Email for communicating results of diagnostic medical investigations to patients (Review)

Meyer B, Atherton H, Sawmynaden P, Car J

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2012, Issue 8

http://www.thecochranelibrary.com

TABLE OF CONTENTS

[Intervention Review]

Email for communicating results of diagnostic medical investigations to patients

Barbara Meyer[1], Helen Atherton[2], Prescilla Sawmynaden[3], Josip Car[4,5]

[1]General Practice, NHS Education for Scotland, Glasgow, UK. [2]Department of Primary Care Health Sciences, Oxford University, Oxford, UK. [3]Department of Primary Care and Public Health, Faculty of Medicine, Imperial College London, London, UK. [4]Global eHealth Unit, Department of Primary Care and Public Health, School of Public Health, Imperial College London, London, UK. [5]Department of Family Medicine, Faculty of Medicine, University of Ljubljana, Ljubljana, Slovenia

Contact address: Barbara Meyer, General Practice, NHS Education for Scotland, 14 Bower St, Glasgow, G12 8PT, UK. babsmeyer76@googlemail.com. babsmeyer@doctors.org.uk.

Editorial group: Cochrane Consumers and Communication Group.
Publication status and date: New, published in Issue 8, 2012.
Review content assessed as up-to-date: 5 January 2010.

Citation: Meyer B, Atherton H, Sawmynaden P, Car J. Email for communicating results of diagnostic medical investigations to patients. *Cochrane Database of Systematic Reviews* 2012, Issue 8. Art. No.: CD007980. DOI: 10.1002/14651858.CD007980.pub2.

ABSTRACT

Background

As medical care becomes more complex and the ability to test for conditions grows, pressure on healthcare providers to convey increasing volumes of test results to patients is driving investigation of alternative technological solutions for their delivery. This review addresses the use of email for communicating results of diagnostic medical investigations to patients.

Objectives

To assess the effects of using email for communicating results of diagnostic medical investigations to patients, compared to SMS/ text messaging, telephone communication or usual care, on outcomes, including harms, for health professionals, patients and caregivers, and health services.

Search methods

We searched: the Cochrane Consumers and Communication Review Group Specialised Register, Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library,* Issue 1 2010), MEDLINE (OvidSP) (1950 to January 2010), EMBASE (OvidSP) (1980 to January 2010), PsycINFO (OvidSP) (1967 to January 2010), CINAHL (EbscoHOST) (1982 to February 2010), and ERIC (CSA) (1965 to January 2010). We searched grey literature: theses/dissertation repositories, trials registers and Google Scholar (searched July 2010). We used additional search methods: examining reference lists and contacting authors.

Selection criteria

Randomised controlled trials, quasi-randomised trials, controlled before and after studies and interrupted time series studies of interventions using email for communicating results of any diagnostic medical investigations to patients, and taking the form of 1) unsecured email 2) secure email or 3) web messaging. All healthcare professionals, patients and caregivers in all settings were considered.

Data collection and analysis

Two review authors independently assessed the titles and abstracts of retrieved citations. No studies were identified for inclusion. Consequently, no data collection or analysis was possible.

Main results

No studies met the inclusion criteria, therefore there are no results to report on the use of email for communicating results of diagnostic medical investigations to patients.

Authors' conclusions

In the absence of included studies, we can draw no conclusions on the effects of using email for communicating results of diagnostic medical investigations to patients, and thus no recommendations for practice can be stipulated. Further well-designed research should be conducted to inform practice and policy for communicating patient results via email, as this is a developing area.

PLAIN LANGUAGE SUMMARY

The effects of using email to send test results to patients

As medical care becomes more complex and the ability to test for conditions grows, pressure on healthcare providers to convey increasing volumes of test results to patients is leading to consideration of different ways to deliver the results to patients.This review searched for high-quality research studies to try to determine how effective sending test results via email to patients or caregivers is, and what the outcomes are for patients/caregivers, healthcare professionals and health services. We found no studies that looked at the effects of using email for sending test results to patients, and so cannot present any results. We recommend that high-quality research is carried out to examine the use of email for this purpose.

BACKGROUND

Related systematic reviews

This review forms part of a suite of reviews, incorporating four other reviews:

- email for the coordination of healthcare appointments and attendance reminders (Atherton 2012);
- email for the provision of information on disease prevention and health promotion (Atherton 2009a);
- email for clinical communication between patients/caregivers and healthcare professionals (Atherton 2009c); and
- email for clinical communication between healthcare professionals (Atherton 2009b).

The use of email

Email is easy to use, widely available internationally and inexpensive. It is used in many areas of life, including banking, travel and retail. Despite the ubiquity of email in day-to-day life and in other sectors of the economy, its use in the healthcare sector is still not routine (Neville 2004; Dixon 2010) although it is increasing. Factors driving the trend of increasing email use include: the natural demographic shift towards an increasing proportion of people comfortable with using technology-driven care solutions; and higher demands on healthcare resources with, for instance, the advent of increased chronic care and demand for more preventive screening, resulting in a focus on working more efficiently (OECD 2006).

Where email communication has been demonstrated in healthcare settings, it is used for requesting prescriptions, booking appointments and for clinical consultation (Kleiner 2002; Gaster 2003; Kittler 2004; Neville 2004; Castren 2005; Anand 2005).

Email for communicating results of diagnostic medical investigations to patients

This review considered the use of email for delivering to patients the results of diagnostic investigations, such as radiological examinations and blood tests. Email is not suitable for all forms of communication, such as where negotiation or uncertainty is involved, but it has been shown to be a sound communication medium for the purposes of requesting or delivering factual information (Fridsma 1994).

Of the potential applications of email in health care, patients have cited the communication of results as one they are keen to see implemented (Neill 1994; Couchman 2001; Goldman 2006). Clinicians have also mirrored this desire (although to a lesser extent), particularly for sending out normal results (Goodyear-Smith 2005).

Advantages and disadvantages

The key advantages of using email for communicating results of diagnostic medical investigations include the following (adapted from Freed 2003; Car 2004a).

- Timely and low cost delivery of information (relative to conventional mail) (Houston 2003).
- Convenience; emails can be sent and subsequently read at an opportune time, outside of traditional office hours where convenient (Neville 2004; Leong 2005).
- The ability to automate the generation of a frequently-used results message.
- The capacity to place hyperlinks to appropriate educational material in an email.
- Email addresses usually stay constant when an address or telephone number changes (Virji 2006), making it a more reliable way of maintaining communication with transient patients.
- 'Read receipts' can be used to confirm that communications have been received.
- Relative to oral communication, the written nature of the communication can be valuable as reference for the recipient, aiding recall and providing evidence of the exchange (Car 2004a; Car 2004b).
- Emails can be archived in online or offline folders separate from the inbox of the email account so that they do not use up space in the inbox but can be kept for reference (Car 2004a; Car 2004b).
- Patients may feel that email is a more intimate, direct communication method than the telephone (Katz 2003).

There are, however, some potential downsides such as the following:

- There is evidence of patient and physician concerns regarding privacy, confidentiality and potential for the misuse of information (Fridsma 1994; Harris 2001; Kleiner 2002; Moyer 2002; Katzen 2005).
- Physicians are wary of the potential for email systems to generate an increased workload (Mandl 1998; Podichetty 2004).
- It may be difficult for practices to recover implementation and other associated costs (especially in fee-for-service healthcare systems) (Mandl 1998).
- Medico-legal issues may exist (including around informed consent and use of non-encrypted email) (Bitter 2000).
- There is the potential to widen health inequalities via the digital divide. As new technologies replace old systems, it has been suggested that certain sectors of the population are being left behind with regard to access and use of these services, such as the elderly, non-English speakers and those in lower income groups (Kleiner 2002; Katz 2004b; Goodyear-Smith 2005; Virji 2006).
- Technological issues may occur, such as recipients having a full mailbox causing email to bounce back to the sender (Virji 2006).
- Systems may be at risk of failures, such as a loss of the link to a central server (a computer which provides services used by other computers, such as email) (Car 2008a). There may be several causes of technological system failure; from local power failure to natural disasters.
- There is a potential for human error which can lead to unintended content or incorrect recipients.

Quality and safety issues

The main quality and safety issues around using email communication for results communication have included confidentiality, potential for errors and ensuing liability, securing payment, incorporating email into existing work patterns and achievable costs (Moyer 1999; Kleiner 2002; Gaster 2003; Gordon 2003; Hobbs 2003; Houston 2003; Car 2004b).

Privacy and confidentiality are a formidable challenge in the adoption of email communication (Car 2004b; Katz 2004a). Patients are more likely to use this type of communication if they have access to the Internet from home, rather than from work, because of privacy issues (Fridsma 1994). Family email accounts can mean a lack of privacy (Mandl 1998). Web messaging systems can address issues around security and liability that are associated with conventional email communication, since they offer encryption capability and access controls (Liederman 2003). However not all healthcare institutions are capable of providing such a facility and instead rely on standard mail (Car 2004b).

Medico-legal issues are of substantial concern when implementing email communication in practice. These include potential liability for security breaches allowing a third party to access confidential medical information, and the possibility of identity fraud whereby someone poses as a patient to obtain private information (Moyer 1999; Couchman 2001; Car 2004b). Suggestions for minimising the legal risks of using email in practice have included: adherence to the same strict data protection rules that must be followed in business and industry; adequate infrastructure to provide encrypted, secure email transit and storage; and the use of informed consent to ensure that the patient is aware of the risks and benefits associated with receiving diagnostic medical results via email (Car 2004b). Obtaining informed consent could include the provision of guidelines to patients about the use of email communication, and provide an opportunity for authentication of identity. Authentication of patient identity can be achieved by routinely validating patient email addresses when email communication commences. Ongoing validation of identity has also been recommended (Medem 2007).

Patient opinion of such systems is also important. Issues facing service users have included questionable reliability, timeliness and the impersonal nature of email (Katz 2003). There is already evidence for patients having diverse preferences about receiving their diagnostic test results (Couchman 2005). For example, there may be a strong case for using email to deliver good news where no

consultation is required (such as a negative chlamydia screening result). Complex messages, such as an inconclusive chest x-ray, may not be suitable for email communication.

Such issues are wide ranging and encompass both healthcare professional and patient perspectives. We planned to identify all issues of quality and safety arising in the included studies. The review is both timely and necessary, since the email delivery of diagnostic test results is in its infancy, and is developing in a non-uniform fashion in the absence of clear evidence of its efficacy, safety and acceptability.

Forms of electronic mail

In the absence of a standardised email communication infrastructure in the healthcare sector, email has been adopted in an ad-hoc fashion and this has included the use of unsecured and secured email communication.

Standard unsecured email is email which is sent unencrypted. Secured email is encrypted; encryption transforms the text into an un-interpretable format as it is transferred across the Internet. Encryption protects the confidentiality of the data, however both sender and recipient must have the appropriate software for encryption and decoding (TechWeb Network 2008).

Secure email also includes various specifically developed applications such as patient portals which utilise web messaging. Such portals provide pro-formas into which patients can enter their message. The message is sent to the recipient in the manner of an email (TechWeb Network 2008).

Secure websites are distributed by secure web servers. Web servers store and disseminate web pages. Secure servers ensure data from an Internet browser is encrypted before being uploaded to the relevant website. This makes it difficult for the data to be intercepted and deciphered (TechWeb Network 2008).

There are significant differences in terms of these applications. Bespoke secure email programmes may incorporate special features such as standard forms guiding the use and content of the email sent, the capacity to show read receipts (in order to confirm the patient has received the correspondence) and, if necessary, facilities for receiving payment (Liederman 2005). However they are costly to set up and may require a greater degree of skill on the part of the user than standard unsecured email (Katz 2004b). For the purpose of the review all methods are included, although secured versus unsecured email would be considered in a subgroup analysis.

Methods of accessing email

Methods of accessing the Internet and thus an email account have changed with time. Traditionally, access would occur via a personal computer or laptop at home or work, connecting to the Internet using a fixed line. There are now several methods of accessing the Internet. Wireless networks (known colloquially as wifi) allow Internet connection to a personal computer, laptop computer or other device wherever a network is available (TechWeb Network 2008). Internet connection is also possible via alternative networks using mobile devices. This includes access via mobile telephones to a wireless application protocol (WAP) network (rather than to the world wide web) or to the third generation (3G) network. Adaptors connecting to a universal serial bus (USB) port can be used to access the 3G network using a laptop computer (TechWeb Network 2008). Therefore email can be accessed away from the office or home in a variety of ways.

For the purposes of the review we included all methods of email access.

OBJECTIVES

To assess the effects of using email for communicating results of diagnostic medical investigations to patients compared to SMS/ text messaging, telephone communication or usual care, on outcomes, including harms, for health professionals, patients and caregivers, and health services.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials (RCTs), quasi-randomised trials, controlled before and after studies (CBAs) with at least two intervention and two control sites, and interrupted time series (ITS) with at least three time points before and after the intervention.

Due to the practicalities of organisational change in a healthcare environment, most studies are not randomised and therefore we considered quasi-randomised trials and CBAs. The inclusion of ITS is particularly valuable in assessing the ongoing merits of a new technology which may required a 'settling in' period. We included trials with individual and cluster randomisation, and relevant trials with economic evaluations.

Types of participants

We considered healthcare professionals, associated administrative staff, patients and caregivers regardless of age, gender and ethnicity. We included studies in all settings, i.e. primary care settings (services of primary health care), outpatients settings (outpatient clinics), community settings and hospital settings. We did not exclude studies according to the type of healthcare professional (e.g. surgeon, nurse, doctor, allied staff).

We considered participants originating the email communication, receiving the email communication and copied into the email communication.

Types of interventions

We included interventions using email for communicating results of any diagnostic medical investigations to patients.

We considered interventions that used email in any of the following three forms:

1. Unsecured standard email to/from a standard email account.
2. Secure email which is encrypted in transit and sent to/from a standard email account with the appropriate decoding software.
3. Web messaging, whereby the message is entered into a proforma which is sent to a specific email account, the address of which is not available to the sender.

We included all methods of accessing email, including broadband via a fixed line, broadband via a wireless connection, connecting to the 3G network and connecting to the WAP network.

Studies in which email was part of a multifaceted intervention were included where the effects were individually reported, even if they did not represent the primary outcome, but only if they achieved the appropriate statistical power. Where this could not be determined, or where it was not possible to separate the effects, we excluded these studies.

We included studies comparing the intervention to no intervention, as well those comparing it to other modes of communication such as face-to-face, postal letters, calls to a landline or mobile telephone, text messaging using a mobile telephone, and if applicable, automated versus personal emails.

We excluded mobile phone text messaging for communicating results, which is the subject of a separate Cochrane review (Gurol-Urganci 2012).

We excluded trials which considered the general use of email for healthcare professional-patient contact for multiple purposes, where communicating the results of diagnostic medical investigations was included but not separately evaluated.

Types of outcome measures

Primary outcomes of interest focused on whether the email has been understood and acted upon correctly by the recipient as intended by the sender, and secondary outcomes focused on whether email was an appropriate mode for the communication exchange.

Primary outcomes

Healthcare professional outcomes resulting from whether the email has been understood and acted upon correctly by the recipient (patient) as intended by the sender (professional), e.g. professional knowledge and understanding, professional behaviour, actions or performance.

Patient outcomes associated with whether the email has been understood and acted upon correctly by the recipient as intended by the sender, e.g. patient understanding, clinical progression, treatment outcomes, patient health status and well-being, patient behaviours or actions (such as making requested follow-up appointments).

Health service outcomes associated with whether the email has been understood and acted upon correctly by the recipient as intended by the sender, e.g. service use, management or coordination of health problem.

Harms e.g. effects on safety or quality of care, breaches in privacy, technology failures.

Secondary outcomes

Professional, patient or carer outcomes associated with whether email was an appropriate mode for the communication exchange, e.g. knowledge and understanding, effects on professional-patient or professional-carer communication or relationship, evaluations of care (such as convenience, timeliness, acceptability, satisfaction).

Health service outcomes associated with whether email was an appropriate mode for the communication exchange, e.g. use of resources or time, costs.

Search methods for identification of studies

Electronic searches

We searched the following electronic bibliographic databases.

- Cochrane Consumers and Communication Review Group Specialised Register (searched 8 January 2010)
- Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library,* Issue 1 2010)
- MEDLINE (OvidSP) (1950 to 5 January 2010)
- EMBASE (OvidSP) (1980 to 7 January 2010)
- PsycINFO (OvidSP) (1967 to 5 January 05/01/2010)
- CINAHL (EbscoHOST) (1982 to 2 February 2010)
- ERIC (CSA) (1965 to 7 January 2010)

We present detailed search strategies in Appendices 2 to 7. John Kis-Rigo, Trials Search Coordinator for the Cochrane Consumers and Communication Group compiled the strategies.

There were no language or date restrictions.

Searching other resources

Grey literature

We searched for grey literature, and ongoing and recently completed studies, in July 2010, using the following sources:

- Australasian Digital Theses Program (http://adt.caul.edu.au/)
- Networked Digital Library of Theses and Dissertations (http://www.ndltd.org)
- UMI ProQuest Digital Dissertations (http://wwwlib.umi.com/dissertations/)
- Index to Theses (http://www.theses.com/) (Great Britain and Ireland)
- Clinical trials register (Clinicaltrials.gov)
- WHO Clinical Trial Search Portal (www.who.int/trialsearch)
- Current Controlled Trials (www.controlled-trials.com)
- Google Scholar (http://scholar.google.co.uk/) (we examined the first 500 hits)

We searched databases from their start date and there were no limitations by language. We kept detailed records of all the search strategies applied.

Reference lists

We examined the reference lists of retrieved relevant studies.

Correspondence

We contacted the authors of included studies across all five reviews (Atherton 2009a; Atherton 2009b; Atherton 2009c; Atherton 2012) for advice as to any further studies or unpublished data that they were aware of. Many of the authors of these included studies were also experts in the field.

Data collection and analysis

Selection of studies

Two review authors (HA and PS) independently assessed the potential relevance of all titles and abstracts identified from electronic searches. We retrieved full text copies of all articles judged to be potentially relevant. Both HA and PS independently assessed these retrieved articles for inclusion. Where HA and PS could not reach consensus a third author, JC, examined these articles. During a meeting of all review authors we verified that there were no included studies in the review.

Data extraction and management

The methods that we would have applied had we found any studies are outlined in Appendix 1 and will be applied to future updates of the review.

Consumer input

We asked two consumers, a health services researcher (UK) and healthcare consultant (Saudi Arabia) to comment on the completed reviews (all five email reviews) before submitting each for the peer-review process, with a view to obtaining feedback on the applicability of the review to potential users. The review also received feedback from two consumer referees as part of the Cochrane Consumers and Communication Review Group's standard editorial process.

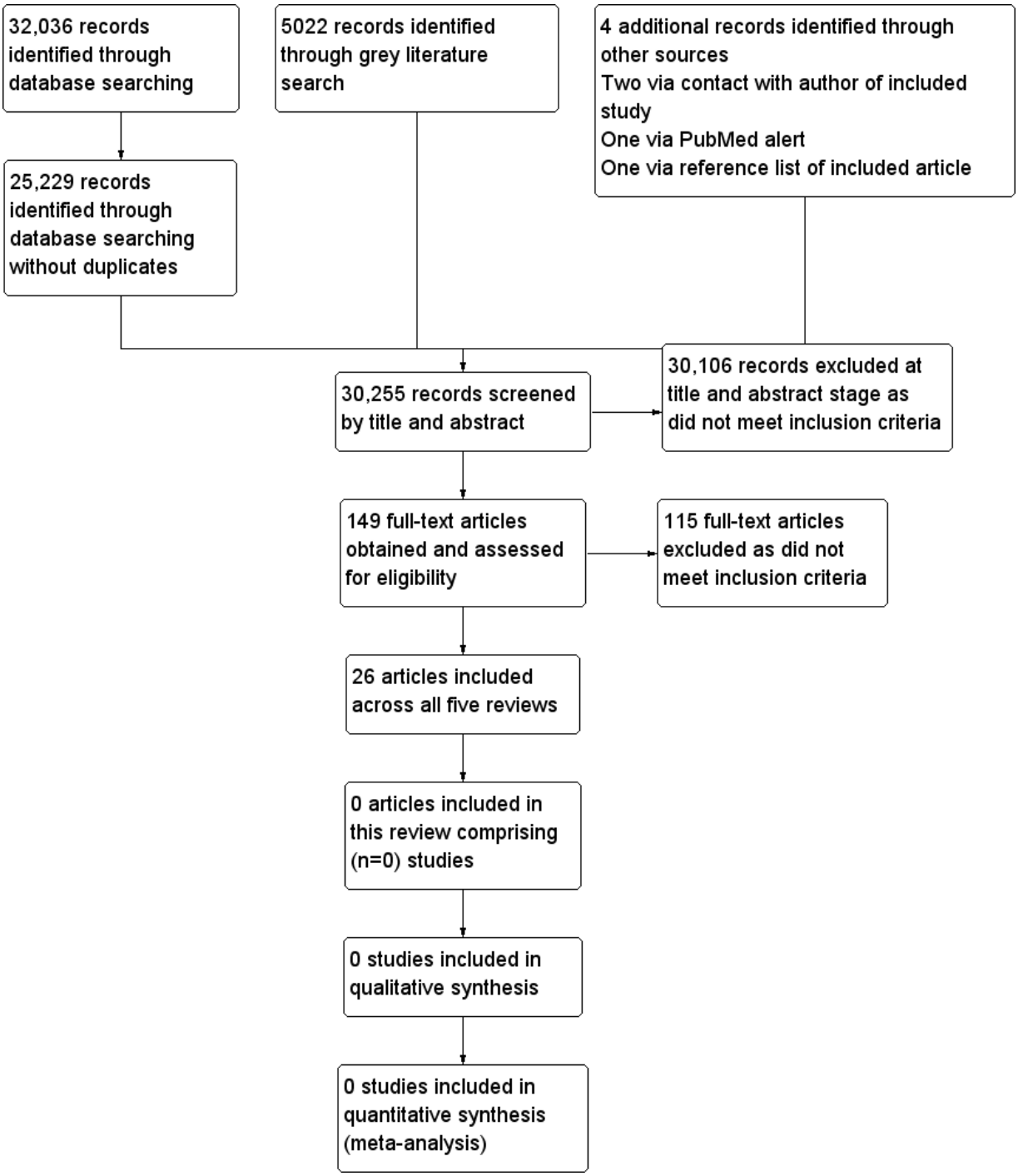
RESULTS

Description of studies

Results of the search

As this review was one in a set of five looking at varying uses of email in healthcare, we conducted a common search for all five reviews (Atherton 2009a; Atherton 2009b; Atherton 2009c; Atherton 2012). Relevant articles were allocated to the appropriate review after being assessed at the full text stage. Figure 1 illustrates the various stages of the search.

Figure 1. Flow diagram illustrating search results.



Included studies

For this review, we identified no studies meeting the inclusion criteria.

Risk of bias in included studies

There were no included studies.

Effects of interventions

There were no included studies.

DISCUSSION

Summary of main results

We found no studies specifically evaluating the use of email to sending test results, despite this being a feature patients were keen to see implemented (Couchman 2001).

Unlike interventions with a directly-measurable impact on health (drug treatments, surgical procedures), email is a complex intervention and its potential impact may come from any number of factors. A complex intervention is one that has several interacting components (Craig 2008). The complexity can have several dimensions; these may include the organisational levels targeted by the intervention (administrative staff, nurses, doctors, management) or degree of flexibility or tailoring of the intervention permitted (standard email allowing free text, web-based systems with a pro-forma for entering text). As a consequence of this complexity it may be more difficult to determine what should be tested and how, and doing this in the context of a controlled trial may be perceived as difficult. We included other types of study designs as well as randomised controlled trials in this review, but none of the listed study designs were identified.

Overall completeness and applicability of evidence

Possible reasons for the lack of included studies may be that emailing diagnostic results to patients comes under the more general category of administrative purposes for email (e.g. scheduling appointments, medication requests or test results) or features as part of generic patient- physician communication systems. In the linked review (Atherton 2009c) of email for communication between patients/caregivers and healthcare professionals, systems set up to facilitate email communication between patients/caregivers and healthcare professionals were used by some patients to enquire about test results and their implications, rather than being used by physicians for sending results to patients However, these studies did not meet the inclusion criteria for this review (Katz 2004b; Kummervold 2004; Lin 2005; Ross 2004; Stalberg 2008).

The idea of communicating results of diagnostic medical investigations featuring as part of a general patient-physician communication system is considered in studies by various US health system organisations. Kaiser Permanente analysed data collected via their integrated electronic health record system on the use of email between physician and patients, and this system included provision of laboratory test results (Zhou 2010). Geisinger, another US health system organisation, conducted an online survey of patients using their patient portal for messaging their healthcare provider, and a function of this portal was the ability for patients to view their 25 most frequently-ordered laboratory tests, with an explanation of the results (Hassol 2004). Both of these organisations utilised systems already in place in the form of integrated electronic healthcare records to carry out their research, rather than conducting trials. Zhou 2010 stated that they "could not conduct a randomized controlled trial; the system architecture and implementation schedules of the patient portal precluded it" and that they were unable to "assess the effect of secure patient-physician e-mail independent of other functionalities of the portal, including lab test results." Other organisations in the US (Abbott 2002; Adamson 2010) and across the world have carried out similar research on existing systems that have multiple functions (Neville 2004) such as provision of test results.

Practice for advising patients of their diagnostic test results varies between clinicians (Boohaker 1996). It may be difficult to establish the overall benefits of any particular method where there is a wide variability in the proportion of telephone transmission/ postal results as well as in the proportion of results proactively reported to patients. Some practices have a policy of 'no news is good news', by which the patient should assume that if the result is not communicated, the result was normal. There are inherent concerns with this strategy, such as the lack of safety netting. Additionally, sending results via email could result in increased workloads (albeit that practices may be meeting previously unmet patient need) (Keren 2003). No single method is suitable for conveying all types of test result, as they have different requirements in terms of urgency and complexity of the message to be delivered. As almost all practices use a combination of methods, and email is likely to provide a complementary option to the current methods, simple studies comparing efficiency of email versus telephone are likely to be somewhat artificial. The suitability of email would largely depend on the complexity and urgency of the result. It may be more useful to study specific types of test result, e.g. negative chlamydia

screening, to establish whether results were adequately understood in a confidential, cost-effective and timely fashion when compared to alternative methods of receiving the same information.
Finally, it is possible that trials have been conducted that are not available in the literature, having found inconclusive or negative benefits of new system developments which may be commercial ventures. Such possible publication biases should be discouraged by use of trial registration, though this is more difficult where commercial organisations drive research.

Quality of the evidence

The search for this review was conducted in January 2010. The length of time that has elapsed between the search date and the publication of this review means that it is possible that relevant studies have been published in the interim period. To counter this, we will update the review in the near future.

AUTHORS' CONCLUSIONS

Implications for practice

No recommendations for practice can be made given the current lack of evidence of benefit (or harm). This is unfortunate, given the burgeoning requirements for patient testing in the areas of health screening e.g. cholesterol, diabetes, renal function and sexual health screening (Swartzendruber 2010; Khunti 2011). Healthcare workers need to examine more efficient patterns of working to keep up with increased per capita healthcare demands (OECD 2006). With ever growing internet access, email usage and technological familiarity in the general population, email provides an obvious mechanism for the transmission of results.

Implications for research

This review highlights the need for randomised controlled trials to evaluate the effects of using email for communicating results of diagnostic medical investigations to patients. Future trials need to be rigorous in design and delivery, with reporting to include high-quality descriptions of all aspects of methodology to enable appraisal and interpretation of results. Prompting the development of such trials may involve addressing barriers to trial development and implementation, including funding and time.

Well-designed randomised controlled trials or controlled before and after studies are needed to ascertain if email will be an effective, safe and secure medium for transmission of results. Trials would benefit from initially focusing on diagnostic tests that lead to a clearly understood results e.g. a normal pap smear or normal prostate specific antigen (PSA) test result (Katz 2004b). In a survey of patient and physicians, these were some the types of tests that were selected as being the most appropriate for transmission via email. As the complexity of the message increases and the need for negotiation of meaning between patient and healthcare professional grows, it seems less likely that email would be suitable. It would require supplementary/additional clinic or telephone consultation (Katz 2004b). For example, abnormal PSA results present a much greater challenge to practitioners in conveying the non-specific nature of the test and its possible interpretations.

Factors to consider are successful receipt of message and time to receipt compared to current standard practice of telephone or postal communications. Some authors (Freed 2003; Car 2008a) have suggested that the use of email communications may be transformational, and as such unexpected outcomes and consequences of this new use of technology may occur. For instance the effect of email on the patient-physician relationship may be difficult to capture in quantitative research formats. Qualitative research methods may provide a deeper insight into issues raised by the use of email to provide patients with test results. These issues may, for example, relate to patient satisfaction.

The chosen study design should allow for analysis of possible variation of effect by patient group, especially by income, education and age. A concern often cited by both patients and physicians is the security of email messaging (Car 2004b) and so this should be addressed specifically to allay or confirm fears which may be influencing its use. Additionally, while postal mail is traditionally considered a more secure method, the robustness of this assertion should be proven as there are numerous potential problems with postal mail including use of an incorrect address or mail being opened by another family member.

Workload concerns have been raised by healthcare staff in relation to email, and future studies should assess the impact of email for results communication on the volume of telephone communications and on follow-up consultations. Katz 2004b notes that more sensitive measures of workload unit should be developed to allow a more accurate measurement of the impact of email for communication. The costs of email have reduced in recent years owing to its ubiquity, and its scaleable nature means that costs do not increase as rapidly with larger numbers of patients as with other methods of communication. Therefore economic assessments should be undertaken where possible.

Outcomes to be assessed by future studies may feature those predominately relating to email, such as its usability, security and impact on healthcare professionals' workload. However it may also assess factors that arise as a consequence of the nature of email: the personal communication it can allow, its two-way nature and the capacity to retain a copy of the information sent/received.

ACKNOWLEDGEMENTS

We thank the staff and editors of the Cochrane Consumers and Communication Review Group, especially Sophie Hill and Megan Prictor for their prompt and helpful advice and assistance.

We thank John Kis-Rigo, Trials Search Coordinator, Cochrane Consumers and Communication Group, for compiling the search strategy.

We thank the authors of the protocol: Mobile phone messaging for communicating results of medical investigations (Gurol-Urganci 2012). In devising the protocol for this review we adapted their selection criteria for types of studies, participants and interventions for use in this review.

We are also grateful to Helen Marlbourgh, of Glasgow University, for guidance regarding search strategies. We thank Aziz Sheikh who provided general advice on the review.

We thank Carina King and Dr Riyadh Alshamsan for consumer input at the review stage.

REFERENCES

Additional references

Abbott 2002
Abbott KC, Mann S, DeWitt D, Youngblood SL, Kennedy S, Poropatich RK. Physician-to-physician consultation via electronic mail: The Walter Reed Army Medical Center ask a doc system. *Military Medicine* 2002;**167**(3):200–4.

Adamson 2010
Adamson SC, Bachman JW. Pilot study of providing online care in a primary care setting. *Mayo Clinic Proceedings* 2010; **85**(8):704–10.

Alderson 2002
Alderson P, Green S. Issues related to the unit of analysis. Cochrane Collaboration Open Learning Material. http://www.cochrane-net.org/openlearning/html/modA2.htm 2002.

Anand 2005
Anand SG, Feldman MJ, Geller DS, Bisbee A, Bauchner H. Content analysis of e-mail communication between primary care providers and parents. *Pediatrics* 2005;**115**(5):1283–8.

Atherton 2009a
Atherton H, Car J, Meyer B. Email for the provision of information on disease prevention and health promotion. *Cochrane Database of Systematic Reviews* 2009, Issue 3. [DOI: 10.1002/14651858.CD007982]

Atherton 2009b
Atherton H, Car J, Meyer B, Majeed A. Email for clinical communication between healthcare professionals. *Cochrane Database of Systematic Reviews* 2009, Issue 3. [DOI: 10.1002/14651858.CD007979]

Atherton 2009c
Atherton H, Car J, Meyer B. Email for clinical communication between patients/caregivers and healthcare professionals. *Cochrane Database of Systematic Reviews* 2009, Issue 3. [DOI: 10.1002/14651858.CD007978]

Atherton 2012
Atherton H, Sawmynaden P, Meyer B, Car J. Email for the coordination of healthcare appointments and attendance reminders. *Cochrane Database of Systematic Reviews* 2012, Issue in press.[Art. No.: CD007981. DOI: 10.1002/14651858.CD007981.pub2]

Bitter 2000
Bitter J. E-mail in medical practice: legal and ethical concerns. *Quality Risk Cost Advisor* 2000;**16**(3):1–8.

Boohaker 1996
Boohaker EA, Ward RE, Uman JE, McCarthy BD. Patient notification and follow-up of abnormal test results. A physician survey. *Archives of Internal Medicine* 1996;**156**(3): 327–31.

Car 2004a
Car J, Sheikh A. Email consultations in health care: 1. scope and effectiveness. *BMJ* 2004;**329**(7463):435–38.

Car 2004b
Car J, Sheikh A. Email consultations in health care. 2. acceptability and safe application. *BMJ* 2004;**329**:439–42.

Car 2008a
Car J, Black A, Anandan C, Cresswell K, Pagliari C, McKinstry B, et al.The impact of eHealth on the quality and safety of healthcare. http://www1.imperial.ac.uk/resources/4565EF18-662B-448B-90C2-E7372B4C2E09/ 2008.

Castren 2005
Castren J, Niemi M, Virjo I. Use of email for patient communication in student health care: a cross-sectional study. *BMC Medical Informatics & Decision Making* 2005;**5** (1):2.

Couchman 2001
Couchman GR, Forjuoh SN, Rascoe TG. E-mail communications in family practice: what do patients expect?. *Journal of Family Practice* 2001;**50**(5):414–8.

Couchman 2005
Couchman GR, Forjuoh SN, Rascoe TG, Reis MD, Koehler B, Walsum KL. E-mail communications in primary care: what are patients' expectations for specific test results? . *International Journal of Medical Informatics* 2005;**74**(1): 21–30.

Craig 2008
Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008;**337**:a1655.

Dixon 2010
Dixon RF. Enhancing primary care through online communication. *Health Affairs* 2010;**29**(7):1364–9.

Freed 2003
Freed DH. Patient-physician e-mail: passion or fashion?. *Health Care Management* 2003;**22**(3):265–74.

Fridsma 1994
Fridsma DB, Ford P, Altman R. A survey of patient access to electronic mail: attitudes, barriers, and opportunities. Proceedings of the Annual Symposium on Computer Applications in Medical Care. 1994:15–19.

Gaster 2003
Gaster B, Knight CL, DeWitt DE, Sheffield JV, Assefi NP, Buchwald D. Physicians' use of and attitudes toward electronic mail for patient communication. *Journal of General Internal Medicine* 2003;**18**(5):385–9.

Goldman 2006
Goldman RD, Macpherson A. Internet health information use and e-mail access by parents attending a paediatric emergency department. *Emergency Medicine Journal* 2006; **23**(5):345–8.

Goodyear-Smith 2005
Goodyear-Smith F, Wearn A, Everts H, Huggard P, Halliwell J. Pandora's electronic box: GPs reflect upon email communication with their patients. *Informatics in Primary Care* 2005;**13**(3):195–202.

Gordon 2003
Gordon C, Krimholtz M. E-mail and patients: a medicolegal minefield. *Lancet* 2003;**362**(9397):1768.

Gurol-Urganci 2012
Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Car J, Atun R. Mobile phone messaging for communicating results of medical investigations. *Cochrane Database of Systematic Reviews* 2012, Issue 6. [DOI: 10.1002/14651858.CD007456.pub2]

Harris 2001
Harris Interactive. New data show internet, website and email usage by physicians all increasing. www.harrisinteractive.com/news/newsletter/healthnews/HI˙HealthCareNews2001Vol1˙iss8.pdf 2001.

Hassol 2004
Hassol A, Walker JM, Kidder D, Rokita K, Young D, Pierdon S, et al.Patient experiences and attitudes about access to a patient electronic health care record and linked web messaging. *Journal of the American Medical Informatics Association* 2004;**11**(6):505–13.

Higgins 2008
Higgins JPT, Green S (eds). Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.1. www.cochrane-handbook.org 2008.

Hobbs 2003
Hobbs J, Wald J, Jagannath YS, Kittler A, Pizziferri L, Volk LA, et al.Opportunities to enhance patient and physician e-mail contact. *International Journal of Medical Informatics* 2003;**70**(1):1–9.

Houston 2003
Houston TK, Sands DZ, Nash BR, Ford DE. Experiences of physicians who frequently use e-mail with patients. *Health Communication* 2003;**15**(4):515–25.

Katz 2003
Katz SJ, Moyer CA, Cox DT, Stern DT. Effect of a triage-based E-mail system on clinic resource use and patient and physician satisfaction in primary care: a randomized controlled trial. *Journal of General Internal Medicine* 2003; **18**:736–44.

Katz 2004a
Katz SJ, Moyer CA. The emerging role of online communication between patients and their providers. *Journal of General Internal Medicine* 2004;**19**:978–83.

Katz 2004b
Katz SJ, Nissan N, Moyer CA. Crossing the digital divide: evaluating online communication between patients and their providers. *The American Journal of Managed Care* 2004;**10**:593–98.

Katzen 2005
Katzen C, Solan MJ, Dicker AP. E-mail and oncology: a survey of radiation oncology patients and their attitudes to a new generation of health communication. *Prostate Cancer & Prostatic Diseases* 2005;**8**(2):189–93.

Keren 2003
Keren R, Muret-Wagstaff S, Goldmann DA, Mandl KD. Notifying emergency department patients of negative test results: pitfalls of passive communication. *Paediatric Emergency Care* 2003;**19**(4):226–30.

Khunti 2011
Khunti K, Walker N, Sattar N, Davies M. Unanswered questions over NHS health checks. *British Medical Journal* 2011;**342**:c6312.

Kittler 2004
Kittler AF, Carlson GL, Harris C, Lippincott M, Pizziferri L, Volk LA, et al.Primary care physician attitudes towards using a secure web-based portal designed to facilitate electronic communication with patients. *Informatics in Primary Care* 2004;**3**:129–38.

Kleiner 2002
Kleiner KD, Akers R, Burke BL, Werner EJ. Parent and physician attitudes regarding electronic communication in pediatric practices. *Pediatrics* 2002;**109**(5):740–4.

Kummervold 2004
Kummervold PE, Trondsen M, Andreassen H, Gammon D, Hjortdahl P. Patient-physician interaction over the internet. *Tidsskrift for den Norske Laegeforening* 2004;**124** (20):2633–6.

Leong 2005
Leong SL, Gingrich D, Lewis PR, Mauger DT, George JH. Enhancing doctor-patient communication using email: a pilot study. *Journal of the American Board of Family Practice* 2005;**18**(3):180–8.

Liederman 2003
Liederman EM, Morefield CS. Web messaging: a new tool for patient-physician communication. *Journal of*

the American Medical Informatics Association 2003;**10**(3): 260–70.

Liederman 2005
Liederman EM, Lee JC, Baquero VH, Seites PG. The impact of patient-physician Web messaging on provider productivity. *Journal of Healthcare Information Management* 2005;**20**:52–7.

Lin 2005
Lin CT, Wittevrongel L, Moore L, Beaty BL, Ross SE. An Internet-basedpatient-provider communication system: randomized controlled trial. *Journal of Medical Internet Research* 2005;**7**(4):e47.

Mandl 1998
Mandl KD, Kohane IS, Brandt AM. Electronic patient-physician communication: problems and promise. *Annals of Internal Medicine* 1998;**129**(6):495–500.

Medem 2007
Medem Inc. eRisk Working Group for Healthcare's Guidelines for Online Communication. http://www.medem.com/phy/phy˙eriskguidelines.cfm 2007.

Moyer 1999
Moyer CA, Stern DT, Katz SJ, Fendrick AM. "We got mail": electronic communication between physicians and patients. *American Journal of Managed Care* 1999;**5**(12):1513–22.

Moyer 2002
Moyer CA, Stern DT, Dobias KS, Cox DT, Katz SJ. Bridging the electronic divide: patient and provider perspectives on e-mail communication in primary care. *American Journal of Managed Care* 2002;**8**(5):427–33.

Neill 1994
Neill RA, Mainous AG III, Clark JR, Hagen MD. The utility of electronic mail as a medium for patient-physician communication. *Archives of Family Medicine* 1994;**3**(3): 268–71.

Neville 2004
Neville RG, Marsden W, McCowan C, Pagliari C, Mullen H, Fannin A. Email consultations in general practice. *Informatics in Primary Care* 2004;**12**(4):207–14.

OECD 2006
Projecting OECD health and long-term health care expenditures; what are the main drivers?. www.oecd.org/dataoecd/57/7/36085940.pdf2006.

Pew 2005
The Pew Internet & American Life Project. Generations online. www.pewinternet.org/pdfs/PIP˙Generations˙Memo.pdf (accessed 10 Aug 2007).

Podichetty 2004
Podichetty V, Penn D. The progressive roles of electronic medicine: benefits, concerns, and costs. *American Journal of the Medical Sciences* 2004;**328**(2):94–9.

Ross 2004
Ross SE, Moore LA, Earnest MA, Wittevrongel L, Lin C. Providing a web-based online medical record with electronic communication capabilities to patients with congestive heart failure: randomized trial. *Journal of Medical Internet Research* 2004;**6**:e12.

Ryan 2007
Ryan R, Hill S, Broclain D, Horey D, Oliver S, Prictor M, Cochrane Consumers and Communication Review Group. Study Quality Guide. www.latrobe.edu.au/cochrane/resources.html (accessed Dec 2008) 2007.

Stalberg 2008
Stalberg P, Yeh M, Ketteridge G, Delbridge H, Delbridge L. E-mail access and improved communication between patient and surgeon. *Archives of Surgery* 2008;**143**(2): 164–9.

Swartzendruber 2010
Swartzendruber A, Zenilman JM. A national strategy to improve sexual health. *JAMA* 2010;**304**(9):1005–6.

TechWeb Network 2008
TechWeb Network. TechWeb Encylopedia. http://www.techweb.com/encyclopedia 2008.

Virji 2006
Virji A, Yarnall KS, Krause KM, Pollak KI, Scannell MA, Gradison M, et al.Use of email in a family practice setting: opportunities and challenges in patient- and physician-initiated communication. *BMC Medicine* 2006;**4**:18.

Zhou 2010
Zhou YY, Kanter MH, Wang JJ, Garrido T. Improved quality at Kaiser Permanente through e-mail between physicians and patients. *Health Affairs* 2010;**29**(7):1370–5.

References to other published versions of this review

Meyer 2009
Meyer B, Car J, Atherton H, McKinstry B. Email for communicating results of diagnostic medical investigations to patients. *Cochrane Database of Systematic Reviews* 2009, Issue 3. [DOI: 10.1002/14651858.CD007980]

* *Indicates the major publication for the study*

DATA AND ANALYSES

This review has no analyses.

APPENDICES

Appendix 1. Methods for application in future updates

We outline below the methods to be applied in any future updates of this review, should studies be identified for inclusion.

Data extraction and management

We will extract data from all included studies using a standard form derived from the data extraction template provided by the Cochrane Consumers and Communication Review Group. We will extract the following data:

- *General information:* Title, authors, source, publication status, date published, language, review author information, date reviewed.
- *Details of study:* Aim of intervention and study, study design, location and details of setting, methods of recruitment of participants, inclusion/exclusion criteria, ethical approval and informed consent, consumer involvement.
- *Assessment of study quality:* Key features of allocation, contemporaneous data collection for intervention and control groups; and for interrupted time series, number of data points collected before and after the intervention, follow-up of participants.
- *Risk of bias:* data to be extracted depends on study design (see Assessment of risk of bias in included studies).
- *Participants:* Description, geographical location, setting, number screened, number randomised, number completing the study, age, gender, ethnicity, socio-economic grouping and other baseline characteristics, test requested, diagnosis, treatment.
- *Health service:* description, geographical location, setting, age, gender, population served, medical setting and clinical context of patients.
- *Intervention:* Description of the intervention and control including rationale for intervention versus the control (usual care). Delivery of the intervention including email type (standard unsecured email, secure email, web portal or hybrid). Type of clinical information communicated. Content of communication (e.g. text, image). Purpose of communication (e.g. obtaining information, providing information). Communication protocols in place. Who delivers the intervention (e.g. healthcare professional, administrative staff). How consumers of interventions are identified. Sender of first communication (health service, professional, patient and/or carer). Recipients of first communication (health service, professional, patient and/or carer). Whether the communication invites a response (content, frequency). Any co-interventions included. Duration of intervention. Quality of intervention. Follow up period and rationale for chosen period.
- *Outcomes:* principal and secondary outcomes, methods for measuring outcomes, methods of follow-up, tools used to measure outcomes, whether the outcome is validated.
- *Results:* for outcomes and timing of outcome assessment, control and intervention groups if applicable.

The data extraction template will be piloted to allow for unforeseen variations in studies. For every included study at least two review authors will independently perform the data extraction. Any discrepancies between the review authors' data extraction sheets will be discussed and resolved, though where necessary; we will involve another review author to resolve discrepancies.

Assessment of risk of bias in included studies

Two review authors will independently assess the quality of included studies, with any disagreements resolved by discussion and consensus, and by consulting a third author where necessary. Studies of different designs will be dealt with separately throughout this review in both the quality assessment and analysis.

For RCTs (and quasi RCTs), we will assess and report on the following elements that contribute to bias, according to the guidelines outlined in Higgins 2008:

- Sequence generation;

- Allocation concealment;
- Blinding (participants, personnel, outcomes assessors, data analysers);
- Intention-to-treat analysis;
- Incomplete outcome data;
- Selective outcome reporting.

We will describe the study and assign a judgement relating to the risk of bias for each item. We would use a template to guide the assessment of risk of bias, based upon the guidance by Higgins 2008, judging each item as 'yes' (indicating a low risk of bias), 'no' (indicating a high risk of bias) or 'unclear' (indicating an uncertain risk of bias). For each study we will summarise the risk of bias for each outcome.

We will also assess a range of other possible sources of bias and indicators of study quality, in accordance with the guidelines of the Cochrane Consumers and Communication Review Group (Ryan 2007), including:

- Baseline comparability of groups;
- Validation of outcome assessment tools;
- Reliability of outcome measures;
- Other possible sources of bias

In the case of studies other than RCTs being identified (that is, quasi-randomised controlled trials, CBA and ITS studies) we will additionally assess the quality of these studies systematically and according to the criteria outlined in the guidelines of the Cochrane Consumers and Communication Review Group so that risk of bias may be ascertained.

We will present the results of the risk of bias assessment in tables and incorporating the results of the assessment of risk of bias into the review through systematic narrative description and commentary about each of the quality items, for each type of included study. This leads to an overall assessment of the risk of bias across the included studies and a judgement about the possible effects of bias on the effect sizes of the included studies.

Where required, we will contact study authors for additional information about the included studies, or for clarification of the study methods.

Measures of treatment effect

For continuous data, where outcomes have been measured in a standard way across studies, we will report the mean difference and confidence intervals. For dichotomous data, when outcomes have been measured in a standard way, we will report the odds ratio/risk ratio and confidence intervals.

Unit of analysis issues

Issues may arise from the inclusion of cluster-randomised trials, repeated measurements and studies with more than two treatment groups. If applicable the data will be analysed according to recommendations in the Cochrane Collaboration Open Learning Module on issues related to the unit of analysis (Alderson 2002).

Dealing with missing data

If data are missing from the relevant comparisons we will attempt to contact the authors of the studies to obtain the information. If the authors cannot be reached, or if the studies are found to be unsatisfactory on the basis of data provided, these studies will be excluded.

Assessment of heterogeneity

Firstly, heterogeneity will be identified by visual inspection of forest plots. Where confidence intervals for individual studies have poor overlap it generally indicates the presence of statistical heterogeneity.

Secondly, a standard Chi^2 test will be used to formally test for the presence of statistical heterogeneity. Where a meta-analysis includes studies with a small sample size or where studies are few in number the Chi^2 test has low power. To allow for this a P value of 0.10 (rather than 0.05) will be used to determine statistical significance. Though a significant result may indicate a problem with heterogeneity, a non-significant result does not provide evidence of no heterogeneity.

As well as carrying out a Chi^2 test, an I^2 statistic will be used. The test assesses the impact of heterogeneity on the meta-analysis, rather than simply testing whether heterogeneity is present. The I^2 statistic quantifies inconsistency across the studies. It describes the % of the variability in effect estimates that is due to heterogeneity rather than sampling error.

The importance of the observed value of I^2 depends on the magnitude and direction of effects, and the strength of the evidence for heterogeneity (Chi^2 test, confidence intervals for I^2). Both the Chi^2 value and the I^2 value can be used together to assess the potential statistical heterogeneity in a meta-analysis.
Where statistical heterogeneity is identified reasons for the heterogeneity will be sought by examining clinical and methodological heterogeneity. These are assessed by comparing the included studies according to participants, interventions, outcomes and study designs, by assessing the risk of bias and by examining subgroups. The level of statistical heterogeneity present will be taken into account when choosing the method of analysis for the review.

Assessment of reporting biases

Where data in the review have been standardised and pooled funnel plots will be used to check for publication bias. Funnel plots are produced using Review Manager 5 software.
In interpreting the funnel plot it is necessary to consider possible reasons for asymmetry other than publication bias and these might include poor methodological design and sampling variation.

Data synthesis

Data synthesis will comprise a narrative overview of the findings. This would be followed by a quantitative meta-analysis if appropriate. The decision to carry out a meta-analysis is dependent on the nature of the studies included in the review. The diversity between studies according to clinical factors, comparisons and outcomes will be considered.
The decision is likely to depend upon the type of intervention and the outcome measures used in the study. Therefore studies should be classified according to:

- Study design: RCTs, CBAs, ITS.
- Outcome measures used, as described under Types of outcome measures

The risk of bias in the included studies will also be considered. Where there is great diversity between studies, and/or a high risk of bias, it is not necessarily appropriate to pool the data. A decision on whether to carry out a meta-analysis will made be according to these factors and after discussion amongst study authors.
Where it is deemed appropriate to carry out a meta-analysis the choice of model will be influenced by the level of statistical heterogeneity identified using both the Chi^2 and I^2 test.
A random-effects meta-analysis assumes that the studies are not all estimating the same intervention effect. It can be used to incorporate heterogeneity among studies. It is not a substitute for a thorough investigation of heterogeneity and is intended primarily for heterogeneity that cannot be explained. It provides a more conservative estimate of effect. A fixed-effect meta-analysis assumes that each study is estimating exactly the same quantity and that any variation between the results of the studies is due to chance. It more precise than a random-effects model, because in the presence of statistical heterogeneity it usually has narrower confidence intervals.
We will conduct the analysis according to Cochrane Handbook guidance (Higgins 2008).

Subgroup analysis and investigation of heterogeneity

Where relevant, subgroup analysis will allow the examination of the effect of certain studies on the pooled effects of the intervention.
1. Age
Consideration of the acceptability to different age groups (for both healthcare professionals and patients). This is important as there is clear evidence that the use of email is predicted by age with a clear tailing off in the generation who have not grown up in the digital age. It is therefore important to consider the intervention effect in the groups which are accustomed to the technology, since the intervention is likely to become more generalisable to the population as it ages. This will be considered where the primary studies seek to consider age group from the outset. We would have distributed patients into three age subgroups: 0 to 17, 18 to 64, over 65. The choice of distribution was made on the basis of two surveys by The Pew Internet & American Life survey (Pew 2005).
2. Location
Location of the studies will also be considered, since differing environments may condition the accessibility of the technology. For instance we might expect communication technologies and their accessibility to differ according to country and/or region, or according to whether the study is set in a rural or urban area.
3. Type of email communication
Additionally we propose to analyse the results by method of electronic mail utilized e.g. standard email versus a secure web messaging service where relevant.

4. Year of Publication
Lastly we will consider results by year of publication, as those more recent studies may be more relevant given evidence of increasing usage and therefore assumed acceptability.

Sensitivity analysis

Studies deemed to be of lower quality after examination of individual study characteristics and assessment of risk of bias will be removed from the analysis to examine the effects of this on the pooled effects of the intervention.
We would exclude studies according to the following filters:

- Outlying studies after initial analysis.
- Largest studies.
- Unpublished studies.
- Language of publication.
- Source of funding (e.g. public versus industry).

Other possible considerations for sensitivity analysis would include different measures of effect size (risk difference, odds ratios).

Appendix 2. CENTRAL search strategy

#1	MeSH descriptor Electronic Mail, this term only
#2	(electronic-mail* or email* or e-mail* or web-mail* or webmail* or internet-mail* or mailing-list or discussion-list or listserv*):ti,ab,kw
#3	(patient or health or information or web or internet) next portal
#4	patient next (web or internet)
#5	(web* or internet or www or electronic* or online or on-line) near (messag* or communicat* or transmi* or transfer* or send* or deliver* or feedback or letter or interactiv* or input* or forum or appointment or booking or schedul* or remind* or referral or consult* or prescri*)
#6	(online or on-line or web* or internet) near (service or intervention or therap* or treatment or counsel*)
#7	e-communication or e-consult* or e-visit or e-referral or e-booking or e-prescri*
#8	MeSH descriptor Computer Communication Networks, this term only
#9	(#8), from 1996 to 2002
#10	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #9)
#11	MeSH descriptor Physician-Patient Relations, this term only
#12	MeSH descriptor Professional-Patient Relations, this term only
#13	MeSH descriptor Interprofessional Relations, this term only

(*Continued*)

#14	"doctor patient relation":kw
#15	"interpersonal communication":kw
#16	"human relation":kw
#17	"patient counseling":kw
#18	MeSH descriptor Telemedicine explode all trees
#19	telehealth or telemedicine or teleconsultation or telecommunication
#20	diagnostic-test or laboratory-test
#21	(#11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20)
#22	internet:kw,ti
#23	(#21 AND #22)
#24	(#10 OR #23)
#25	(#24)…….[in Clinical Trials]

Appendix 3. MEDLINE (OvidSP) search strategy

1. computer communication networks/
2. limit 1 to yr="1996 - 2002"
3. electronic mail/
4. (electronic mail* or email* or e-mail* or web mail* or webmail* or Internet mail* or mailing list* or discussion list* or listserv*).tw.
5. ((patient or health or information or web or Internet) adj portal*).tw.
6. (patient adj (web* or internet)).tw.
7. ((web* or internet or www or electronic* or online) adj5 (messag* or communicat* or transmi* or transfer* or send* or deliver* or feedback or letter* or interactiv* or input* or forum or appointment* or booking* or remind* or referral* or consult* or prescri*)).tw.
8. ((online or web* or internet) adj4 (service* or intervention* or therap* or treatment* or counsel*)).tw.
9. (e-communication* or e-consult* or e-visit* or e-referral* or e-booking* or e-prescri*).tw.
10. or/2-9
11. physician patient relations/
12. professional patient relations/
13. interprofessional relations/
14. remote consultation/
15. or/11-14
16. internet/
17. 15 and 16
18. 10 or 17
19. randomized controlled trial.pt.
20. controlled clinical trial.pt.
21. random*.tw.

22. placebo*.tw.
23. drug therapy.fs.
24. trial.tw.
25. groups.tw.
26. clinical trial.pt.
27. evaluation studies.pt.
28. research design/
29. follow up studies/
30. prospective studies/
31. (control* or prospectiv* or volunteer*).tw.
32. cross over studies/
33. comparative study.pt.
34. experiment*.tw.
35. time series.tw.
36. (pre test or pretest or post test or posttest).tw.
37. (pre intervention or preintervention or post intervention or postintervention).tw.
38. (impact* or intervention* or chang*).tw.
39. effect?.tw.
40. or/19-39
41. exp animals/ not humans.sh.
42. 40 not 41
43. 18 and 42

Appendix 4. EMBASE (OvidSP) search strategy

1. e-mail/
2. (electronic mail* or email* or e-mail* or web mail* or webmail* or internet mail* or mailing list* or discussion list* or listserv*).tw.
3. ((patient or health or information or web or internet) adj portal*).tw.
4. (patient adj (web* or internet)).tw.
5. ((web* or internet or www or electronic* or online) adj5 (messag* or communicat* or transmi* or transfer* or send* or deliver* or feedback or letter* or interactiv* or input* or forum or appointment* or booking* or scheduling or remind* or referral* or consult* or prescri*)).tw.
6. ((online or web* or internet) adj4 (service* or intervention* or therap* or treatment* or counsel*)).tw.
7. (e-communication* or e-consult* or e-visit* or e-referral* or e-booking* or e-prescri*).tw.
8. or/1-7
9. doctor patient relation/
10. interpersonal communication/
11. human relation/
12. patient counseling/
13. exp telemedicine/
14. telecommunication/
15. exp diagnostic test/
16. or/9-15
17. internet/
18. 16 and 17
19. 8 or 18
20. randomized controlled trial/
21. single blind procedure/ or double blind procedure/
22. crossover procedure/
23. random*.tw.
24. trial.tw.
25. placebo*.tw.

26. ((singl* or doubl*) adj (blind* or mask*)).tw.
27. (experiment* or intervention*).tw.
28. (pre test or pretest or post test or posttest).tw.
29. (preintervention or postintervention).tw.
30. (cross over or crossover or factorial* or latin square).tw.
31. (assign* or allocat* or volunteer*).tw.
32. (control* or compar* or prospectiv*).tw.
33. (impact* or effect? or chang* or evaluat*).tw.
34. time series.tw.
35. or/20-34
36. nonhuman/
37. 35 not 36
38. 19 and 37

Appendix 5. PsycINFO (OvidSP) search strategy

1. exp electronic communication/
2. (electronic mail* or email* or e-mail* or web mail* or webmail* or internet mail* or mailing list* or discussion list* or listserv*).tw.
3. ((patient or health or information or web or internet) adj portal*).tw.
4. (patient adj (web* or internet)).tw.
5. ((web* or internet or www or electronic* or online) adj5 (messag* or communicat* or transmi* or transfer* or send* or deliver* or feedback or letter* or interactiv* or input* or forum or appointment* or booking* or schedul* or remind* or referral* or consult* or prescri*)).tw.
6. ((online or web* or internet) adj4 (service* or intervention* or therap* or treatment* or counsel*)).tw.
7. online therapy/
8. (e-communication* or e-consult* or e-visit* or e-referral* or e-booking* or e-prescri*).tw.
9. or/1-8
10. exp therapeutic processes/
11. interpersonal communication/
12. telemedicine/
13. feedback/
14. or/10-13
15. internet/
16. exp internet usage/
17. 15 or 16
18. 14 and 17
19. 9 or 18
20. ("32" or "33" or "34").cc.
21. (health* or medic* or patient* or clinic* or hospital* or illness* or disease* or disorder* or therap* or physician* or doctor* or psychotherap* or psychiatr* or telemedic* or treatment* or consult* or counsel* or referral* or remind* or appointment* or booking* or schedul* or visit* or prescri* or promot* or prevent* or diagnos* or test result* or screen* or intervention* or care).ti,ab,hw,id.
22. 20 or 21
23. 19 and 22
24. random*.ti,ab,hw,id.
25. (experiment* or intervention*).ti,ab,hw,id.
26. trial*.ti,ab,hw,id.
27. placebo*.ti,ab,hw,id.
28. groups.ab.
29. ((singl* or doubl* or trebl* or tripl*) and (blind* or mask*)).ti,ab,hw,id.
30. (pre test or pretest or post test or posttest).ti,ab,hw,id.
31. (preintervention or postintervention).ti,ab,hw,id.
32. (cross over or crossover or factorial* or latin square).ti,ab,hw,id.

33. (assign* or allocat* or volunteer*).ti,ab,hw,id.
34. (control* or compar* or prospectiv*).ti,ab,hw,id.
35. (impact* or effect? or chang* or evaluat*).ti,ab,hw,id.
36. time series.ti,ab,hw,id.
37. exp experimental design/
38. ("0430" or "0450" or "0451" or "1800" or "2000").md.
39. or/24-38
40. limit 39 to human
41. 23 and 40

Appendix 6. CINAHL (EbscoHOST) search strategy

Search conducted by Cochrane Consumers & Communication Review Group and results sent to us.

Appendix 7. ERIC (CSA) search strategy

(KW=(computer mediated communication* or electronic mail* or email* or e-mail* or web mail* or webmail* or internet mail* or mailing list* or discussion list* or listserv*) or KW=((patient or health or information or web or internet) within 1 portal*) or KW=(patient within 1 (web* or internet)) or KW=((web* or internet or www or electronic* or online or on-line) within 5 (messag* or communicat* or transmi* or transfer* or send* or deliver* or feedback or letter* or interactiv* or input* or forum or appointment* or booking* or schedul* or remind* or referral* or consult* or prescri*)) or KW=((online or on-line or web* or internet) within 4 (service* or intervention* or therap* or treatment* or counsel*)) or KW=(e-communication* or e-consult* or e-visit* or e-referral* or e-booking* or e-prescri*)) and (KW=(health* or medic* or patient* or clinic* or hospital* or illness* or disease* or disorder* or therap* or physician* or doctor* or psychotherap* or psychiatr* or telemedic* or treatment* or consult* or counsel* or referral* or remind* or appointment* or booking* or schedul* or visit* or prescri* or promot* or prevent* or diagnos* or test result* or screen* or intervention* or care)) and (KW=(random* or trial* or placebo* or assign* or allocat* or volunteer* or crossover or cross over or factorial* or singl* blind* or doubl* blind* or clinical stud* or longitudinal stud* or control* or compar* or intervention* or preintervention or postintervention or pre test or pretest or post test or posttest or experiment* or prospectiv* or chang* or evaluat* or impact* or effect* or time series))

HISTORY

Protocol first published: Issue 3, 2009

Review first published: Issue 8, 2012

CONTRIBUTIONS OF AUTHORS

Barbara Meyer wrote the protocol and the review.

Helen Atherton co-wrote the protocol and the review and carried out the search.

Prescilla Sawmynaden assisted in conducting the search.

Josip Car conceived the idea for the review.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- NHS Education for Scotland, UK.

BM was funded during the production of the review protocols by NHS Education for Scotland.

- eHealth unit, Department of Primary Care and Public Health, Imperial College London, UK.

The review received a partial financial contribution from The Department of Primary Care and Public Health, Imperial College London. The Department of Primary Care & Public Health at Imperial College is grateful for support from the NIHR Collaboration for Leadership in Applied Health Research & Care (CLAHRC) Scheme, the NIHR Biomedical Research Centre scheme, and the Imperial Centre for Patient Safety and Service Quality.

External sources

- Medical Research Council, UK.

HA was the recipient of a Medical Research Council PhD Studentship, administered by Imperial College, London, UK (October 2008-2011).

- NHS Connecting for Health Evaluation Programme, UK.

http://www.haps.bham.ac.uk/publichealth/cfhep/

- National School of Primary Care Research, UK.

HA is the recipient of a research fellowship from the National School of Primary Care Research (from January 2012)

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We made changes to the Background section of the review since the protocol was published (Meyer 2009), to update the cited literature.

We had stated in the protocol that the following databases would be searched as part of the grey literature search:

- Dissertation Abstracts (North American and European theses) via British Library
- TrialsCentralTM (www.trialscentral.org)

We did not search these databases, and this decision was made in conjunction with the Cochrane Consumers and Communication Review Group. TrialsCentral TM pulled in information from sources already used in the grey literature search. The only search options were to search by condition or intervention for clinical and drug interventions only (no free text). Dissertation Abstracts was not searched as several of the other databases would duplicate this search (Index to Theses, ProQuest).

MEDLINE search: Minor changes have been made to the MEDLINE strategy since the protocol stage (Meyer 2009). The new version of the search can be found in Appendix 3 of the review. These changes were made in conjunction with the Review Group's Trials Search Coordinator, John Kis-Rigo. The changes involve the removal of the term 'on-line' from the strategy. This is because Ovid MEDLINE changed the way it processed this term, and we were retrieving a very high number of articles (20,000+), whereas before the change in processing we had obtained around 8000. Removing this term brought the retrieval rate back down to acceptable levels.

Data synthesis: Minor changes made to the wording of this section for clarity.

INDEX TERMS

Medical Subject Headings (MeSH)

*Diagnosis; *Electronic Mail; *Telephone; *Text Messaging

MeSH check words

Humans