers” and “peer support workers” to prevent and manage vascular diseases: a systematic review and meta-analysis (Provisional abstract). *BMC Health Services Research* 13, 533.
- Smith, A., Skow, A., Bodurtha, J., Kinra, S., 2013. Health information technology in screening and treatment of child obesity: a systematic review (Structured abstract). *Pediatrics* 131, e894–e902.
- Smith, C., Gold, J., Ngo, T.D., Sumpter, C., Free, C., 2015. Mobile phone-based interventions for improving contraception use, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Smith, S.R., Newton, K., Smith, J.A., Dumville, J.C., Iheozor-Ejiofor, Z., Pearce, L.E., Barrow, P.J., Hancock, L., Hill, J., 2016. Internal dressings for healing perianal abscess cavities, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Stacey, D., Noorani, H.Z., Fisher, A., Robinson, D., Joyce, J., Pong, R.W., 2003. Telephone triage services: systematic review and a survey of Canadian call centre programs (Provisional abstract). Title to be Checked 93.
- Stead, L.F., Hartmann-Boyce, J., Perera, R., Lancaster, T., 2013. Telephone counselling for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Stead, L.F., Koilpillai, P., Lancaster, T., 2015. Additional behavioural support as an adjunct to pharmacotherapy for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Stellefson, M., Chaney, B., Barry, A., Chavarria, E., Tennant, B., Walsh-Childers, K., Sriram, P., Zagora, J., 2013. Web 2.0 chronic disease self management for older adults: a systematic review (Provisional abstract). *Journal of Medical Internet Research* 15.
- Stephens, J., Allen, J., 2013. Mobile phone interventions to increase physical activity and reduce weight: a systematic review (Provisional abstract). *Journal of Cardiovascular Nursing* 28, 320–329.
- Stinson, J., Wilson, R., Gill, N., Yamada, J., Holt, J., 2009. A systematic review of internet-based self-management interventions for youth with health conditions (Structured abstract). *Journal of Pediatric Psychology* 34, 495–510.
- Stoffers, J.M., Völlm, B.A., Rucker, G., Timmer, A., Huband, N., Lieb, K., 2012. Psychological therapies for people with borderline personality disorder, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Stolic, S., Mitchell, M., Wollin, J., 2010. Nurse-led telephone interventions for people with cardiac disease: a review of the research literature (Structured abstract). *European Journal of Cardiovascular Nursing* 9, 203–217.
- Storm-Versloot, M.N., Vos, C.G., Ubbink, D.T., Vermeulen, H., 2010. Topical silver for preventing wound infection, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Su, M., Lin, C., Tsao, L., 2014. The efficacy of e-health management on weight control in adolescents: a systematic review (Provisional abstract). *Journal of Nursing* 74–84.
- Suksomboon, N., Poolsup, N., Nge, Y., 2014. Impact of phone call intervention on glycemic control in diabetes patients: a systematic review and meta-analysis of randomized, controlled trials (Provisional abstract). *PLOS ONE* 9, e89207.
- Sutcliffe, P., Martin, S., Sturt, J., Powell, J., Griffiths, F., Adams, A., Dale, J., 2011. Systematic review of communication technologies to promote access and engagement of young people with diabetes into healthcare (Structured abstract). *BMC Endocrine Disorders* 11.
- Taylor, V., Bossi, M., Bunce, C., Greenwood, J.A., Dahlmann-Noor, A., 2015. Binocular versus standard occlusion or blurring treatment for unilateral amblyopia in children aged three to eight years, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Tait, R., Christensen, H., 2010. Internet-based interventions for young people with problematic substance use: a systematic review (Structured abstract). *Medical Journal of Australia* 192, S15–S21.
- Takeda, A., Taylor, S.J., Taylor, R.S., Khan, F., Krum, H., Underwood, M., 2012. Clinical service organisation for heart failure, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Tan, K., Lai, N.M., 2012. Telemedicine for the support of parents of high-risk newborn infants, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Tao, D., Or, C., 2013. Effects of self-management health information technology on glycaemic control for patients with diabetes: a meta-analysis of randomized controlled trials (Provisional abstract). *Journal of Telemedicine and Telecare* 19, 133–143.
- Thomas, R., Barker, L., Rubin, G., Dahlmann-Noor, A., 2015. Assistive technology for children and young people with low vision, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Thomas, R.E., Lorenzetti, D.L., 2014. Interventions to increase influenza vaccination rates of those 60 years and older in the community, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Thomas, S., Jeyaraman, M., Hodge, W., Hutnik, C., Costella, J., Malvankar-Mehta, M., 2014. The effectiveness of teleglaucoma versus in-patient examination for glaucoma screening: a systematic review and meta-analysis (Provisional abstract). *PLOS ONE* e113779.
- Tingey, P.C., Harding, S.E., Pope, J., Fenlon, D., Furst, D., Shea, B., Silman, A., Thompson, A., Wells, G.A., 1998. Cyclofenil for Raynaud’s phenomenon in progressive systemic sclerosis, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Tran, K., Polisena, J., Coyle, D., Coyle, K., Kluge, E., Cimon, K., McGill, S., Noorani, H., Palmer, K., Scott, R., 2008. Home telehealth for chronic disease management (Structured abstract). Title to be Checked 1.
- Treweek, S., Mitchell, E., Pitkethly, M., Cook, J., Kjeldstrøm, M., Johansen, M., Taskila, T.K., Sullivan, F., Wilson, S., Jackson, C., Jones, R., Lockhart, P., 2010. Strategies to improve recruitment to randomised controlled trials, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Tudor Car, L., Gentry, S., van-Velthoven, M.H., Car, J., 2013. Telephone communication of HIV testing results for improving knowledge of HIV infection status, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Tzelepis, F., Paul, C., Walsh, R., McElduff, P., Knight, J., 2011. Proactive telephone counseling for smoking cessation: meta-analyses by recruitment channel and methodological quality (Structured abstract). *Journal of the National Cancer Institute* 103, 922–941.
- Udsen, F., Hejlesen, O., Ehlers, L., 2014. A systematic review of the cost and cost-effectiveness of telehealth for patients suffering from chronic obstructive pulmonary disease (Provisional abstract). *Journal of Telemedicine and Telecare* 212–220.
- Välimäki, M., Hätönen, H., Lahti, M., Kuosmanen, L., Adams, C.E., 2012. Information and communication technology in patient education and support for people with schizophrenia, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- van Dam, H.A., van der Horst, F.G., Knoop, L., Ryckman, R.M., Crebolder, H.F., van den Borne, B.H., 2005. Social support in diabetes: a systematic review of controlled intervention studies (Structured abstract). *Patient Education and Counseling* 59, 1–12.
- van den Berg, N., Schumann, M., Kraft, K., Hoffmann, W., 2012. Telemedicine and telecare for older patients: a systematic review (Structured abstract). *Maturitas* 73, 94–114.
- van der Krieke, L., Wunderink, L., Emerencia, A., de Jonge, P., Sytema, S., 2014. E-mental health self-management for psychotic disorders: state of the art and future perspectives (Provisional abstract). *Psychiatric Services* 65, 33–49.
- van Dijk, H., Hermens, H.J., 2004. Distance training for the restoration of motor function (Provisional abstract). *Journal of Telemedicine and Telecare* 10, 63–71.
- van Driel, M.L., Morledge, M.D., Ulep, R., Shaffer, J.P., Davies, P., Deichmann, R., 2016. Interventions to improve adherence to lipid-lowering medication, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- van Velthoven, M., Brusamento, S., Majeed, A., Car, J., 2013. Scope and effectiveness of mobile phone messaging for HIV/AIDS care: a systematic review (Provisional abstract). *Psychology, Health and Medicine* 18, 182–202.
- van Velthoven, M., Tudor Car, L., Car, J., Atun, R., 2012. Telephone consultation for improving health of people living with or at risk of HIV: a systematic review (Structured abstract). *PLOS ONE* 7, e36105.
- van-Velthoven, M.H., Tudor Car, L., Gentry, S., Car, J., 2013. Telephone delivered interventions for preventing HIV infection in HIV-negative persons, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- van Vugt, M., de Wit, M., Cleijne, W., Snoek, F., 2013. Use of behavioral change techniques in web-based self-management programs for type 2 diabetes patients: systematic review (Provisional abstract). *Journal of Medical Internet Research* 15, e279.
- Vanwormer, J.J., Boucher, J.L., Pronk, N.P., 2006. Telephone-based counseling improves dietary fat, fruit, and vegetable consumption: a best-evidence synthesis (Structured abstract). *Journal of the American Dietetic Association* 106, 1434–1444.
- Vaona, A., Pappas, Y., Grewal, R.S., Ajaz, M., Majeed, A., Car, J., 2017. Training interventions for improving telephone consultation skills in clinicians, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Verberk, W., Kessels, A., Thien, T., 2011. Telecare is a valuable tool for hypertension management, a systematic review and meta-analysis (Structured abstract). *Blood Pressure Monitoring* 16, 149–155.

- Verhoeven, F., Tanja-Dijkstra, K., Nijland, N., Eysenbach, G., van Gemert-Pijnen, L., 2010. Asynchronous and synchronous teleconsultation for diabetes care: a systematic literature review (Structured abstract). *Journal of Diabetes Science and Technology* 4, 666–684.
- Vermeulen, H., van Hattem, J.M., Storm-Versloot, M.N., Ubbink, D.T., Westerbos, S.J., 2007. Topical silver for treating infected wounds, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Vervloet, M., Linn, A., van Weert, J., de Bakker, D., Bouvy, M., van Dijk, L., 2012. The effectiveness of interventions using electronic reminders to improve adherence to chronic medication: a systematic review of the literature (Structured abstract). *Journal of the American Medical Informatics Association* 19, 696–704.
- Vodopivec-Jamsek, V., de Jongh, T., Gurol-Urganci, I., Atun, R., Car, J., 2012. Mobile phone messaging for preventive health care, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Walsh, C.M., Sherlock, M.E., Ling, S.C., Carnahan, H., 2012. Virtual reality simulation training for health professions trainees in gastrointestinal endoscopy, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Wantland, D.J., Portillo, C.J., Holzemer, W.L., Slaughter, R., McGhee, E.M., 2004. The effectiveness of Web-based vs. non-Web-based interventions: a meta-analysis of behavioral change outcomes (Structured abstract). *Journal of Medical Internet Research* 6.
- Warshaw, E., Hillman, Y., Greer, N., Hagel, E., MacDonald, R., Rutks, I., Wilt, T., 2011. Teledermatology for diagnosis and management of skin conditions: a systematic review (Provisional abstract). *Journal of the American Academy of Dermatology* 64, 759–772.e21.
- Waterman, H., Evans, J.R., Gray, T.A., Henson, D., Harper, R., 2013. Interventions for improving adherence to ocular hypotensive therapy, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Watkins, I., Xie, B., 2014. eHealth literacy interventions for older adults: a systematic review of the literature (Provisional abstract). *Journal of Medical Internet Research* e225.
- Weber Buchholz, S., Wilbur, J., Ingram, D., Fogg, L., 2013. Physical activity text messaging interventions in adults: a systematic review (Provisional abstract). *Worldviews on Evidence-Based Nursing* 10, 163–173.
- Webster, J., Flint, A., 2014. Exit interviews to reduce turnover amongst healthcare professionals, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Wei, C., Herrick, A., Raymond, H.F., Anglemyer, A., Gerbase, A., Noar, S.M., 2011. Social marketing interventions to increase HIV/STI testing uptake among men who have sex with men and male-to-female transgender women, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Wei, I., Pappas, Y., Car, J., Sheikh, A., Majeed, A., 2011. Computer-assisted versus oral-and-written dietary history taking for diabetes mellitus, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Welch, V., Tugwell, P., Petticrew, M., de Montigny, J., Ueffing, E., Kristjansson, B., McGowan, J., Benkhalti Jandu, M., Wells, G.A., Brand, K., Smylie, J., 2010. How effects on health equity are assessed in systematic reviews of interventions, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

- Whittaker, R., Borland, R., Bullen, C., Lin, R., McRobbie, H., Rodgers, A., 2010. Mobile phone-based interventions for smoking cessation (Structured abstract). *Sao Paulo Medical Journal* 128, 106–107.
- Whittaker, R., McRobbie, H., Bullen, C., Rodgers, A., Gu, Y., 2016. Mobile phone-based interventions for smoking cessation, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Wilcox, M., Adhikari, N., 2012. The effect of telemedicine in critically ill patients: systematic review and meta-analysis (Structured abstract). *Critical Care* 16.
- Williams, T.L., May, C.R., Esmail, A., 2001. Limitations of patient satisfaction studies in telehealthcare: a systematic review of the literature (Structured abstract). *Telemedicine and e-Health* 7, 293–316.
- Wilt, T.J., MacDonald, R., Hagerty, K., Schellhammer, P., Kramer, B.S., 2008. 5-alpha-reductase inhibitors for prostate cancer prevention, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Wu, L., Forbes, A., Griffiths, P., Milligan, P., While, A., 2010. Telephone follow-up to improve glycaemic control in patients with type 2 diabetes: systematic review and meta-analysis of controlled trials (Structured abstract). *Diabetic Medicine* 27, 1217–1225.
- Wu, S., Kutlubaev, M.A., Chun, H.-Y.Y., Cowey, E., Pollock, A., Macleod, M.R., Dennis, M., Keane, E., Sharpe, M., Mead, G.E., 2015. Interventions for post-stroke fatigue, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Wu, T., Qingpu, L., Zhenyong, Y., 2007. Yizhi capsule for vascular dementia, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Xie, Y., Wang, L., He, J., Wu, T., 2008. Acupuncture for dysphagia in acute stroke, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Ye, X., Bapuji, S., Winters, S., Struthers, A., Raynard, M., Metge, C., Kreindler, S., Charette, C., Lemaire, J., Synyshyn, M., Sutherland, K., 2014. Effectiveness of internet-based interventions for children, youth, and young adults with anxiety and/or depression: a systematic review and meta-analysis (Provisional abstract). *BMC Health Services Research* 313.
- Young, L., Chan, P., Cram, P., 2011a. Staff acceptance of tele-ICU coverage: a systematic review (Provisional abstract). *Chest* 139, 279–288.
- Young, L., Chan, P., Lu, X., Nallamothe, B., Sasson, C., Cram, P., 2011b. Impact of telemedicine intensive care unit coverage on patient outcomes: a systematic review and meta-analysis (Structured abstract). *Archives of Internal Medicine* 171, 498–506.
- Yu, C., Bahniwal, R., Laupacis, A., Leung, E., Orr, M., Straus, S., 2012. Systematic review and evaluation of web-accessible tools for management of diabetes and related cardiovascular risk factors by patients and healthcare providers (Structured abstract). *Journal of the American Medical Informatics Association* 19, 514–522.
- Zeng, X., Yuan, Y., Wu, T., Yan, L., Su, H., 2007. Chinese herbal medicines for hyperthyroidism, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.
- Zhai, Y., Zhu, W., Cai, Y., Sun, D., Zhao, J., 2014. Clinical- and cost-effectiveness of telemedicine in type 2 diabetes mellitus: a systematic review and meta-analysis (Provisional abstract). *Medicine* e312.
- Zhang, X., Wu, T., Zhang, J., Yan, Q., Xie, L., Liu, G.J., 2007. Chinese medicinal herbs for the common cold, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

Zhao, J., Zhai, Y., Zhu, W., Sun, D., 2014. Effectiveness of telemedicine for controlling asthma symptoms: a systematic review and meta-analysis (Provisional abstract). *Telemedicine and e-Health* epub.

Zwarenstein, M., Goldman, J., Reeves, S., 2009. Interprofessional collaboration: effects of practice-based interventions on professional practice and healthcare outcomes, in: *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd.

10.2 STAKEHOLDER ENGAGEMENT 'PROJECT EXPLAINER' CARD



Health Innovation Network
 South London

NHS England Technology Enabled Care Evidence Review

About Technology Enabled Care Services

Technology Enabled Care Services (TECS) is a broad concept that encompasses a number of different types of technology solution, as follows:



Telehealth
The remote monitoring of patient's health status and its use to vary or personalise care.



Telecare
The placing of healthcare technologies in the patient's home.



Telemedicine
The use of remote consultation to deliver care at a distance from the healthcare provider.



Telecoaching
The provision of advice or talking therapy at a distance.



Digital health apps
Software provided on mobile devices which aims to support the delivery of treatment or preventive care, or self-management.

Strictly speaking, the term 'TECS' can apply both to digital solutions used in traditional healthcare settings (where the close connection with 'MedTech' devices blurs technological distinctions somewhat) and those deployed in *non*-traditional locations (e.g. devices enabling people to be monitored and supported in their home; remote assistive video/telephony systems).

It is the latter – digital solutions used *outside of* traditional health settings – and those focusing on remote, assistive technologies, that are the primary focus of the NHS England *Harnessing Technology* workstream and, accordingly, of this evidence review.

