Interactive Health Communication Applications for people with chronic disease (Review)

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[Intervention Review]

Interactive Health Communication Applications for people with chronic disease

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ABSTRACT

Background

Interactive Health Communication Applications (IHCAs) are computer-based, usually web-based, information packages for patients that combine health information with at least one of social support, decision support, or behaviour change support. These are innovations in health care and their effects on health are uncertain.

Objectives

To assess the effects of IHCAs for people with chronic disease.

Search strategy

We designed a four-part search strategy. First, we searched electronic bibliographic databases for published work; second, we searched the grey literature; and third, we searched for ongoing and recently completed clinical trials in the appropriate databases. Finally, researchers of included studies were contacted, and reference lists from relevant primary and review articles were followed up. As IHCAs require relatively new technology, the search time period commenced at 1990, where possible, and ran until 31 December 2003.

Selection criteria

Randomised controlled trials (RCTs) of IHCAs for adults and children with chronic disease.

Data collection and analysis

One review author screened abstracts for relevance. Two review authors screened all candidate studies to determine eligibility, apply quality criteria, and extract data from included studies. Authors of included RCTs were contacted for missing data. Results of RCTs were pooled using random-effects model with standardised mean differences (SMDs) for continuous outcomes and odds ratios for binary outcomes; heterogeneity was assessed using the I^2 statistic.

Main results

We identified 24 RCTs involving 3739 participants which were included in the review.

IHCAs had a significant positive effect on knowledge (SMD 0.46; 95% confidence interval (CI) 0.22 to 0.69), social support (SMD 0.35; 95% CI 0.18 to 0.52) and clinical outcomes (SMD 0.18; 95% CI 0.01 to 0.35). Results suggest it is more likely than not that

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IHCAs have a positive effect on self-efficacy (a person's belief in their capacity to carry out a specific action) (SMD 0.24; 95% CI 0.00 to 0.48). IHCAs had a significant positive effect on continuous behavioural outcomes (SMD 0.20; 95% CI 0.01 to 0.40). Binary behavioural outcomes also showed a positive effect for IHCAs, although this result was not statistically significant (OR 1.66; 95% CI 0.71 to 3.87). It was not possible to determine the effects of IHCAs on emotional or economic outcomes.

Authors' conclusions

IHCAs appear to have largely positive effects on users, in that users tend to become more knowledgeable, feel better socially supported, and may have improved behavioural and clinical outcomes compared to non-users. There is a need for more high quality studies with large sample sizes to confirm these preliminary findings, to determine the best type and best way to deliver IHCAs, and to establish how IHCAs have their effects for different groups of people with chronic illness.

PLAIN LANGUAGE SUMMARY

Computer-based programmes ('Interactive Health Communication Applications') for people with chronic disease

People with chronic disease have multiple needs, including information about their illness and the various treatment options; social support; support with making decisions; and help with achieving behaviour change, for example, changes in diet or exercise. Computer-based programmes which combine health information with online peer support, decision support, or help with behaviour change may be one way of meeting these needs, and of helping people to achieve better health. This review sought to find out how such computer programmes, known as Interactive Health Communication Applications (IHCAs), might affect people with chronic disease. The review authors found that IHCAs improved users' knowledge, social support, health behaviours and clinical outcomes. It is also more likely than not that IHCAs improve users' self-efficacy (a person's belief in their capacity to carry out a specific action). It was not possible to determine whether IHCAs had any effect on emotional and economic outcomes. The included studies involved different IHCAs, with different characteristics, for a wide range of chronic diseases. There was variability in several of the outcomes, and the results should therefore be treated with some caution. There is a need for more large, high quality studies to confirm these preliminary findings, to determine the best type and best way to deliver IHCAs, and to establish how IHCAs have their effects for different groups of people with chronic illness.

BACKGROUND

Interactive Health Communication Applications (IHCAs) are computer-based, usually web-based, packages for patients that combine health information with at least one of social support, decision support, or behaviour change support. To date, the major conceptual thinking in this area has been undertaken in the USA by the Science Panel on Interactive Communication and Health (SciPICH 1998), which convened in 1998. This panel defined the terms Interactive Health Communications and Interactive Health Communication Applications as follows:

Definitions

Interactive Health Communication (IHC): the interaction of an individual - consumer, patient, caregiver, or professional - with or through an electronic device or communication technology to access or transmit health information or receive guidance and support on a health-related issue. Using this definition, IHC encompasses technology-mediated health communication and does not include direct communication such as face-to-face clinician-patient counselling (Eng 1999).

Interactive Health Communication Applications (IHCAs): the operational software programmes or modules that interface with the end user. This includes health information and support web sites and clinical decision-support and risk assessment software (which may or may not be online), but does not include applications that focus exclusively on administrative, financial, or clinical data, such as electronic medical records, dedicated clinical telemedicine applications or clinical decision-support systems for providers (Eng 1999).

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According to SciPICH (Eng 1999), the functions of IHCAs are to:

- relay information;
- enable informed decision making;
- promote health behaviours;
- promote peer information exchange and emotional support;
- promote self-care; and
- manage demand for health services.

Hence the important defining feature of an IHCA is that it does not simply provide health information, but combines such information with at least one (and frequently more than one) additional service. This additional service can be decision support, behaviour change support or peer support. The mode of delivery is not important in defining IHCAs. Nor is the site of use important in this definition, although access may have an impact on the effects of IHCAs. Hence, IHCAs can be used by individuals in their own homes, or through public internet access points, such as doctors' offices, internet cafes, libraries or information kiosks. IHCAs do not include new mechanisms for simple doctor-patient communication; e-mail between a physician and patient is therefore not an IHCA. Some IHCAs, however, do include e-mail components, where users can e-mail questions to a dedicated health professional. This professional is not usually part of the patient's normal health care team. Peer support is often in the form of online chat rooms, peer posting of answers to Frequently Asked Questions, or patient stories about their illness journey.

Potential benefits and harms of IHCAs

The overwhelming majority of the published literature in this field refers to potential benefits of IHCAs. Even the SciPICH panel, which was intended to take a strategic overview of the area, pays little attention to the potential harms of IHCAs, referring briefly to the need for evaluation to identify unintended negative consequences (Eng 1999). In terms of the functions of IHCAs listed above, the published consensus thinking can be summarised as follows:

Relaying information

IHCAs are expected to be superior to conventional means of relaying information to patients, as IHCAs can contain large volumes of information, but present it in small, accessible chunks. Information can be updated centrally as new research evidence becomes available. Good web design is expected to allow users to 'drill down' to reach the level of information desired, ranging from broad introductory information to detailed information about, for example, treatments currently under development. Information can be tailored to individuals, according to data provided by the user, for example, on their dietary or exercise habits. This increases the personal relevance and retention of information (Dijkstra 1999; Walker 1998). Moreover, the information can be presented in accessible formats, by using video and audio clips, simple graphics and personal stories. IHCAs can be visited and revisited at the user's convenience, either as information needs change, for a reminder, or to share information with friends, family or carers.
There are, however, both theoretical and empirical reasons to believe that health information on its own is insufficient to achieve positive outcomes (Haby 2001). Combining information with peer support, behaviour change support or decision support may lead to some of the following benefits expected from an IHCA (Klemm 2003).

Enabling informed decision-making

The expectation here is that well-informed patients will be more able to make informed decisions than patients who do not have access to information. IHCAs do not have to contain formal decision-support tools, although some do.

Promoting health behaviours

Again, the expectation here is that well-informed people are more likely to follow healthy behaviours than poorly-informed people. However, this assumption is probably only partially correct - if knowledge was all that was needed to promote healthy behaviour, smoking, for example, would not be as prevalent as it is.

Promoting peer information exchange and emotional support

Patient desire for peer information exchange and emotional support has been well documented, and forms the basis for the many successful self-help organisations that exist across the developed world. SciPICH and other researchers in this field have postulated that IHCAs will allow the formation of online support communities, and that these will be beneficial to participants.

Promoting self-care

This assumption is based on the literature on self-care. It is known that peer-led groups can promote self-care (Bodenheimer 2002), and proponents of IHCAs suggest that this function can be delivered through online groups.

Managing demand for health services

This assumption may also be flawed, as it is based on the view that well-informed consumers, actively engaging in self-care, will place less demand on health services than those who are less well informed. The rationale for this assumption comes from Lorig's work on self-care for chronic disease (Bodenheimer 2002). However, the alternative is also possible: well-informed consumers may

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recognise the value of specific treatments, thus increasing uptake and hence costs.

There is no list of possible harms of IHCAs in the literature; however there are references to the following areas of concern:

Equity

Will IHCAs increase or reduce equity in terms of access to services, quality of care and health outcomes? On the one hand, the widespread access to the internet may help to promote equity, allowing people access to information they would find hard to access using traditional media. Alternatively, the 'digital divide' may increase disparities, either in terms of access to information, or in the use people are able to make of the information.

False or misleading information

The possibility of IHCAs providing false or misleading information, and the effects of such misinformation have caused concern (Eysenbach 2002).

Privacy

In order for an IHCA to provide tailored information, the user has to input substantial detail about his or her health. How will the privacy of this information be guarded?

Malpractice

Some writers have raised concerns about malpractice issues, particularly from the point of view of developers of IHCAs and those with commercial interests. Can such developers be sued if a user has an unexpected negative outcome as a result of using the IHCA? (Patrick 1999).

Quality criteria

Accuracy of information, safeguarding of privacy, and issues around malpractice represent some of the components of overarching concern about IHCA quality. What are the criteria for a 'good' IHCA? Should there be a body responsible for licensing or monitoring IHCAs, and if so, who should be represented on this body, and how should it operate? (Patrick 1999).

Rationale for developing IHCAs for people with chronic disease

Chronic disease is defined as a disease or condition that is ongoing, in contrast to acute conditions which resolve completely within a relatively short time period. People with chronic disease can be considered to be on an illness journey (Lapsley 2004), starting with the original symptoms which lead to diagnosis, and continuing through phases which may include relapse and remission; steady levels of health; improvement; or deterioration.

There is good evidence that people with chronic disease want more, and better, information about their health problems and the various treatment options available (Coulter 1999). Information needs tend to change as patients progress through their illness journey, and different patients will have different needs at different points (Davison 2002). Some people will only want access to simple information, while others will want to be as well informed as possible, and will search for detailed, in-depth information (Stewart 2000).

Self-management of chronic disease requires a number of tasks and skills. According to Lorig (Lorig 2003), there are three sets of tasks: first the medical management of the condition, such as taking medication, adhering to a diet, or using an inhaler. The second set of tasks involves maintaining, changing and creating new meaningful behaviours or life roles. The final set of tasks is dealing with the emotional sequelae of having a chronic condition. Emotions such as anger, fear, frustration and depression are commonly experienced by someone with a chronic disease; hence learning to manage these emotions is part of the work required to manage the condition (Corbin 1988). The skills needed for these tasks include problem-solving, decision-making, finding and utilising resources, forming partnerships with healthcare workers and taking action (Lorig 2003). Lorig postulates that enhancing self-efficacy (ie. a person's belief in their capacity to carry out a specific action) is a key step in programmes that effectively enable patients to improve their self-management skills (Lorig 2003).

IHCAs have the potential to address these multiple needs. IHCAs can provide accurate, detailed information in an accessible way. They can provide peer support, which may help with the tasks relating to life roles and negative emotions. We have also seen that the literature claims that IHCAs may enable decision-making, and promote desirable health behaviours (which may require taking action).

International situation

The majority of work in this field has been undertaken in the USA. Most of the evaluations have occurred in academic centres; however, a large and increasing number of IHCAs are developed outside the academic framework, and are sold to health insurance companies and other healthcare providers as a means of maintaining patient satisfaction while reducing healthcare costs. In Australia, the benefits of internet access to health information for rural populations, often living long distances from urban centres, has been well recognised, and there has been considerable investment in this, including in IHCAs. In the UK, IHCAs are at the intersection of a number of core National Health Service (NHS) policies. These include the Expert Patient Policy (DOH; EPTF 2001), which recognises the importance of patient expertise in self-management, and the heavy investment in online information for both

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patients and professionals (eg. NHS Direct Online, nhs.uk, and the National Electronic Library for Health). For example, NHS Direct Online has a budget of £7.5 million over three years to place patient information materials on its website. Research in the UK is, however, less well developed than that in the USA. Overall, work in the field of IHCAs is at present limited to the developed world.

Existing systematic reviews

Two systematic reviews which overlap with IHCAs for chronic disease have already been undertaken - one on computerised cognitive behavioural therapy (CCBT) (Kaltenthaler 2002) and one on decision aids (O'Connor 2003).

Computerised cognitive behavioural therapy

Kaltenthaler's review, published in 2002, examined the clinical and cost effectiveness of CCBT compared to 'treatment as usual' or therapist-led cognitive behavioural therapy (CBT) for treatment of depression and/or anxiety. Included in this remit were generalised anxiety, panic disorders, agoraphobia, social phobia and specific phobias. The intervention studied was CCBT delivered alone or as part of a package of care, either via a computer interface or over the telephone with a computer-led interface. The review included RCTs, and, for outcomes where RCT evidence was not available, non-randomised studies. Sixteen studies were included, from which the authors concluded that there was some evidence of poor-to-moderate quality that CCBT is as effective as therapist-led CBT in clinically-depressed, anxious or phobic outpatient and primary care populations. Authors also reported limited evidence of poor-to-moderate quality that CCBT is more effective than treatment as usual for these patient populations.

Decision aids

O'Connor's Cochrane review, updated in 2003, examined the effects of decision aids for people facing health treatment or screening decisions. They define decision aids as "preparing people to participate in preference-sensitive decisions." In order for an intervention to be included in the review, it had to be "designed to help people make specific and deliberative choices among options (including the status quo) by providing (at the minimum) information on the options and outcomes relevant to a person's health status. The aid also may have included: information on the disease/condition; costs associated with options; probabilities of outcomes tailored to personal health risk factors; an explicit values clarification exercise; information on others' opinions; a personalized recommendation on the basis of clinical characteristics and expressed preferences; and guidance or coaching in the steps of decision making and in communicating with others."

Decision aids range from simple paper-and-pencil aids to complex multimedia computer programmes. Thirty-four RCTs were included in this review, and provided evidence that, compared to usual care, decision aids improved user knowledge, led to more realistic expectations, reduced decisional conflict relating to feeling informed, increased the proportion of people active in decision making and reduced the proportion of people who remained undecided post intervention. Decision aids did no better than comparisons in affecting satisfaction with decision making, anxiety and health outcomes.

Relationships with this review

Whether CCBT fulfils the definition of an IHCA will depend on the makeup of individual programmes. Where the programme contains health information coupled with behaviour change support, it would fit in the remit of an IHCA. However, where the programme more closely mimics a client-therapist relationship, it may well not. The primary aim of CCBT is to replace (or in some cases act as an adjunct to) therapist-led CBT, that is, to enable patients to identify, and subsequently alter, the cognitions and behaviours which lead to the development and maintenance of mental health problems. They are not primarily designed to relay information; enable informed decision making; promote health behaviours; promote peer information exchange and emotional support; promote self-care; or manage demand for health services. Their primary aim was well addressed in the Kaltenthaler review (Kaltenthaler 2002). We decided it was inappropriate to subdivide CCBT packages into those which were IHCAs, and those which were not, and then assess the former against aims which the packages were not designed to address.

Similarly, some decision aids are IHCAs, while others are not. Again, decision aids have a unifying primary aim, stated in the O'Connor review (O'Connor 2003), which is to prepare people for participating in preference-sensitive decisions. Decision aids tend to focus on rubicon decisions - for example, participating in a screening programme, or having an operation. In contrast, although IHCAs often contain decision support, this is only one component of the total package. The decision support may be around more ongoing issues, for example, when to increase the dose of inhaled steroids for a patient with asthma. As with our approach to CCBT, we decided not to subdivide decision aids into those which were IHCAs and those which were not, but to exclude decision aids from the review.

Postulated pathway of action of IHCAs

Review of the health psychology literature (Armitage 2001), coupled with proposed pathways of action of specific IHCAs (Brown 1997; Gustafson 1999) or other self-management interventions (Lorig 2003), led us to postulate that IHCAs act by combining information with additional services (peer support, decision support

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or behaviour change support) to allow internalisation and interpretation of the information by the user. This leads to changes in knowledge, motivation for improved health or health behaviours, affective parameters and self-efficacy. It is likely that these factors interact with each other; for example, understanding the risks of the condition may increase or reduce the user's anxiety levels with subsequent follow-on effect on their motivation to improve health. The combination of enhanced self-efficacy with motivation and knowledge enables users to change their health behaviours, leading in turn to changes in clinical outcomes (Figure 1). Our analytical approach was designed to test this hypothesised pathway of action. Hence, we did not examine outcomes such as decisional confidence, which were not part of the hypothesised pathway of action.

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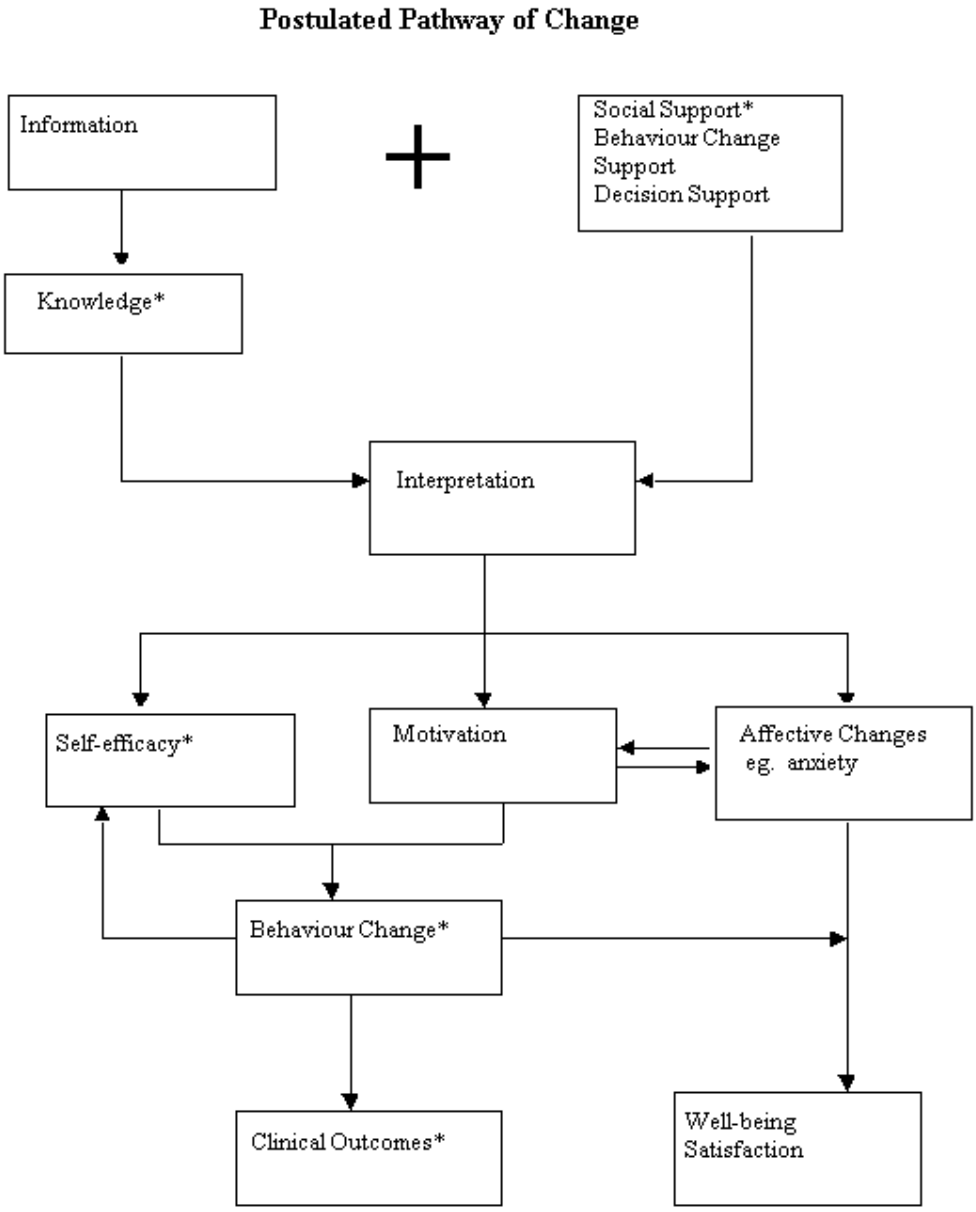
Figure 1.



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Summary of rationale for review

The literature contains many claims for potential benefits of IHCAs, and very substantial investment in IHCAs is occurring in the USA and UK; however it is unclear to what extent these benefits actually occur. This review examined the effects of IHCAs for people with chronic disease. The objectives were designed to test the claims in the literature for potential benefits of IHCAs and our postulated pathway of action. Outcomes which were not reflected in our hypothesised pathway of action were not examined, with the exception of economic outcomes which we considered to be of great interest to health service policy makers and managers and so were included. Potential harms were insufficiently described in the literature to be formally tested in this review; however, we scrutinised included studies for evidence of unintended adverse consequences.

OBJECTIVES

The objectives of this systematic review were to determine the effects of IHCAs on patients in terms of:

- knowledge;
- social support;
- self-efficacy;
- emotional outcomes;
- behavioural outcomes;
- clinical outcomes;

and to determine the effects of IHCAs on economic outcomes, in terms of resource utilisation.

METHODS

Criteria for considering studies for this review

Types of studies

In our protocol, we had planned to include randomised controlled trials (RCTs), quasi-randomised trials, before-and-after studies, interrupted time series analyses and economic evaluations. We had intended to use RCTs to draw conclusions about effectiveness; before-and-after studies and interrupted time series studies for conclusions about 'promising interventions' ready for trialling; and qualitative studies and surveys to inform the background and discussion. This over-inclusiveness was designed to avoid missing important or significant data in a rapidly expanding field, preliminary exploration of which suggested that it did not contain many RCTs. However, the search strategy found 24 RCTs meeting the inclusion criteria. We were therefore able to raise the study design threshold for inclusion in the review to include RCTs only, as these provide a more robust level of evidence. N of 1 trials were excluded.

Types of participants

People of all ages with chronic disease (Black 1995). This includes children, as long as the intervention was able to be used by the child. Community, primary care, outpatient and inpatient populations were included. Some interventions were aimed at carers, particularly for patients with Alzheimer's; results for carers are reported separately.

Chronic disease was defined as a disease or condition that is ongoing, in contrast to acute conditions which resolve completely within a relatively short time period. Common chronic diseases include diabetes mellitus, ischaemic heart disease, asthma, chronic obstructive pulmonary disease, epilepsy, Parkinson's disease, Alzheimer's disease, arthritis and renal failure. In accordance with current guidelines, obesity (BMI greater than or equal to 30 kg / m^2) was considered a chronic disease, whereas being overweight but not obese (BMI < 30 kg / m^2) was not. Where there was any doubt as to whether a condition was a chronic disease or not, the decision was referred to the steering group.

Types of interventions

IHCAs, as defined by SciPICH and described in the Background to this review. This was operationalised as any package that required the user to interact directly with any form of computer, and contained health information plus at least one of peer support, decision support or behaviour change support, and was not defined by the authors of the paper as a decision aid or computerised cognitive behavioural therapy.

Comparisons: normal care, non-interactive forms of patient education (e.g. written, audiotape, video, group or one-to-one didactic sessions led by either peers or professionals); interactive educational sessions led either by peers or professionals.

We excluded decision aids and computerised cognitive behavioural therapy for the reasons given in the Background (Kaltenthaler 2002; O'Connor 2003). We excluded decision-support systems aimed solely at professionals, and simple information packages that did not contain social support, decision support or behaviour change support, as these are not IHCAs. Similarly, we excluded interventions that only contained social support, decision support or behaviour change support with no health information, as this did not fit our operationalisation of the SciPICH definition.

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Types of outcome measures

Outcome measures were chosen to reflect our objectives. These were in turn based on the benefits of IHCAs claimed in the literature, and on our postulated pathway of action of IHCAs. Our outcome categories were: effects on patients in terms of knowledge, social support, self-efficacy, emotions and health behaviours; health outcomes; and resource utilisation. Self-efficacy refers to a person's belief in their capacity to undertake a specific action or achieve a specific goal.

Search methods for identification of studies

We designed a four-part search strategy. First, we searched the following electronic databases:

- *The Cochrane Library* Issue 2, 2003;
- MEDLINE (1990 to 2003);
- EMBASE (1990 to 2003);
- PsycINFO (1990 to 2003);
- CINAHL (1990 to 2003).

Second, to capture grey literature, we searched:

- ASLIB Index to Theses (1990 to 2003);
- Dissertation Abstracts (1990 to 2003);
- System for Information on Grey Literature in Europe (SIGLE) (1990 to 2003);
- for conference proceedings, the Index to Scientific and Technical Proceedings database (1990 to 2003).

Third, for ongoing and recently-completed clinical trials, we searched:

- National Research Register (2003);
- International Register of Controlled Trials (2003);
- MetaRegister of Controlled Trials (2003).

Finally, we contacted researchers of included studies and screened reference lists from relevant primary and review articles for potentially useful studies. As IHCAs require relatively new technology, most work in this area has been undertaken since 1995. In order to capture early or pioneering studies, the search was started at 1990 where possible. As our original protocol was not limited to RCTs, no RCT-only filter was applied.

Biomedical databases

The systematic review topic was reduced to two concepts: interactive health communication applications (IHCAs) and functions of the interactive health communication applications (functions). Although the systematic review focused on chronic disease, we agreed it would be impossible to list all chronic diseases, so the decision as to whether the disease described in the study was 'chronic' was made at the screening abstracts stage. Queries were referred to the steering group for discussion.

A number of papers discussing interactive health communication were read and were used to generate a list of thesaurus and text word search terms to create a search strategy in the MEDLINE database. The search was run and the resulting papers were examined to assess their relevance and to gauge the precision and comprehensiveness of the search strategy. Overall it was thought that the strategy was identifying appropriate papers. A few minor additional phrase terms were added to the search strategy, namely digital interactive television and interactive video disks. Finally a validated methodology filter designed to capture clinical trials, RCTs and prospective studies was added to the search (see below). In order to avoid missing potentially useful references, we generated a list of examples of interactive health communication software packages, and ran a second search on these. This second search did not retrieve any unique references when compared to the original MEDLINE search, and thus only the first MEDLINE strategy was employed. The MEDLINE search strategy was used as a model for searching the EMBASE, PsycINFO and CINAHL databases.

The Cochrane Library was searched in two parts. The *Cochrane Database of Systematic Reviews* (CDSR), the Database of Abstracts of Reviews of Effectiveness (DARE) and the Cochrane Central Register of Controlled Trials (CENTRAL) were searched using the KA24 Ovid Interface. This version of *The Cochrane Library* does not support thesaurus searching, and therefore only the text words and phrases from the MEDLINE search strategy could be used.

The Health Technology Assessment database (HTA) and the National Health Service Economic Evaluation Database database (NHSEED), part of *The Cochrane Library*, were searched via the Centre for Reviews and Dissemination's website using a modified version of the MEDLINE strategy. In both these databases, it was not possible to build up the search set-by-set (line-by-line) and then link them by 'AND', thus each line of the MEDLINE strategy had to be run as a separate search. It was decided at this point to search only the IHCA terms, and to view the records to see if any of them described interactive health communication functions, rather than inputting all lines of the MEDLINE search relating to the functions of IHCAs.

Grey literature

SIGLE (System for Information on Grey Literature in Europe), the ASLIB Index to Theses, Dissertation Abstracts, the International Standard Randomised Controlled Trials Register, the MetaRegister of Randomised Controlled Trials and the National Research Register were all searched using the same approach as the HTA and NHSEED databases (ie. using just the IHCA terms). For the Index to Scientific and Technical Proceedings, this again was searched using free text terms and phrases to cover IHCAs. This database covers all areas of science, and thus to avoid generating unmanageable numbers of records, it was necessary to link the very general search phrases, eg. computers communication, to one or more of

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the following search terms: medicine OR health OR therap* OR counsel* OR health education OR patient education OR health promotion.

The search strategy for MEDLINE is given at Appendix 1. Modified versions of this strategy were used for other databases and registers, and are available in full from the review authors on request.

Data collection and analysis

Document retrieval

Citations and brief records identified by the search strategy were downloaded electronically into a bibliographic management package (RefMan10), whenever possible. Where search results could not be saved electroncally, paper records were kept. Titles and/or abstracts were assessed by a single researcher (EM or JB). Assessments erred on the side of inclusiveness; in other words, if we could not definitely exclude the study at this stage, we requested the full paper. There was no language restriction. Where necessary, we sought help for translation from colleagues.

Study selection process

This was a multi-stage process. The selection criteria were applied liberally to the titles and/or abstracts generated by the search. All titles and abstracts identified as potentially reporting studies involving an IHCA for people with a chronic disease were provisionally included for consideration on the basis of full text articles. The reproducibility of this process was tested in the early stages of the review and found to be good. Final inclusion/exclusion decisions were made by consensus by two independent researchers (EM and JB) after retrieving the full text copies of all potentially-relevant citations and determining whether they met the inclusion criteria. Disagreements or questions were referred to the steering group, where a decision was reached by consensus and the reasons for the decision recorded.

All studies which fulfilled the inclusion criteria were included in the systematic review, and listed in the table of included studies. Included studies which presented sufficient data to allow calculation of standardised mean differences (SMD) or odds ratios (OR) were included in the relevant meta-analyses.

Study quality assessment

Two independent researchers (EM and JB) assessed RCTs for quality. In line with the *Cochrane Reviewers' Handbook* (Alderson 2004), studies were assessed for adequacy of concealment of allocation to experimental or control groups. Concealment of allocation was considered adequate if centralised randomisation or another robust method to prevent foreknowledge were used. Inadequate measures included use of alternation, case record numbers, birth dates, weekdays or open random number lists. Studies were rated as having adequate concealment of allocation (A); unclear (B); or having inadequate concealment (C) (Alderson 2004).

The two other important factors contributing to study validity are blinding the assessor to participant's allocated group, and follow-up. Almost all studies relied heavily on self-reports for measurement of outcomes, and many of the outcomes are subjective, so blinding the assessor was not possible, and we did not apply this criterion. Information on the follow-up rate is provided in an additional table giving further information on included studies (Table 1).

Table 1. Further Details of Included Studies

Author	Cond/ IHCA	Country	Methods	PPT Characteristics	Follow Up Rate	Details of IHCA	Intervention Group	Control Group	Outcome Measures*
									* Outcome measures in capitals were selected for data synthesis.
Andrewes 1996	Eating Disorder / DIET	Australia	RCT, 2 arms: intervention versus control	54 patients with Diagnostic and Statis-	54/54 = 100%	A computer based psychoed- u-	Completed the DIET programme	Non-directional computer based	Eating Disorders Attitude Question-

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Table 1. Further Details of Included Studies (*Continued*)

				tical Manual (3rd ed., rev.) (DSM-III-R) diagnosed eating disorders: 14 with anorexia, 9 with bulimia, 4 with both in each group. Mean age 22 years. Intervention group n = 27, control group n = 27.		cation programme containing 11 information modules about eating disorders plus personal stories.	twice in a healthcare setting with an interval of 7 days between the 1st and 2nd sessions.	counselling programme	naire, EATING DISORDERS KNOWLEDGE QUESTIONNAIRE, evaluation of computer programme
Bartholomev 2000	Asthma / Watch Discover Think Act (WDTA)	USA	RCT, 2 arms: intervention versus control	171 children with asthma and their primary caregivers, recruited from inner-city asthma clinics. 112 males, 59 females; mean age 10.9 years (range 7 to 17 years); 42% Hispanic, 53% African-American. Of the 133 children who completed th study the in-	133 / 171 = 78%. No information about distribution of dropouts.	An interactive multimedia computer game delivered via CD-ROM, provides tailored information on asthma self-management for children with asthma. The program game functions incorporate decision support and behaviour chan	Played the game during scheduled visits to asthma or community pediatric clinics. Participation time in the study was from 4 to 15.6 months, mean = 7.6 months.	Received no intervention.	CHILD KNOWLEGE OF ASTHMA, CHILD SELF MANAGEMENT, CHILD SELF EFFICACY, symptoms, FUNCTIONAL STATUS and HOSPITALISATION/ER VISITS

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Table 1. Further Details of Included Studies (*Continued*)

				tervention gr n = 70, control group n = 63.		support. It utilises text, graphics, animation, sou video clips. Data input = child's personal asthma symptoms, e vironmental triggers, mec ications, PEI			
Brennan 1995	Alzhemier's disease / ComputerLink	USA	RCT, 2 arms: intervention versus control	102 caregivers with primary responsibility for a person with Alzheimer's disease. Intervention group n = 51, control group n = 51; 67% female; 72% white participants; median age = 64 years; education = completed high school.	96 / 102 = 94%. 4 dropouts in intervention group; 2 in comparison group.	A specialised computer network, ComputerLink. ComputerLink provides factual information in the form of an electronic encyclopaedia and peer and decision support via online discussion group and self defined decision problem analysis.	Received in-home access to ComputerLink via a provided computer link for 12 months.	Received a monthly telephone call.	Decision confidence, decision-making skill, SOCIAL ISOLATION, DEPRESSION, ECONOMIC ANALYSIS
Brennan 1998	AIDS & HIV / ComputerLink	USA	RCT, 2 arms: intervention versus control	57 people living with AIDS. Mean age = 33 years; 93% male; 61% white participants; 34% work-	48 / 57 = 84%. 6 dropouts from intervention group; 3 from control group.	A specialised computer network , ComputerLink ComputerLink provides information	Received in-home access to ComputerLink via a provided computer terminal for 6 months.	Received printed brochures and a monthly telephone call to maintain con-	Decision making skill, decision confidence, SOCIAL ISOLATION, DEPRESSION, PA-

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Table 1. Further Details of Included Studies (*Continued*)

				ing; mean years of education = 13.5. Intervention group n = 31, control group n = 26		in the form of an electronic encyclopaedia. Peer support and decIsion support is provided via online discussion groups and a decision support system based on decision modelling.		tact with research staff.	TIENT HEALTH STATUS
Brown 1997	Diabetes / Packy and Marlon	USA	RCT, 2 arms: intervention versus control	59 children with Diabetes Mellitus, aged 8 to 16, recruited from two paediatric endocrinology outpatient clinics. Intervention group n = 31, control group n = 28	Not stated specifically; results tables suggest 100% follow up.	Interactive computer programme in video game format. The game follows the adventures of two adolescent elephant friends at diabetes summer camp facing threats to their well-being. Information about self-care is provided in the form of multiple choice quizzes and	Received in-home access to a video game system and the video game Packy and Marlon to play on it for a period of 6 months.	Received in-home access to a video game system and an entertainment video game to play on it for a period of 6 months.	Enjoyment of game scale, SELF EFFICACY MEASURE, SOCIAL SUPPORT, KNOWLEDGE SCORE, DIABETES SELF-CARE RATING SCALE, HBA1C, NUMBER OF URGENT CARE VISITS

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Table 1. Further Details of Included Studies (*Continued*)

						behaviour change support is provided throug role playing within the game - the characters m engage in spe cific behavio to stay healtl The ability of two players to interact within the camp hel facilitate pee support.			
Dragone 2002	Cancer / Kidz with Leukemia	USA	RCT, 2 arms: intervention versus control	41 children aged 4 to 11 with acute lymphoblastic leukaemia or acute myeloid leukaemia in first remission. 41 children recruited, 31 completed study, (14 x 4 to 6 year olds; 17 x 7 to 11 year olds); 25/31 white, 3/31 Latino; 1/31 African American; 1 / 31 Asian; 1/31 Other. Of the 31 children com pleting the	31/41 = 76%	An interactive CD-ROM, delivered via compute to educate children with leukaemia. Information is provided on areas such as treatment, tests, blood cells, anatomy physiology and expert explanations . Behaviour change support is provided with in the Help Yourself mod ule. Miscel-	Received CD-ROM to use for a 3 month period. Participants could access the CDROM only if they already had a computer at home or had access to one at school or elsewhere .	Received conventional leukaemia information in book format.	Health locus of control, LEUKAEMIA EVENT KNOWLEDGE INTERVIEW, satisfaction and use of computer questionnaires (children and parents)

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Table 1. Further Details of Included Studies (*Continued*)

				study the intervention gr n = 15, control group n= 16		laneous topics include sibling view of leukaemia living with leukaemia.			
Glasgow 2003	Diabetes / D-NET 2003	USA	RCT, 4 arms (control; coach; social support; social support + coach) For the purpose of systematic review the comparison used = control (information only) vs information + social support.	320 adults with Type II Diabetes Mellitus. 47% male; mean age 59 (SD 9.2 years); 83% had no or very limited Internet experience; mean time since diagnosis 8 years.	264/320 = 82%; 'n' in each arm of trial and follow up numbers by group is not presented. An overall follow up rate of 82% is reported by authors with no significant difference between groups reported. Assuming equal numbers were assigned to each group with an 82 % follow up rate = 80 x 82% = 66 completers per trial arm.	A computer system giving in home access via a providing Internet connection to electronic information on diabetes. Additional modules contain peer support and behaviour ch support.	Received information + e-mail forum (Diabetes Support Conference - peer led but professionally mediated) and some e-mail focus forums. Home access for 10 months.	Received computer access to electronic articles providing information only about medical, nutritional and lifestyle aspects of diabetes.	DIABETES SUPPORT SCALE, Kristal ffb scale, grams daily fat, AVERAGE MINUTES PER DAY OF PHYSICAL ACTIVITY, CENTRE FOR EPIDEMIOLOGICAL STUDIES - DEPRESSION SCALE, lipid ratio, HBA1C, block nci fat screener
Gorman 1995	Urinary Incontinence / UICS	USA	RCT, 3 arms: UICS versus booklet (AHCPR patient guideline with hand-	60 ambulatory, alert community dwelling women with urinary in-	60 / 60 = 100%	Computer based expert interactive system containing information about	Used the expert system at a single session arranged by research staff.	Watched a general health video.	EPISODES OF URINARY INCONTINENCE, Incontinence

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Table 1. Further Details of Included Studies (*Continued*)

			out) vs. control. For purposes of systematic review, UICS is compared with control.	continence defined as accidental urine loss at least twice a week. Mean age = 55, Intervention (UIC group n = 22, booklet group n= 18, control grou n = 20.		urinary incontinence. Behavioural support provided through bladder training and pelvic muscle exercises.			Impact on Life Questionnaire
Guendelman 2002	Asthma / Health Buddy	USA	RCT, 2 arms: intervention versus control	134 children with asthma, recruited from primary care clinic; aged 8 to 16 years, 57% male; 76% African-American; 93% public insurance. Intervention group n = 66, control group n = 68.	128 / 134 = 96% at 6 weeks; 120/134 = 90% at 12 weeks. Dropouts equally distributed between groups.	A personal, interactive computer programme linked to a secure web site. The programme gives information on asthma via core questions, asthma facts and trivia functions. Behaviour change support is provided immediate feedback giving praise or encourage on answers to questions on asthma self management query clinical outcome	Accessed the programme at home via a provided telecommunications device for a period of 90 days.	Used a standard asthma diary.	LIMITATION IN ACTIVITY, pefr:50-80% or <50% of personal best, asthma symptoms, missed school days, functional status, URGENT CALLS TO HOSPITAL, VISITS TO ER, HOSPITALISATION, TAKES ASTHMA MEDICATION WITHOUT REMINDER, reminded to use Health Buddy

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Table 1. Further Details of Included Studies (*Continued*)

Gustafson 1999	AIDS & HIV / CHESS	USA	RCT, 2 arms: CHESS versus control	204 HIV-positive patients; 90% male; 84% white participants; 65% experiencing HIV-related symptoms; average education = some college. Intervention group n = 107, control n = 97.	183/204 = 90% (92% in control group; 88% in intervention) .	A computer based health support system which provides breast cancer patients with information on their illness via functions such as question and answer facilities and the instant library. Decision support is provided via a decision aid service and peer support via online discussion groups. Behaviour support is delivered in the form of assessment and action plan facilities.	Received in-home access to CHESS via a provided PC for either 6 (1st cohort) or 3 months (2nd and 3rd cohorts).	Received usual care only.	Cognitive function, negative emotions, DEPRESSION-MOS SUBSCALE, PHYSICAL FUNCTION, active life, energy, SOCIAL SUPPORT, PARTICIPATION IN HEALTH CARE, USE OF AMBULATORY CARE SERVICES AND HOPITALISATION
Gustafson 2001	Cancer / CHESS	USA	RCT, 2 arms: intervention versus control	295 women with newly diagnosed breast cancer, under age 60. Mean age 44.4 years; 74% white	246 / 295 = 83% (84% in control group; 82% in intervention group).	A computer based health support system which provides HIV-positive patients with infor-	Received in-home access to CHESS via a provided PC for 6 months.	Received a copy of Dr Susan Love's Breast Book.	SOCIAL SUPPORT, information competence, unmet information needs, PARTICI-

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Table 1. Further Details of Included Studies (*Continued*)

				participants; 85% private insurance. Intervention group n = 147, control group n= 148.		mation on their illness via functions such as question and answer facilities and the instant library. Decision support is provided via a decision aid service and peer support via online discussion groups. Behaviour support is delivered in the form of health plan, assessment a action plan facilities.			PATION - BEHAVIOURAL INVOLVEMENT IN HEALTH CARE, participation level of confidence, confidence in doctors, EMOTIONAL WELL-BEING - FACT B, breast cancer concerns
Homer 2000	Asthma / Asthma Control	USA	RCT, 2 arms: intervention versus control	137 children aged 3 to 12, with physician-diagnosed asthma, recruited from hospital (118) and community clinic (19). Mean age 7.4 years; 30.7% female; 60.5% African-American,	106 / 137 = 77% (80% of control group; 75% of intervention group).	An interactive educational computer programme in game format. Children help a superhero complete all 6 levels of game while keeping his asthma under control. General asthma	Used the programme over 3 sessions at either a primary care clinic or a neighbourhood health center. The average time to complete the game for a first time player was 45 to 60	Received an asthma education book and played a non-educational computer game.	CHILD KNOWLEDGE, TOTAL NUMBERS OF EMERGENCY DEPARTMENT AND ACUTE OFFICE VISITS DURING STUDY PERIOD, child's average ASTHMA SPECIFIC SYMP-

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Table 1. Further Details of Included Studies (*Continued*)

				5.3% Hispanic. Intervention group n = 76, control group n = 61.		information is provided by the programme as well as behaviour change and decision support facilities.	minutes.		TOM SEVERITY, satisfaction, PEFR METER AVAILABLE, use of pefr meter, monitoring number of common triggers and allergens in home environment
Horan et al 1990	Diabetes / DISC	USA	RCT, 2 arms: intervention versus control	20 adolescents aged 12 to 19 with Type 1 Diabetes Mellitus for > 1 year. 30% male; 80% white participants. Recruited from paediatric endocrinologists in private practice and from customers at a store for people with diabetes. Intervention group n = 10, control group n = 10.	20/20 = 100%	A microcomputer based system giving in-home access via a provided computer terminal. DISC contains 3 components. Information is provided via factual and applied diabetes education; behaviour change support is provided via goal setting; and problem solving functions and facilities for reviewing self monitored da on blood glu-	Used the computer at home for a period of 15 weeks, spending 7 weeks on the diabetes education model and focusing on the goal-setting and problem solving module for the last 8 weeks.	Received conventional diabetes education via an education booklet.	HBA1C, blood glucose levels, frequency of smbg, APPLIED DIABETES KNOWLEDGE SCORE, BEHAVIOUR CHANGE - EXERCISE, diet, insulin, emotional stress, physical stress, weight, hormones, alcohol and drugs

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Table 1. Further Details of Included Studies (*Continued*)

						cose, exercise, diet, em tional stress etc.			
Huss 2003	Asthma / Wee Willie Wheezie	USA	RCT, 2 arms: intervention versus control	148 children, recruited from hospital discharge records and local pediatric allergy and asthma clinics. Mean age 9.6 y; 44% male; 21% non-Hispanic White; 78% non-Hispanic Bla Intervention group n = 78, control group n = 70.	101 / 148 = 68%. Intervention group = 56/78 = 72%; control group = 45/70 = 64%.	An interactive computer programme in game format where children negotiate Wee Willie through various home-like environments and hazards. Information is provided via quizzes. Behaviour change support is provided in the form of Wee Willie 'healt line' which responds to environmental triggers or missed me ication. An onscreen nur provides guid ance on incorrect answers.	Received conventional education (written asthma materials and a non-asthma-related computer programme) and the computer based instructional asthma game - Wee Willie Wheezie. Ch dren played the asthma game for 20 minutes during a scheduled home visit.	Received conventional education: written asthma materials and a non-asthma-related computer programme.	SPIROMETRY used to measure pulmonary function, asthma severity measured using NAEPP criteria, Pediatric Asthma Quality of Life, ASTHMA KNOWLEDGE TEST, Air control questionnaire
Krishna 2003	Asthma / Impact	USA	RCT, 2 arms: intervention versus control	246 children (under 18 years) with asthma attending	228/246 = 93% (intervention group = 107/119 = 90%; con-	An internet-enabled, interactive multimedia	Received conventional asthma education and	Received conventional asthma education, including	PEDIATRIC ASTHMA CARE KNOWLEDGE

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Table 1. Further Details of Included Studies (*Continued*)

				a pediatric pulmonary clinic. 65% male; 86% white participants. Intervention group n = 119, control group n = 127. Only children in the age group 7 to 17 years used the programme independently of carers.	trol group = 121/127 = 95%).	asthma education programme incorporating information and self management skil Provides behavior chang and decision support in its graphic templates co taining interactive vignettes.	used IMPACT during 3 routine visits to an asthma clinic. The program takes approximately 1 hour 20 minutes to complete.	verbal and written asthma information on the disease and concepts related to its control.	SURVEY FOR CHILDREN (7-17), caregivers 0-6, caregivers 7-17, DAYS WITH ASTHMA SYMPTOMS, days of activity limitation, days of sleep disturbance, school days missed, URGENT VISITS TO THE PHYSICAN, ER VISITS, HOSPITALISATION, DAYS OF STAYS IN HOSPITAL, days of quick relief medicine, use of inhaled steroids
Lehmann 2001	Diabetes / AIDA	Italy	RCT, 2 arms intervention versus control. Partial cross-over design.	24 adults with Type I Diabetes Mellitus; 50% male. Intervention group n = 12, control group n = 12.	18 / 24 = 75% (67% in control group; 83% in intervention group).	An interactive computer programme accessible via the world wide web. It contains information, behaviour change support and decision support.	Received 6 sessions using AIDA. Sessions lasted an average of 104 minutes. Participants did not interact directly with the computer but via a 'facilitator' as the pro-	Received 6 sessions of conventional education (slides) on the same topics. After completing post-test questionnaires they crossed over to receive 6 sessions on	KNOWLEDGE SCORE, social and emotional impact of diabetes on lifestyle, self-monitoring of blood glucose, forward thinking, well-being and self-confidence,

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Table 1. Further Details of Included Studies (*Continued*)

							gramme software was written in English.	AIDA.	hypoglycaemic attacks, HbA1C, empowerment
Mahoney 2002	Alzheimer's disease / Memory Loss CD	USA	RCT, 2 arms: intervention versus control	113 adults concerned about memory loss in a family member; intervention group n = 56, control group n = 57.	113 / 113 = 100%	A computer programme, delivered via a multimedia CD-ROM. Decision support and peer support are contained within modules on 'Making Plans' and 'Common Family Experiences'.	Used the programme on a project laptop during a home interview with research staff.	Received no intervention and were offered the opportunity to view the CD-ROM at the end of the research project.	KNOWLEDGE ABOUT MEMORY LOSS IN FAMILY MEMBERS; user satisfaction with the programme; CONTACTS WITH CLINICIANS
Ritterband 2003	Encopresis / U Can Poop Too	USA	RCT, 2 arms: intervention versus control	24 encopretic children; 19 boys; mean age 8.46 years (SD 1.81 years). Intervention group n = 12, control group n = 12.	24 / 24 = 100%	A computer programme delivered via the internet containing three core modules. Two provide information on encopresis and medication. The third provides behaviour change support via a detailed an-	Received in-home access to the programme via a provided computer and internet connection. They received the programme for 3 weeks and accessed the website an average of 14 times per participant d	Received phone calls only from research staff.	Bowel habits (child information form), ENCOPRESIS KNOWLEDGE QUESTIONNAIRE (EKQ), VECAT (assesses bowel-specific problems related to encopresis), NUMBER OF BOWEL ACCIDENTS PER WEEK,

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Table 1. Further Details of Included Studies (*Continued*)

						imated tutorial and a personalised instruction s	ing that time		use of internet programme
Shegog 2001	Asthma / Watch Discover Think Act (WDTA)	USA	RCT, 2 arms: intervention versus control	76 children recruited from clinics and schools; mean age 10.7 years; 47.9% white, non-Hispanic participants; 40.8% African-American pa ticipants; 7% Hispanic participants; 46 boys. 71 children completed the study of whic intervention group n = 38, control n = 33.	71 / 76 = 93%; distribution of dropouts between groups not given.	An interactive multimedia computer game delivered via CD-ROM. The programme provides intensive, tailored information on self-management for children with asthma. Text, graphics, animation, sound and video clips are utilis and behaviou support delivered via verbal reinforcement, g practice, feed back goal setting and incentives. Dat input = child' personal asth symptoms, e vironmental triggers, med ications, PEF	Participants in the intervention group played the game during a session organised at a university-linked medical centre.	Received no intervention.	KNOWLEDGE QUESTIONNAIRE ON ASTHMA MANAGEMENT, SELF-EFFICACY FOR ASTHMA MANAGEMENT, causal attributions, attribution classification, demographic and health information, computer experience, motivation, attitude toward CAL, process of use
Smith 2000	Diabetes / WTW	USA	RCT, 2 arms: intervention versus con-	30 women with Diabetes Melli-	Follow up rate not stated.	A computer programme accessed	Received in-home access to the pro-	Received paper copies of all the	HBA1C, health status, sources of support,

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Table 1. Further Details of Included Studies (*Continued*)

			trol	tus (Type I or II); aged 35 to 60 years; with a telephone and living at least 25 miles outside the 6 major cities of Montana. Intervention group n = 15, control group n = 15.		via a PC with modem connection. The software contained 4 components: conversation (online support group providing pe support); mailbox (pri vate e-mail corresponde between gro members); F (formal diabetes education); and Resource Ra (bulletin boa	gramme via a provided laptop for 5 months. They also received a notebook of health information regarding women's health in gen eral and specific diabetes information.	information materials that the intervention group received; that is, health information notebook and hard copies of computer-generated information.	PERSONAL RESOURCE QUESTIONNAIRE, Quality of Life Index, Social Readjustment Rating Scale PSYCHOSOCIAL ADAPTION TO ILLNESS SCALE, usage of computer programme
Turnin 1992	Diabetes / Diabeto	France	RCT, 2 arms: intervention versus control. Crossover design.	105 patients with diabetes. 59% male; 72% Type I Diabetes Mellitus; 74% working; mean age 45 years. Intervention group n = 54, control group = 51.	Follow up rate not stated.	Interactive dietary information and individualised counselling delivered via a Minitel videotext terminal. The programme provides dietetic information for diabetic patients. Behaviour chan support is	Received in-home access to Diabeto for 6 months.	No intervention for 6 months then crossed over to the intervention arm.	DIETETIC KNOWLEDGE SCORES, eating habits - caloric excess, % of carbohydrate, carbohydrate deficit, REDUCTION OF % FAT OF CALORIFIC INTAKE, fat excess, changes in body weight,

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Table 1. Further Details of Included Studies (*Continued*)

						provided via an individualised dossi containing e ergy requirements calculation and individualise meal analysis options, adapted mer personalised advice and dietary and cardiovascular information.			HBA1C
Turnin 2001	Obesity / Nutri-Expert	France	RCT, 2 arms: intervention versus control	557 obese patients: BMI > or equal to 33.3kg / m2. Mean age 41.2 y; 92.3% female; salaried workers 36.5%, unemployed or retired 23.1%, teaching or health care professions 14.1%. Of the 341 participants who completed th study intervention grou n = 169, control group n = 172.	341 / 557 = 61%. Dropouts equally distributed between intervention and control group (88 from control group and 91 from intervention group)	Nutrition education software programme on obesity delivered via a Minitel videotext terminal containing information on nutrition for obese patients. Behavior change support is provided by energy requirements calculation a individualise meal analysis options, adapted men and person-	Received usual care (7 medical/ dietetic visits) plus in-home access to the software programme via a provided terminal for 12 months.	Received usual care (7 medical/ dietetic visits).	BMI, waist circumference, weight, DIETETIC KNOWLEDGE SCORES, dietary intake (CALORIFIC INTAKE, carbohydrate, sugar, protein and fat intake), fasting plasma insulin and lipids - cholesterol

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Table 1. Further Details of Included Studies (*Continued*)

						alised advice A discussion forum provides peer support.			
Wydra 2001	Cancer / Coping with Cancer	USA	RCT, 2 arms: intervention versus control	174 patients with cancer; 51% male; 81% white participants; age range = 21 to 82 years. Intervention group n = 86, control group n = 88.	160 / 174 = 92%; distribution of dropouts between groups not given.	Interactive Video Disc delivered via a video disc player. Provides information on fatigue, saving and maintaining energy, managing stress and sleeping better. Behaviour change support was provided by self-management content of the modules eg. exercises to identify side effects, causes and patterns of problems such as fatigue.	Participants in the intervention group used the video disc at a single session in a cancer treatment centre.	Received usual care.	SELF CARE ACTIVITIES, wide range achievement test, self care ability
Wylie-Rosett 2001	Obesity / CD-ROM	USA	RCT, 3 arms: workbook only versus workbook + computer programme vs workbook	588 people; mean BMI = 35.6 kg/m2; 82% female; 83% white; 84%> 1yr	Raw data not given; overall study completion rate given as 81% with dropout rates	A multimedia computer programme providing information on nutrition and	Participants in the intervention group accessed the programme via touch-	Received a workbook containing 20 sections with self-help sheets.	KCAL PER DAY, % Kcal from fat, blocks walked daily, minutes

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Table 1. Further Details of Included Studies (*Continued*)

			+ computer programme + staff counselling. For purposes of systematic review, intervention = computer programme + workbook; control = workbook only.	of college; recruited from a managed care organisation. Workbook only (control group) n = 116, workbook+c group (intervention gr n = 236, workbook+c counselling n= 236. Sample size and n in each arm arrived at by authors in the light of data from studies.	of 16% (n = 19), 22% (n = 53) and 17% for the least, intermediate and most intensive intervention grou respectively.	fitness. Behavior change support is delivered via psychobehavioural content such as the setting, reviewing and evaluation of cho sen tailored behaviour go on food intake and phy ical activity.	screens in kiosks situated within a medical waiting room over a 12 month period. During the first 3 months, participants were asked to log on to the computer system at least once a week and thereafter at least once a montl		walked continuously, weight, BMI, waist circumference, % of body fat, cholesterols, triglicerides, glucose, blood pressure, COST ANALYSIS, diabetes and cardiovascular risk, medication usage and evaluation of computer programme
									* Outcome measures in capitals were selected for data synthesis.

Data extraction

Two review authors (EM and SST) independently extracted data. Data extracted included: author(s); date of publication; details of the intervention and control; details of participants; outcome measures reported in the primary studies; duration of follow-up and time at which outcomes were measured; and end-point mean, standard deviation and number of participants for the main outcome measure in each category of outcomes. Data were extracted onto standardised computer-based forms. Disagreements about data extracted were addressed by discussion between the two review authors. If the disagreement could not have been resolved by discussion, it would have been referred to the steering group; however this was not necessary. Only data from one outcome measure per outcome category were extracted, to prevent double counting. When there was more than one outcome measure in a particular outcome category, the decision as to which outcome data would be extracted was taken in a steering group meeting. These decisions were based on the clinical importance, or importance to consumers, of the outcome; or on the similarity of the outcome to those reported in other studies to enable data synthesis. The steering group were not aware of the results for each outcome during

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these discussions. When there were data missing, or where it was not possible to extract the necessary data because of the way it had been presented in the paper, we contacted the lead author requesting further information. As a result of these requests, missing data were provided for three studies, and stated not to be available for one study.

Once the data had been double extracted into computer-based forms, it was entered into RevMan by one review author (SST). Printouts of the data entered into RevMan were independently checked against the data entry forms and the original papers by two review authors (EM and JB).

Data synthesis

We decided to pool the data in a meta-analysis for a number of reasons. This review examines the effects of an intervention (IHCA) across a range of chronic disease, and is deliberately not limited to one disease. As this is a relatively new area of research, there are only a handful of studies in each disease area. This is insufficient to allow us to perform a meta-analysis for any one disease area. Further, IHCAs are designed to achieve similar outcomes (eg. beneficial changes in knowledge, perceived social support, health behaviours and clinical outcomes) across a range of diseases. We postulate that the IHCAs have a common method of working across all diseases (see Figure 1). For these reasons, we believe it appropriate to pool the data across studies for the various outcome categories.

Two studies (Brennan 1995; Mahoney 2002) reported data from carers, as the intervention was targeted at carers of patients with Alzheimer's disease/memory loss. We decided not to combine data from carers with data from patients; however, where it was possible to calculate SMDs for carers' outcomes these are included in the Additional tables of results.

Calculation of individual study estimates of the effect of the IHCA

The study outcome categories were knowledge, social support, self-efficacy, emotional, behavioural, clinical and economic outcomes. Data reported for emotional outcomes were too diverse to pool, and data for economic outcomes were too incomplete to allow extraction of meaningful data. Hence, meta-analyses were only performed for knowledge, social support, self-efficacy, behavioural and clinical outcomes. Final assessment means, standard deviations and sample sizes of the main outcome measure in each outcome category were used for each individual study's estimates. Three studies (Glasgow 2003; Gustafson 1999; Gustafson 2001) presented covariate adjusted end point means for their behavioural and social support outcomes and for clinical outcomes (Glasgow 2003). These adjusted means and standard deviations were used in the calculations for these outcomes.

The knowledge outcome for one study (Horan 1990), behavioural outcomes for three studies (Guendelman 2002; Homer 2000; Horan 1990), and clinical outcome for one study (Guendelman 2002) were expressed as binary variables. The data for the behavioural outcome 'takes asthma medication without a reminder' in (Guendelman 2002) were presented in the original paper in three categories: 'seldom or never,' 'most' or 'all' of the time. For the purpose of analysis, these three categories were dichotomised into 'seldom or never' versus 'most or all' of the time.

Use of standardised mean difference

The effect size for all continuous outcome variables was calculated as the standardised mean difference (SMD), which is the difference in the intervention and control group means divided by the pooled standard deviation with an adjustment for small sample bias. The SMD was used as there were several different scales or measures used to measure the same outcome. In the social support, emotional, behavioural and clinical outcome categories, some scales represented an improved outcome with an increased score, while others represented an improved outcome with a lower score. In order to harmonise these, for those outcomes where improvement was represented by a decreased score, the final means were multiplied by -1 as suggested in the *Cochrane Reviewers' Handbook* (Section 8.2.2.2) (Alderson 2004) before being entered into RevMan. SMDs were classified as positive when in favour of the intervention, and negative when in favour of the control. They were also categorised according to Lipsey categories, that is, small = 0 to 0.32; medium > 0.32 to 0.55; and large > 0.55 (Lipsey 1993).

Use of odds ratios

The knowledge outcome for one study (Horan 1990), behavioural outcomes for three studies (Guendelman 2002; Homer 2000; Horan 1990), and clinical outcome for one study (Guendelman 2002) were expressed as binary variables. The final assessment odds ratios (ORs) were calculated for all binary outcomes as: odds of favourable event in intervention group / odds of favourable event in control group as suggested in the *Cochrane Reviewers' Handbook* (Box 8.2.1) (Alderson 2004). Outcomes in favour of the intervention (IHCA) were thereby represented by odds ratios greater than 1. For consistency, the clinical binary outcome of 'any limitation in activity' was reversed to 'no limitation of activity' so that an OR of greater than 1 continued to represent an outcome in favour of the intervention.

Combining the results in a random-effects meta-analysis

RevMan 4.2 software was used to combine the individual study SMDs in a meta-analysis. There are two models for combining the effects of several studies: the fixed-effects model and the random-effects model. The fixed-effects model assumes that the only variability that occurs between studies arises from random variation and assumes a common effect. The random-effects model

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assumes that the effects in the studies are not all the same and takes this into consideration as an additional source of variation. Effects are also assumed to be randomly distributed, and the combined effect estimate is the central point of this distribution (*Cochrane Reviewers' Handbook* Section 8.6) (Alderson 2004). A random-effects meta-analysis is more conservative, and was used here as it was considered a more appropriate model to combine the results of the included studies which were clinically and methodologically diverse. Variations included different IHCAs, different lengths of exposure to the intervention (from 20 minutes to over 9 months), and different disease conditions. The random-effects meta-analysis performed in RevMan uses a variation on the inverse variance method known as the DerSimonian and Laird method (DerSimonian 1986), which also includes assessments for heterogeneity (*Cochrane Reviewers' Handbook* Section 8.6.2) (Alderson 2004). Heterogeneity may be present as a result of clinical or methodological differences between studies. Separate meta-analyses were performed for knowledge, social support, self-efficacy, behavioural and clinical outcomes. An overall effect was calculated for each meta-analysis, and a positive value indicated the effect was in favour of the intervention. The three binary behavioural outcomes were combined in a separate random-effects meta-analysis.

In order to describe a gradient of effect sizes across the range of outcomes addressed, in presenting the results, we have distinguished between those which had a positive effect (favouring the intervention) and were statistically significant, and those where the results suggest that it is more likely than not that IHCAs have a positive effect on outcomes, but where the results were not statistically significant.

Consumer participation

A consumer with experience of chronic disease and development of an IHCA for other people with chronic disease was an active member of the steering group. In addition, he internally peer-reviewed the report for comprehensibility and use of language.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of ongoing studies.

We identified 24,757 unique citations. Of these, 958 were either potentially relevant, or could not be adequately assessed without retrieving the full paper. Once the full report had been retrieved, the majority were not included in the review as: (1) the intervention was not an IHCA (692 papers); (2) the participants did not have a chronic disease (114 papers); or (3) the paper did not refer to an RCT (50 papers). One hundred and one papers reported a total of 32 RCTs of an IHCA for chronic disease. Eight of these were excluded (see Characteristics of excluded studies) leaving the 24 RCTs contained within the Characteristics of included studies table. These 24 included studies involved a total of 3739 participants, and covered a range of conditions. These conditions are listed below, with the numbers in square brackets [ ] indicating the number of included studies dealing with each condition:

- AIDS / HIV (adults) [2];
- Alzheimer's disease / memory loss(carers) [2];
- asthma (children) [6];
- cancer (breast, leukaemia) (children and adults) [3];
- diabetes (both Type 1 and Type 2) (children and adults) [6];
- eating disorders (adults) [1];
- encopresis (faecal soiling) (children) [1];
- obesity (adults) [2];
- urinary incontinence (adult women) [1].

Inclusion in the meta-analyses

Of the 24 included studies presented in the Characteristics of included studies and Additional Table 1, only 14 provided data suitable for use in one or more of the meta-analyses. The reasons for not including data from studies which appeared to provide data relevant to the meta-analyses are presented below and summarised in Additional Table 2.

Table 2. Included Studies - outcome data not utilised in meta -analyses

Study	Condition / IHCA	Country	Type of Study	Outcome Category	Outcome Measure	Reason for Omission
Brennan 1995	Alzhemier's disease / Computer-Link	USA	RCT, 2 arms: intervention versus control	Social Support	Social isolation	This study presented data on carers rather than patients. For this reason data was not included in the social support meta-

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Table 2. Included Studies - outcome data not utilised in meta -analyses (*Continued*)

						analysis. An SMD however has been calculated and is presented in Additional Table 4.
Brennan 1998	Alzheimer's disease / ComputerLink	USA	RCT, 2 arms: intervention versus control	Emotional	Depression - CES-D	Data not presented.
Dragone 2002	Cancer / Kidz with Leukemia	USA	RCT, 2 arms: intervention versus control	Knowledge	Leukaemia event knowledge interview	Knowledge: mean and SD not given so not possible to calculate SMD from the data presented.
Gorman 1995	Urinary Incontinence / UICS	USA	RCT, 3 arms: UICS versus booklet (AHCPR patient guideline with handout) vs. control. For purposes of systematic review, UICS is compared with control.	Clinical	Episodes of urinary incontinence over 3 days	Clinical: mean no. of episodes at final assessment only presented. No standard deviations provided so SMD not calculable.
Homer 2000	Asthma / Asthma Control	USA	RCT, 2 arms: intervention versus control	Knowledge, Clinical	Knowledge, Asthma Severity Score	Knowledge & Clinical: no standard deviations provided so SMD not calculable.
Horan 1990	Diabetes / DISC	USA	RCT, 2 arms: intervention versus control	Clinical	HbA1c	Clinical: SMD not calculable as no data presented for HbA1c.
Huss 2003	Asthma / Wee Willie Wheezie	USA	RCT, 2 arms: intervention versus control	Knowledge, Clinical	Asthma Knowledge Test, Spirometry	Knowledge: data on Asthma Knowledge Test not reported (Air Control questionnaire data presented only). Clinical: reported in text as no difference between

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Table 2. Included Studies - outcome data not utilised in meta -analyses (*Continued*)

						groups. No final data presented on spirometry; SMD not calculable.
Lehmann 2001	Diabetes / AIDA	Italy	RCT, 2 arms intervention versus control. Partial cross-over design.	Knowledge	Knowledge Questionnaire	Knowledge: Knowledge Questionnaire data not presented.
Mahoney 2002	Alzheimer's disease / Memory Loss CD-ROM	USA	RCT, 2 arms: intervention versus control	Knowledge	Knowledge about memory loss	Knowledge: this study presented data on carers rather than patients. For this reason it was not included in the knowledge outcome meta-analysis. An SMD however has been calculated and is presented in Additional Table 3.
Ritterband 2003	Encopresis / U Can Poop Too	USA	RCT, 2 arms: intervention versus control	Knowledge, Behavioural	Encopresis Knowledge Questionnaire, VECAT	Knowledge and Behavioural: not possible to calculate SMDs from data presented.
Smith 2000	Diabetes / WTW	USA	RCT, 2 arms: intervention versus control	Social Support, Emotional, Clinical	Personal Resource Questionnaire, Psychosocial Adjustment to Illness (PAIS), HbA1c	Social Support: only mean scores and no SDs were presented; SMD not calculable. Emotional: data not presented.Clinical: no data presented for HbA1c.
Wydra 2001	Cancer / Coping with Cancer	USA	RCT, 2 arms: intervention versus control	Behavioural	Self-care activities	Behavioural: SMD not calculable as no SD provided.
Wylie-Rosett 2001	Obesity / CDROM	USA	RCT, 3 arms: workbook	Behavioural, Clinical	Reduction in dietary intake, re-	Behavioral and Clinical:

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Table 2. Included Studies - outcome data not utilised in meta -analyses (*Continued*)

			only versus workbook + computer programme vs workbook + computer programme + staff counselling. For purposes of systematic review, intervention = computer programme + workbook; control = workbook only.		duction in BMI	only change from baseline data provided. No final SD presented so SMD not calculable.

Carers

Two studies presented data on carers, not patients (Brennan 1995; Mahoney 2002) and so were not used in the meta-analyses. As these studies did provide data suitable for calculating the SMD, they are described in the text, and the SMD presented in the relevant additional tables.

Knowledge

Dragone (Dragone 2002) studied children with leukaemia. Knowledge, as measured by the leukaemia event knowledge interview was an outcome; however, it was not possible to calculate the SMD from the data presented. Homer studied children with asthma (Homer 2000); a knowledge outcome was included, but it was not possible to calculate the SMD. Huss (Huss 2003) studied children with asthma, and measured knowledge; however this paper did not report data on the asthma knowledge test, and it was unclear whether the measure for which data were presented (the Air Control Questionnaire) was solely a measure of knowledge, or whether it also assessed other outcomes. Ritterband (Ritterband 2003) studied children with encopresis (faecal soiling). Knowledge was measured using the Encopresis Knowledge Questionnaire but it was not possible to calculate the SMD from the data presented. All other studies which presented data on knowledge are included in Additional Table 3 with either the SMD or OR results.

Table 3. Knowledge

Study	Measurement	No. at End Point	Outcome Timescale	SMDs & Lipsey Cat.
Andrewes 1996	Eating Disorders Knowledge Questionnaire (outcome improves as scale in-	Control = 27, Intervention = 27, Total = 54	1 week	0.76 (Large) Intervention

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Table 3. Knowledge (*Continued*)

	creases)			
Bartholomew 2000	Knowledge Score (outcome improves as scale increases)	Control = 62, Intervention = 70, Total = 132	7.9 months (mean)	0.11 (Small) Intervention
Brown 1997	Knowledge Score (outcome improves as scale increases)	Control = 28, Intervention = 31, Total = 59	6 months	0.07 (Small) Intervention
Krishna 2003	Paed. Asthma Knowledge Care Survey (Children aged 7 to 17) (outcome improves as scale increases)	Control = 28, Intervention = 25, Total = 53	12 months	0.96 (Large) Intervention
Mahoney 2002	Knowledge Score Test (outcome improves as scale increases). Not used in meta-analysis as study on carers.	Control = 57, Intervention = 56, Total 113	Immediately post-test	1.41 (Large) Intervention
Shegog 2001	Knowledge Questionnaire (outcome improves as scale increases)	Control = 33, Intervention = 38, Total = 71	3 weeks	0.56 (Large) Intervention
Turnin 1992	Dietetic Knowledge (outcome improves as scale increases)	Control = 50, Intervention = 45, Total = 95	6 months	0.72 (Large) Intervention
Turnin 2001	Dietetic Knowledge Test (outcome improves as scale increases)	Control = 105, Intervention = 94, Total =199	12 months	0.31 (Small) Intervention
Binary Outcomes				
Study	Measurement	No. at End Point	Outcome Timescale	Odds Ratio*
Horan 1990	Applied Diabetes Knowledge Score (outcome improves as scale increases)	Control = 9, Intervention = 9, Total = 18	18 Weeks	1.60
	*Odds ratio. <1 = in favour of the control, >1 = in favour of the intervention			

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Social support

Brennan (Brennan 1995) presented data on social isolation for carers; these data are presented in the additional table but not used in the meta-analysis. Smith (Smith 2000) studied rural women with diabetes and measured global social support with the Personal Resource Questionnaire, but it was not possible to calculate SMD from the data provided. All other studies which presented data on social support are represented in the meta-analysis (Additional Table 4).

Table 4. Social Support

Study	Measurement	No. at End Point	Outcome Timescale	SMDs & Lipsey Cat.
Brennan 1995	Reduced social isolation (outcome improves as scale decreases). Not used in meta-analysis as study on carers.	Control = 49, Intervention = 47, Total = 96	12 months	-0.14 (Small) Control
Brennan 1998	Reduced social isolation (outcome improves as scale decreases)	Control = 23, Intervention = 25, Total = 48	6 months	0. 12 (Small) Intervention
Brown 1997	Social support (outcome improves as scale increases)	Control = 28, Intervention = 31, Total = 59	6 months	0.18 (Small) Intervention
Glasgow 2003	Diabetes support scale (outcome improves as scale increases)	Control = 66, Intervention = 66, Total = 132	10 months	0.45 (Medium) Intervention
Gustafson 1999	Social support (outcome improves as scale increases)	Contol = 24, Intervention = 27, Total = 51*	5 months	0.51(Medium) Intervention
Gustafson 2001	Social support (outcome improves as scale increases)	Control = 125, Intervention = 121, Total = 246*	5 months	0.35 (Medium) Intervention
	* Data provided by authors			

Self-efficacy

Only three studies reported data on self-efficacy and all three are included in the meta-analysis (Additional Table 5).

Table 5. Self-efficacy

Study	Measurement	No. at End Point	Outcome Timescale	SMDs & Lipsey Cat.

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Table 5. Self-efficacy (*Continued*)

Bartholomew 2000	Child Self-efficacy expectations (outcome improves as scale increases)	Control = 69, Intervention = 70, Total = 139	7.9 months (mean)	0.14 (Small) Intervention
Brown 1997	Perceived self-efficacy (outcome improves as scale increases)	Control = 28, Intervention = 31, Total = 59	6 months	0.20 (Small) Intervention
Shegog 2001	Child self-efficacy for asthma self-management (outcome improves as scale increases)	Control = 32, Intervention = 38, Total = 70	3 weeks	0.48 (Medium) Intervention

Behavioural outcomes

Ritterband (Ritterband 2003) studied children with encopresis (faecal soiling), and included a behavioural outcome (VECAT); however it was not possible to calculate SMD from the data presented. Wydra (Wydra 2001) studied adults with cancer and included behavioural outcomes (self-care activities); however it was not possible to calculate SMD from the data presented. Wylie-Rosett (Wylie-Rosett 2001) studied adults with obesity and included the behavioural outcome of dietary intake; however as endpoint standard deviations were not presented it was not possible to calculate the SMD. All other studies which presented data on behavioural outcomes are included in Additional Table 6 with either SMD or OR results.

Table 6. Behavioural Outcomes

Study	Measurement	No. at End Point	Outcome Timescale	SMDs & Lipsey Cat.
Bartholomew 2000	Child self- management (outcome improves as scale increases)	Control = 63, Intervention = 69, Total = 132	7.9 months (mean)	0.32 (Small) Intervention
Brown 1997	Diabetes self-care rating scale (outcome improves as the scale increases)	Control = 28, Intervention = 31, Total = 59	6 months	0.43 (Medium) Intervention
Glasgow 2003	Average mins. of activity per day (outcome improves as scale increases)	Control = 66, Intervention = 66, Total = 132	10 months	-0.09 (Small) Control
Gustafson 1999	Participation in health care (outcome improves as scale increases)	Control = 23, Intervention = 24, Total = 47	5 months	0.77 (Large) Intervention

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Table 6. Behavioural Outcomes (*Continued*)

Gustafson 2001	Behaviourial involvement in health care (outcome improves as scale increases)	Control = 125, Intervention = 119, Total = 244*	5 months	0.11 (Small) Intervention
Turnin 1992	Reduction in % fat of calorific intake (outcome improves as scale decreases)	Control = 46, Intervention = 43, Total = 89	6 months	0.44 (Medium) Intervention
Turnin 2001	Reduction in caloric intake (outcome improves as scale decreases)	Control = 97, Intervention = 89, Total = 186	12 months	-0.06 (Small) Control
		* Data provided by authors		
Binary Outcomes				
Study	Measurement	No. at End Point	Outcome Timescale	Odds Ratios**
Guendelman 2002	% of pts taking asthma medication without reminder. Binary outcome analysed separately.	Control = 52, Intervention = 58, Total = 110	12 weeks	2.88
Homer 2000	% of pts with peak flow metre available. Binary outcome analysed separately.	Control = 49, Intervention = 57, Total = 106	> 9 months	0.91
Horan 1990	% of pts who changed exercise behaviour. Binary outcome analysed separately.	Control = 10, Intervention = 10, Total = 20	18 weeks	2.33
				** Odds ratio. <1 = in favour of the control, >1 = in favour of the intervention.

Clinical outcomes

Gorman (Gorman 1995) studied adult women with urinary incontinence, and included a clinical outcome (episodes of urinary incontinence); however it was not possible to calculate an SMD from the data presented. Homer (Homer 2000) studied children with asthma and included a clinical outcome but it was not possible to calculate an SMD from the data presented. Horan (Horan 1990) studied adolescents with Type 1 diabetes mellitus, and included a clinical outcome (glycosylated haemoglobin) in the design; however data on this outcome were not reported. Huss (Huss 2003) studied children with asthma, and undertook spirometry; however it was not possible to calculate an SMD from the data presented. Smith (Smith 2000) studied women with diabetes, and did not present any data on the clinical outcome studied (glycosylated haemoglobin). Wylie-Rosett (Wylie-Rosett 2001) studied obese adults and included a clinical outcome; however it was not possible to use the data as end-point standard deviations were not

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presented. All other studies which presented data on clinical outcomes are included in Additional Table 7 with either SMD or OR results.

Table 7. Clinical Outcomes

Study	Measurement	No. at End Point	Outcome Timescale	SMDs & Lipsey Cat.
Bartholomew 2000	Functional status (outcome improves as scale increases)	Control = 55, Intervention = 58 , Total = 113	7.9 months (mean)	0.21 (Small) Intervention
Brennan 1998	Health status (outcome improves as scale increases)	Control = 23, Intervention = 25, Total = 48	6 months	-0.42 (Medium) Control
Brown 1997	Reduction in HbA1c (outcome improves as scale decreases)	Control = 28, Intervention = 31 , Total = 59	6 months	-0.23(Small) Control
Glasgow 2003	Reduction in HbA1c (outcome improves as scale decreases)	Control = 66, Intervention = 66, Total = 132	10 months	0.24 (Small) Intervention
Gustafson 1999	Physical function (outcome improves as scale increases)	Control = 24, Intervention = 26, Total = 50	5 months	0.07 (Small) Intervention
Krishna 2003	Decrease in days with asthma symptoms (outcome improves as scale decreases)	Control = 44, Intervention = 42 , Total = 86	12 months	0.40 (Medium) Intervention
Lehmann 2003	Reduction in HbA1c (outcome improves as scale decreases)	Control = 8 , Intervention = 10, Total = 18	6 weeks	0.77 (Large) Intervention
Ritterband 2003	Decrease in bowel accidents per week (outcome improves as scale decreases)	Control = 12, Intervention = 12 , Total = 24	3 weeks	0.77 (Large) Intervention
Turnin 1992	Reduction in HbA1c (outcome improves as scale decreases)	Control = 50, Intervention = 45, Total = 95	6 months	0.42 (Medium) Intervention
Turnin 2001	Decrease in BMI (outcome improves as scale decreases)	Control = 120, Intervention = 110, Total = 230	12 months	0.10 (Small) Intervention
Binary Outcomes				

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Table 7. Clinical Outcomes (*Continued*)

Study	Measurement	No. at End Point	Outcome Timescale	Odds Ratio*
Guendelman 2002	Reduction in limitations in activity. Not included in this meta-analysis and not presented in separate meta-analysis as single binary result.	Control = 60, Intervention = 62, Total = 122	12 weeks	1.84
	* Odds ratio. <1 = in favour of the control, >1 = in favour of the intervention			

Risk of bias in included studies

Five studies reported sufficient detail on allocation procedures for the assessors to be reasonably certain that concealment of allocation was adequate. Nineteen studies simply said that participants were randomly allocated, but gave insufficient information about the methods of randomisation and/or the concealment of allocation. Twenty-one of the 24 included studies reported information on follow-up rates. Of these, six achieved follow-up rates of 100%; six achieved rates of 90 to 100%; four achieved rates of 80 to 89%; three achieved rates of 70 to 79%; and two reported follow-up rates of between 60 to 69%. None reported follow-up rates of less than 60%. Follow up rates for each study are presented in Additional Table 1.

Effects of interventions

For those outcomes where meta-analysis could be undertaken, we present the results of the meta-analysis, as this provides the clearest and most succinct summary of the results. However, for two outcome categories (emotional and economic), meta-analysis could not be undertaken, either because there were insufficient studies reporting data in this outcome category, or because the various outcome measures were judged to be too dissimilar to justify pooling the data. In these cases we present a narrative summary of the findings. In addition, we searched for unintended adverse consequences of IHCA; no study reported these.

For the results given below, information about each study has been summarised in Additional tables (Table 1 and Additional tables 3 to 8). Table 1 provides further information on included study characteristics. Additional tables 03 to 08 summarise the data presented for each outcome category (knowledge, social support, self-efficacy, emotional, behavioural and clinical outcomes). Each table contains information on the outcome measure used; the number of participants providing end-point data on each outcome (or if not reported for each outcome, the number of participants who completed the study); the duration of follow up; the effect estimate (SMD or OR); and the Lipsey effect size category (for SMDs).

(1) Knowledge

There were eight studies which reported sufficient data on knowledge for SMDs to be calculated. These eight studies were (Andrewes 1996; Bartholomew 2000; Brown 1997; Krishna 2003; Mahoney 2002; Shegog 2001; Turnin 1992; Turnin 2001) (Table 3). An additional study (Horan 1990) provided binary data, allowing an odds ratio (OR) to be calculated (AdditionalTable 3).

Studies providing continuous data

Andrewes compared computer-based psychoeducational modules with non-directive computer-based counselling for young adults with eating disorders. The programme was completed twice in a health care setting, with an interval of seven days between the first and second sessions. One week after the intervention, knowledge, as assessed by the eating disorders knowledge questionnaire, was improved in the intervention group (n = 27), compared to the control group (n = 27) (SMD 0.76) (Andrewes 1996).
Bartholomew examined an interactive multimedia computer game which provided intensive tailored self-management for children with asthma. This was compared with 'normal care' (no intervention). Children in the intervention group played the game during

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scheduled visits to asthma or community paediatric clinics over a mean of 7.6 months. Mean follow-up time was 7.9 months, at which point knowledge was improved in the intervention group (n = 70), compared to the control group (n = 62) (SMD 0.11) (Bartholomew 2000).

Brown examined an interactive computer programme in video game format which featured two adolescent elephant friends (Packy and Marlon) at a diabetes summer camp. Players had to save the camp from rats and mice. In order to do this, players had to help monitor the elephants' blood glucose, give insulin, review diabetes logbooks, find correct foods and encourage self-care in various situations. The intervention group had home access to this video game system for six months; the control group had home access to a non-educational video game and entertainment video for six months. The study population was children with diabetes mellitus, aged 8 -16, recruited from two paediatric outpatient clinics. After six months, knowledge was improved in the intervention group (n = 31), compared to the control group (n = 28) (SMD 0.07) (Brown 1997).

Krishna examined an internet-enabled, interactive multimedia asthma education programme, which presented principles of self-management and behavioural objectives. Participants also received conventional asthma education, which included verbal and written information on asthma and concepts related to its control. Outcomes were compared with those of participants receiving the conventional materials only. Participants were children with asthma attending a paediatric pulmonary clinic. They used the programme, which took approximately 80 minutes to complete, during three routine visits to the clinic. Mean follow-up time was 12 months, at which point knowledge was improved in the intervention group (n = 25), compared to the control group (n = 28) (SMD 0.96) (Krishna 2003).

Mahoney examined a computer programme delivered by a multimedia CD-ROM which contained information regarding distinguishing normal forgetfulness from dementia; procedures for clinical diagnosis; resources available; and family responses; and compared it with no intervention. The CD-ROM was viewed on a project laptop during a home interview with research staff. Participants were 113 adults concerned about memory loss in a family member. Immediately after viewing the programme, knowledge about memory loss was greater in the intervention group (n = 56) than the control group (n = 57) (SMD 1.41). This study was not used in the meta-analysis as the study focused on carers rather than patients (Mahoney 2002).

Shegog compared an interactive multimedia computer game which provided intensive, tailored, self-management for children with asthma with 'normal care' (no intervention). Participants played the game during a single session organised at a university linked medical centre. Children with asthma were recruited from clinics and schools. Mean follow-up time was three weeks, at which point knowledge was improved in the intervention group (n = 38), compared to the control group (n = 33) (SMD 0.56) (Shegog 2001).

Turnin 1992 compared interactive dietary information and individualised online counselling delivered via a Minitel videotext terminal with no intervention. Participants, who were adults with diabetes mellitus, had home access to the intervention for six months. At the six month follow-up, knowledge was improved in the intervention group (n = 45), compared to the control group (n = 50) (SMD 0.72) (Turnin 1992).

Turnin 2001 compared an interactive programme which provided individualised, tailored dietary information, help in meal composition, evaluation of calorific requirements, menu suggestions and a discussion forum with 'normal care' (7 medical / dietetic visits) for obese adults. Participants in the intervention group had home access to the software programme for twelve months. At the twelve month follow-up, knowledge was improved in the intervention group (n = 94), compared to the control group (n = 105) (SMD 0.31) (Turnin 2001).

Studies providing binary data

Horan examined an intervention comprising fifteen weeks of home access to a micro-computer, which combined diabetes education with data management and review, as well as goal setting and problem solving. This was compared with a conventional diabetes education booklet for 20 adolescents who had had Type 1 diabetes for more than one year. At the fifteen week follow up, the proportion of participants who had increased their knowledge by more than 5% was higher in the intervention group (n = 9) than in the control group (n = 9). As only baseline mean scores and the number of participants in each study group who improved or did not improve on the test were presented, the SMD could not be calculated and the data could not be combined with other studies in this meta-analysis. The odds ratio (OR 1.60) is presented in Additional Table 3 (Horan 1990).

IHCAs had a significant positive effect on knowledge (SMD 0.46; 95% CI 0.22 to 0.69). There was substantial heterogeneity in this outcome (I^2 = 52.8%). (See Analysis 1.1).

(2) Social support

There were six studies which provided sufficient data for calculation of an SMD for social support outcomes. These six studies were (Brennan 1995; Brennan 1998; Brown 1997; Glasgow 2003; Gustafson 1999; Gustafson 2001) (Additional Table 4).

Brennan 1995 was not used in the meta-analysis as the study focused on carers, not patients. This study examined home access to ComputerLink for primary caregivers of a person with Alzheimer's disease. ComputerLink provided information, an electronic encyclopaedia, online discussion groups and decision support to caregivers, and was compared with a control group receiving a monthly telephone call. At the twelve month follow-up, those in the intervention group (n = 47) had greater social isolation compared to

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those in the control group (n = 49); that is, the control group had a more favourable outcome (SMD -0.14) (Brennan 1995).

Brennan 1998 compared the effects of home access to ComputerLink for people living with AIDS with the effects of a printed brochure and a monthly telephone call for six months. ComputerLink was a specialised computer network which provided information, an electronic encyclopaedia, online discussion groups and decision support. At the six month follow-up, those in the intervention group (n = 25) had reduced social isolation (an improved outcome), compared to those in the control group, once depression had been accounted for (n = 23) (SMD 0.12) (Brennan 1998).

Brown examined an interactive computer programme in video game format which featured two adolescent elephant friends (Packy and Marlon) at a diabetes summer camp. Players had to save the camp from rats and mice. In order to do this, players had to help monitor the elephants' blood glucose, give insulin, review diabetes logbooks, find correct foods and encourage self-care in various situations. The intervention group had home access to this video game system for six months; the control group had home access to a non-educational video game and entertainment video for six months. The study population was children with diabetes mellitus, aged 8 - 16, recruited from two paediatric outpatient clinics. At six month follow-up, the intervention group (n = 31) had improved social support compared to those in the control group (n = 28) (SMD 0.18) (Brown 1997).

Glasgow compared home access to an internet-enabled computer system providing information and a professionally mediated e-mail diabetes peer support forum, with computer access to information only for adults with Type 2 diabetes mellitus. At the ten month follow-up point, the intervention group (n = 66) had better perceived social support than the control group (n = 66) (SMD 0.45) (Glasgow 2003).

Gustafson 1999 examined home access to a computerised support system for people with HIV / AIDS which provided information, decision support,and online discussion groups with other users, compared with 'normal' care (no intervention). At the five month follow-up point, the intervention group (n=27) had better perceived social support than the control group (n = 24) (SMD 0.51) (Gustafson 1999).

Gustafson 2001 examined home access to a computerised support system for women with breast cancer (CHESS) which provided information, social support (discussion groups and personal stories) and decision support (health charts, decision aids and action plans). This was compared with a control group which received a book only. At the five month follow-up point, the intervention group (n = 121) had better perceived social support than the control group (n = 125) (SMD 0.35). This study also specifically looked at the differential effect of the intervention in medically underserved women when compared to more affluent women with private health insurance. The authors demonstrated an interaction between indicators of medical underservice (race, education and lack of insurance) and experimental assignment, such that medically underserved women assigned to CHESS appeared to benefit even more from CHESS than the more affluent women assigned to the intervention group (Gustafson 2001).

IHCAs had a significant positive effect on social support (SMD 0.35; 95% CI 0.18 to 0.52). There was no evidence of heterogeneity in this outcome (I^2 = 0%). (See Analysis 2.1).

(3) Self-efficacy

Three studies reported data on self-efficacy (Bartholomew 2000; Brown 1997; Shegog 2001) (Additional Table 5). Self-efficacy refers to a person's belief in their capacity to undertake a specific action or achieve a specific goal.

Bartholomew compared an interactive multimedia computer game which provided intensive tailored self-management for children with asthma with 'normal care' (no intervention). Children in the intervention group played the game during scheduled visits to asthma or community paediatric clinics over a mean of 7.6 months. Mean follow-up time was 7.9 months, at which point self-efficacy was improved in the intervention group (n = 70) compared to the control group (n = 69) (SMD 0.14) (Bartholomew 2000).

Brown examined an interactive computer programme in video game format which featured two adolescent elephant friends (Packy and Marlon) at a diabetes summer camp. Players had to save the camp from rats and mice. In order to do this, players had to help monitor the elephants' blood glucose, give insulin, review diabetes logbooks, find correct foods and encourage self-care in various situations. The intervention group had home access to this video game system for six months; the control group had home access to a non-educational video game and entertainment video for six months. The study population was children with diabetes mellitus, aged 8 to 16, recruited from two paediatric outpatient clinics. After six months, self-efficacy was improved in the intervention group (n = 31) compared to the control group (n = 28) (SMD 0.20) (Brown 1997).

Shegog compared an interactive multimedia computer game which provided intensive, tailored, self-management for children with asthma with 'normal care' (no intervention). Participants played the game during a single session organised at a university linked medical centre. Children with asthma were recruited from clinics and schools. Mean follow-up time was three weeks, at which point self-efficacy was improved in the intervention group (n = 38) compared to the control group (n = 32) (SMD 0.48) (Shegog 2001).

Results suggest it is more likely than not that IHCAs have a positive effect on self-efficacy (SMD 0.24; 95% CI 0.00 to 0.48). There was no evidence of heterogeneity in this outcome (I^2 = 0%). (See Analysis 3.1).

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(4) Emotional outcomes

Six studies reported some data on emotional outcomes (Brennan 1995; Brennan 1998; Glasgow 2003; Gustafson 1999; Gustafson 2001; Smith 2000). Meta-analysis could not be undertaken as the outcome measures used were too disparate (depression, emotional well-being and psychosocial adaptation to illness) (Additional Table 8).

Table 8. Emotional Outcomes

Study	Measurement	No. at End Point	Outcome Timescale	SMD & Lipsey Cat.
Brennan 1995 (study on carers)	Depression CES-D	Control = 49, Intervention = 47, Total = 96	12 months	-0.30 (Small) Control
Glasgow 2003	Depression CES-D	Control = 66, Intervention = 66 , Total = 132	10 months	0.16 (Small) Intervention
Gustafson 1999	Depression MOS	Control = 24, Intervention = 27, Total = 51	5 months	0.24 (Small) Invtervention
Gustafson 2001	Emotional Well -Being Fact -B	Control = 125, Intervention = 121, Total = 246	5 months	0.06* (Small) Intervention
				* using pooled SDs

Brennan 1995 examined home access to ComputerLink for primary caregivers of a person with Alzheimer's disease. ComputerLink provided information, an electronic encyclopaedia, online discussion groups and decision support to caregivers, and compared it with a control group receiving a monthly telephone call. Depression was measured using the Center for Epidemiologic Studies Depression scale. This study conceptualised depression as an intervening (or control) variable; at the twelve month follow up there was a small effect in favour of the control group (n = 49) compared to the intervention group (n = 47) (SMD -0.30) (Brennan 1995).

Brennan 1998 compared home access to ComputerLink for people living with AIDS with a printed brochure and a monthly telephone call for six months. ComputerLink was a specialised computer network which provided information, an electronic encyclopaedia, online discussion groups and decision support. Depression was conceptualised as an intervening (or control) variable that impacted on perceived social isolation, and data on levels of depression in the two groups were not presented. Hence this study is not included in Additional Table 8 (Brennan 1998).

Glasgow compared home access to an internet-enabled computer system providing information and a professionally mediated e-mail diabetes peer support forum, with computer access to information only for adults with Type 2 diabetes mellitus. Depression was measured using the Center for Epidemiologic Studies Depression scale. At the ten-month follow-up point, there was a small effect size in favour of the intervention group (n = 66) compared to the control group (n = 66) (SMD 0.16) (Glasgow 2003).

Gustafson 1999 examined home access to a computerised support system for people with HIV / AIDS which provided information, decision support and online discussion groups with other users, and compared it with 'normal care' (no intervention). Depression was measured using the Medical Outcomes Survey, short form 23. At the five month follow-up, there was a small effect size in favour of the intervention group (n = 27) compared to the control group (n = 24) (SMD 0.24) (Gustafson 1999).

Gustafson 2001 examined home access to a computerised support system for women with breast cancer (CHESS) which provided information, social support (discussion groups and personal stories) and decision support (health charts, decision aids and action

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plans). This was compared with a control group which received a book only. Emotional well-being was measured using the Functional Assessment of Cancer Therapy Breast (FACT-B) instrument. At five month follow-up, the intervention group (n = 121) had better emotional well-being than the control group (n = 125) (SMD 0.06) (Gustafson 2001).

Smith compared five months of home access to a computer-based programme providing online support, diabetes education and a bulletin board with paper copies of the educational material for women with Type 1 or Type 2 diabetes mellitus. The measure used for emotional outcome was the Psychosocial Adaptation to Illness Scale (PAIS). It was not possible to calculate an SMD, as standard deviations were not provided, but the authors report the results in the text as showing no difference between groups. Due to the lack of complete data, this study is not included in additional Table 8 (Smith 2000).

In summary, it was not possible to determine whether IHCAs have an effect on emotional outcomes.

(5) Behavioural outcomes

Seven studies reported sufficient data on behavioural outcomes to allow SMD to be calculated (Bartholomew 2000; Brown 1997; Glasgow 2003; Gustafson 1999; Gustafson 2001; Turnin 1992; Turnin 2001). Three additional studies provided binary data allowing Odds Ratios (OR) to be calculated (Guendelman 2002; Homer 2000; Horan 1990) (Additional Table 6).

Studies providing continuous data

Bartholomew compared an interactive multimedia computer game which provided intensive tailored self-management for children with asthma with 'normal care' (no intervention). Children in the intervention group played the game during scheduled visits to asthma or community paediatric clinics over a mean of 7.6 months. After a mean of 7.9 months follow-up, children in the intervention group (n = 69) showed improved self-management behaviours compared to those in the control group (n = 63) (SMD 0.32) (Bartholomew 2000).

Brown examined an interactive computer programme in video game format which featured two adolescent elephant friends (Packy and Marlon) at a diabetes summer camp. Players had to save the camp from rats and mice. In order to do this, players had to help monitor the elephants' blood glucose, give insulin, review diabetes logbooks, find correct foods and encourage self-care in various situations. The intervention group had home access to this video game system for six months; the control group had home access to a non-educational video game and entertainment video for six months. The study population was children with diabetes mellitus, aged 8 -16, recruited from two paediatric outpatient clinics. After six months, children in the intervention group (n = 31) scored higher (better) on the diabetes self-care rating scale than those in the control group (n = 28) (SMD 0.43) (Brown 1997).

Glasgow compared home access to an internet-enabled computer system providing information and a professionally mediated e-mail diabetes peer support forum,with computer access to information only for adults with Type 2 diabetes mellitus. At the ten month follow-up point, participants in the control group (n = 66) showed a higher average number of minutes of activity per day (an improved outcome) than those in the intervention group (n = 66) (SMD -0.09) (Glasgow 2003).

Gustafson 1999 compared home access to a computerised support system for people with HIV / AIDS, which provided information, decision support, and online discussion groups with other users, to 'normal care' (no intervention). At the five month follow-up point, the intervention group (n = 24) showed greater participation in health care (an improved outcome) than the control group (n = 23) (SMD 0.77) (Gustafson 1999).

Gustafson 2001 examined home access to a computerised support system for women with breast cancer (CHESS) which provided information, social support (discussion groups and personal stories) and decision support (health charts, decision aids and action plans). This was compared with a control group which received a book only. At the five month follow-up point, the intervention group (n = 119) showed greater behavioural involvement in health care (an improved outcome) than the control group (n = 125) (SMD 0.11) (Gustafson 2001).

Turnin 1992 compared interactive dietary information and individualised online counselling delivered via a Minitel videotext terminal with no intervention. Participants, who were adults with diabetes mellitus, had home access to the intervention for six months. At the six month follow-up, the percentage of total calorific intake from fat was reduced (an improved outcome) in the intervention group (n = 43) compared to the control group (n = 46) (SMD 0.44) (Turnin 1992).

Turnin 2001 compared an interactive programme which provided individualised, tailored dietary information, help in meal composition, evaluation of calorific requirements, menu suggestions and a discussion forum with 'normal care' (7 medical / dietetic visits) for obese adults. Participants in the intervention group had home access to the software programme for twelve months. At the twelve month follow-up point, calorific intake was reduced (an improved outcome) in the control group (n=97) compared to the intervention group (n = 89) (SMD -0.06) (Turnin 2001).

Studies providing binary data

Guendelman compared ninety days of home access to an internet-enabled computer programme which provided personalised, interactive information and advice on asthma self-management with a standard asthma diary for children with asthma recruited from a primary care clinic. After twelve weeks, a higher proportion of the intervention group (n = 58) were taking asthma medication

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without a reminder than those in the control group (n = 52) (OR 2.88) (Guendelman 2002).

Homer examined an interactive educational computer programme in game format, for children with asthma, in which players help a superhero complete all six levels of the game while keeping his asthma under control. Participants used the game over three sessions in a primary care clinic or neighbourhood health centre, and the average time taken to complete the game for a first time player was 45-60 minutes. Children in the control group received an age-appropriate asthma education book and a non-educational computer game. At nine month follow up, a greater proportion of the participants in the control group (n = 49) had a peak flow metre available (a favourable outcome) compared to those in the intervention group (n = 57) (OR 0.91) (Homer 2000).

Horan examined fifteen weeks of home access to a microcomputer-based system which provided data management and review, factual and applied diabetes education, and problem-solving and goal setting and compared it with a conventional diabetes education booklet for adolescents with Type 1 diabetes mellitus. After eighteen weeks of follow-up, a higher proportion of participants in the intervention group (n = 10) had changed their exercise behaviour (a favourable outcome) than those in the control group (n = 10) (OR 2.33) (Horan 1990).

IHCAs had a significant positive effect on continuous behavioural outcomes (SMD 0.20; 95% CI 0.01 to 0.40). Binary behavioural outcomes also showed a positive effect for IHCAs, although this result was not statistically significant (OR 1.66; 95% CI 0.71 to 3.87). Both continuous data (I^2 = 50.3%) and binary data (I^2 = 48.2%) showed substantial heterogeneity. Despite this, IHCAs are most likely to be beneficial in terms of behavioural outcomes. (See Analysis 4.1; Analysis 4.2**).**

(6) Clinical outcomes

Ten studies provided sufficient data to allow SMD to be calculated (Bartholomew 2000; Brennan 1998; Brown 1997; Glasgow 2003; Gustafson 1999; Krishna 2003; Lehmann 2003; Ritterband 2003; Turnin 1992; Turnin 2001). One additional study (Guendelman 2002) provided binary data, allowing an OR to be calculated (Additional Table 7).

Studies providing continuous data

Bartholomew compared an interactive multimedia computer game which provided intensive tailored self-management for children with asthma with 'normal care' (no intervention). Children in the intervention group played the game during scheduled visits to asthma or community paediatric clinics over a mean of 7.6 months. After a mean of 7.9 months follow-up, children in the intervention group (n = 58) showed improved functional status compared to those in the control group (n = 55) (SMD 0.21) (Bartholomew 2000).

Brennan 1998 compared home access to ComputerLink for people living with AIDS with a printed brochure and a monthly telephone call for six months. ComputerLink was a specialised computer network which provided information, an electronic encyclopaedia, online discussion groups and decision support. At the six-month follow up, those in the control group (n = 23) had less of a reduction in health status (ie. a better outcome for the control group) compared to those in the intervention group (n = 25) (SMD -0.42) (Brennan 1998).

Brown examined an interactive computer programme in video game format which featured two adolescent elephant friends (Packy and Marlon) at a diabetes summer camp. Players had to save the camp from rats and mice. In order to do this, players had to help monitor the elephants' blood glucose, give insulin, review diabetes logbooks, find correct foods and encourage self-care in various situations. The intervention group had home access to this video game system for six months; the control group had home access to a non-educational video game and entertainment video for six months. The study population was children with diabetes mellitus, aged 8 -16, recruited from two paediatric outpatient clinics. After six months, children in the control group (n = 28) had a smaller increase (ie. a better outcome for the control group) in glycosylated haemoglobin levels than those in the intervention group (n = 31) (SMD -0.23) (Brown 1997).

Glasgow compared home access to an internet-enabled computer system providing information and a professionally mediated e-mail diabetes peer support forum with computer access to information only for adults with Type 2 diabetes mellitus. At the ten month follow-up point, participants in the intervention group (n = 66) had lower (better) glycosylated haemoglobin levels than those in the control group (n = 66) (SMD 0.24) (Glasgow 2003).

Guendelman compared ninety days of home access to an internet-enabled computer programme which provided personalised, interactive information and advice on asthma self-management with a standard asthma diary for children with asthma recruited from a primary care clinic. After twelve weeks, fewer children in the intervention group (n = 62) reported limitation in activity compared to the children in the control group (n = 60) (OR 1.84) (Guendelman 2002).

Gustafson 1999 compared home access to a computerised support system for people with HIV / AIDS which provided information, decision support, and online discussion groups with other users to 'normal care' (no intervention). At the five month follow-up point, the intervention group (n = 26) showed better physical function than the control group (n = 24) (SMD 0.07) (Gustafson 1999).

Krishna examined an internet-enabled, interactive multimedia asthma education programme, which presented principles of self-management and behavioural objectives. Participants also received conventional asthma education, which included verbal and written information on asthma and concepts related to its control. Outcomes were compared with those of participants receiving the conventional materials only. Participants were children with

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asthma attending a paediatric pulmonary clinic. They used the programme, which took approximately 80 minutes to complete, during three routine visits to the clinic. Mean follow up time was 12 months, at which point children in the intervention group (n = 42) had fewer days with asthma symptoms than those in the control group (n = 44) (SMD 0.40) (Krishna 2003).

Lehmann compared six sessions use of an interactive web-based programme containing education, self-management and decision support with six sessions of conventional diabetes education on the same topics in adults with Type 1 diabetes mellitus. After six weeks, the level of glycosylated haemoglobin was lower (better) in the intervention group (n = 10) compared to the control group (n = 8) (SMD 0.77) (Lehmann 2003).

Ritterband examined three weeks of home access to a computer-based programme delivered over the internet which combined information on encopresis (faecal soiling) with behavioural treatments and training, and compared it with a group receiving phone calls from the research staff. At the three week point, children in the intervention group (n = 12) had fewer bowel accidents (an improved outcome) than those in the control group (n = 12) (SMD 0.77) (Ritterband 2003).

Turnin 1992 compared interactive dietary information and individualised online counselling delivered via a Minitel videotext terminal with no intervention. Participants, who were adults with diabetes mellitus, had home access to the intervention for six months. At the six month follow-up, glycosylated haemoglobin was lower (better) in the intervention group (n = 45) compared to the control group (n = 50) (SMD 0.42) (Turnin 1992).

Turnin 2001 compared an interactive programme which provided individualised, tailored dietary information, help in meal composition, evaluation of calorific requirements, menu suggestions and a discussion forum with 'normal care' (7 medical / dietetic visits) for obese adults. Participants in the intervention group had home access to the software programme for twelve months. At the twelve month follow-up, Body Mass Index (BMI) was lower (an improved outcome) in the intervention group (n = 110) than in the control group (n = 120) (SMD 0.10) (Turnin 2001).

Studies providing binary data

Guendelman compared ninety days of home access to an internet-enabled computer programme which provided personalised, interactive information and advice on asthma self-management with a standard asthma diary for children with asthma recruited from a primary care clinic. After twelve weeks, fewer children in the intervention group (n = 62) reported limitations in activity compared to the children in the control group (n = 60) (OR 1.84) (Guendelman 2002).

IHCAs had a significant positive effect on continuous clinical outcomes (SMD 0.18; 95% CI 0.01 to 0.35). There was some heterogeneity in this outcome (I^2 = 30.6%). Despite this, IHCAs are most likely to be beneficial in terms of clinical outcomes. (See Analysis 5.1**).**

(7) Economic outcomes

Nine studies presented some data on health service utilisation or economic outcomes (Bartholomew 2000; Brennan 1995; Brown 1997; Guendelman 2002; Gustafson 1999; Homer 2000; Krishna 2003; Mahoney 2002; Wylie-Rosett 2001). Data synthesis could not be undertaken as the data provided in most of these studies did not permit any estimation of overall health service resource use.

Bartholomew compared an interactive multimedia computer game which provided intensive tailored self-management for children with asthma with 'normal care' (no intervention). Children in the intervention group played the game during scheduled visits to asthma or community paediatric clinics over a mean of 7.6 months. The two economic outcomes included were number of emergency room visits and number of hospitalisations. There was no difference between the two groups for the first outcome, while the number of hospitalisations was lower in the intervention group compared to the control group, particularly in children under 12 years of age. No data on routine care were provided, making it impossible to determine overall use of health service utilisation (Bartholomew 2000).

Brennan 1995 examined home access to ComputerLink for primary caregivers of a person with Alzheimer's disease. ComputerLink provided information, an electronic encyclopaedia, online discussion groups and decision support to caregivers, and compared it with a control group receiving a monthly telephone call. An economic analysis undertaken from the perspective of the primary caregiver was undertaken, which concluded that the total costs to the caregiver of ComputerLink were less than the costs of equivalent community care (Payton 1995).

Brown examined an interactive computer programme in video game format which featured two adolescent elephant friends (Packy and Marlon) at a diabetes summer camp. Players had to save the camp from rats and mice. In order to do this, players had to help monitor the elephants blood glucose, give insulin, review diabetes logbooks, find correct foods and encourage self-care in various situations. The intervention group had home access to this video game system for six months; the control group had home access to a non-educational video game and entertainment video for six months. The study population was children with diabetes mellitus, aged 8 -16, recruited from two paediatric outpatient clinics. Data were provided on the number of urgent care visits in the past three months (no significant difference between the two groups), but no other data on health service utilisation were provided, making it impossible to determine overall resource utilisation (Brown 1997).

Guendelman compared ninety days of home access to an internet-enabled computer programme which provided personalised, interactive information and advice on asthma self-management

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with a standard asthma diary for children with asthma recruited from a primary care clinic. Data were provided on the number of urgent calls, emergency department visits and hospitalisations. The number of urgent calls was lower at the 12 week follow up in the intervention group than in the control group, but there was no significant difference in the other two economic outcomes. No data on routine health service utilisation were provided, making it impossible to determine overall resource utilisation (Guendelman 2002).

Gustafson 1999 compared home access to a computerised support system (CHESS) for people with HIV / AIDS, which provided information, decision support, and online discussion groups with other users to 'normal care' (no intervention). Data were reported for use of ambulatory care services (non-emergency visits, average visit time, emergency visits and phone calls) and for hospitalisation (number of hospitalisations per subject, average length of stay when hospitalised and hospital days per subject). Data were collected in three two-month periods: prior to installation of CHESS, during the installation period, and after CHESS had been removed from participants' homes. Data from the two-month period prior to installation were not presented. Data comparing health service utilisation during the CHESS installation period with the after CHESS had been removed period showed no significant difference between the intervention and control groups for non-emergency and emergency visits. However, average visit time was shorter in the intervention group than the control group during implementation (42.91 minutes versus 49.38 minutes, $p = 0.043$); this difference became non-significant after the computer programme had been removed (31.07 minutes versus 29.59 minutes, $p > 0.2$). Participants in the intervention group also made more phone calls to health providers than participants in the control group during the installation period (2.53 versus 1.71, $p = 0.013$). Once again, after removal of the system, the difference persisted but became non-significant (2.17 versus 1.65, $p = 0.094$). Data on hospitalisations were also presented for two-month periods during and after CHESS installation. These data showed that the intervention group had fewer hospitalisations per subject than the control group during installation (0.14 versus 0.21, $p = 0.02$), but that this difference became non-significant after CHESS had been removed (0.14 versus 0.19, $p > 0.2$). Participants in the intervention group had shorter average lengths of stay (5.00 versus 8.16 days, $p = 0.009$) and fewer hospital days per subject (0.59 versus 1.72, $p = 0.007$) than participants in the control group during the installation period. After CHESS had been removed, the difference in average length of stay became non-significant (6.76 versus 5.32 days, $p > 0.2$), as did the difference in number of hospital days per subject (0.80 versus 1.15, $p = 0.118$) (Gustafson 1999).

Homer compared an interactive educational computer programme in game format, for children with asthma, in which players help a superhero complete all six levels of the game while keeping his asthma under control. Participants used the game over three sessions in a primary care clinic or neighbourhood health centre, and the average time taken to complete the game for a first time player was 45-60 minutes. Children in the control group received an age-appropriate asthma education book and a non-educational computer game. Data were reported for the total number of emergency department and acute office visits for asthma during the study period. There was no significant difference between the two groups for these data (Homer 2000).

Krishna examined an internet-enabled, interactive multimedia asthma education programme, which presented principles of self-management and behavioural objectives. Participants also received conventional asthma education, which included verbal and written information on asthma and concepts related to its control. Outcomes were compared with those of participants receiving the conventional materials only. Participants were children with asthma attending a paediatric pulmonary clinic. They used the programme, which took approximately 80 minutes to complete, during three routine visits to the clinic. Data on urgent visits to the physician, emergency room visits, hospitalisations and days of hospital stay were presented, with fewer urgent visits and emergency room visits in the intervention group than in the control group. There was no significant difference between the two groups for number of hospitalisations and days of hospital stay (Krishna 2003).

Mahoney compared a computer programme delivered by a multimedia CD-ROM, which contained information distinguishing normal forgetfulness from dementia, procedures for clinical diagnosis, resources available and family responses, with no intervention. The CD-ROM was viewed on a project laptop during a home interview with research staff. Participants were 113 adults concerned about memory loss in a family member. Data were collected on the number of clinician contacts in the intervention group ($n = 44$) in the six months following the intervention, but the corresponding data were not collected for the control group (Mahoney 2002).

Wylie-Rosett examined a multimedia computer programme containing nutrition, fitness and psycho-behavioural content with information, guidance, interactive quizzes and video clips and compared it with a self-help workbook for obese adults. Cost data from the perspective of the managed care organisation were calculated as $6.23 for workbook only and $8.57 for workbook + IHCA per pound lost by participants (Wylie-Rosett 2001).

It was therefore not possible to draw any conclusions about the effects of IHCAs on overall resource use or the cost of the intervention.

Postulated Pathway of Change

Few studies included a postulated pathway of change for the IHCA, and those that did tended not to collect data on intermediary outcomes. The pathway of change could therefore not be tested, and that it was not possible to test the various hypotheses that might have helped to explain the findings.

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DISCUSSION

IHCAs have been developed for a range of chronic diseases and all age ranges, from preschool children to carers of patients with Alzheimer's disease. However, overall conclusions regarding their effects are limited by the range of populations in the trials, disparate conditions studied, the variable nature of the IHCA, and the differing intensity of exposure (from 20 minutes, to many hours spread over six to nine months). Researchers used very different outcomes, and even where similar outcomes were studied, different outcome measures were used. Control groups received variable interventions. In spite of these limitations, some tentative conclusions emerge.

Main results

IHCAs have a significant positive effect on knowledge, perceived social support, health behaviours and clinical outcomes. Results suggest it is more likely than not that IHCAs have a positive effect on self-efficacy. It was not possible to determine the effects of IHCAs on emotional or economic outcomes.

Knowledge

The effect on knowledge is compatible with previous work on computer-assisted learning (CAL), which has repeatedly demonstrated that CAL is at least as effective, and often more effective, than traditional teaching methods (Fletcher Flinn 1995). Similarly, O'Connor (O'Connor 2003) found that decision aids, when compared to usual care, substantially increased knowledge about the condition and decision faced amongst users. It is likely that there are a number of factors contributing to IHCAs' ability to improve knowledge, including the interactive nature of the information, the use of audio, graphics and video to present the information, and users' ability to revisit the information repeatedly over time.

Social support

Qualitative studies of IHCAs (Andersson 2002; Boisen 2003; Glueckauf 2003; Hanson 1999; Hanson 2000; Pierce 2002; McTavish 2003; Rolnick 1999; Scheerhorn 1997; Shaw 2000; Smyth 1993; Steiner 2002) suggest that social support is of great importance to users. The positive effect of IHCAs on social support demonstrated in this review is therefore an important finding. Qualitative studies suggest that the important features of social support include the 24-hour availability of the online discussion group and the ability to share experiences with people with the same illness, and hence, facing similar problems. Our results differ from, but are compatible with, the systematic review examining electronic support groups (ESG) by Eysenbach et al (Eysenbach 2004). This review identified 38 distinct studies of which 20 were randomised trials, 11 were before-and-after studies, three were non-randomised controlled trials, three were meta-analyses of n of 1 trials, and one was a cohort study. Only six of these studies evaluated 'pure' peer-to-peer communities, and one had a factorial design with a 'peer-to-peer only' arm, whereas 31 evaluated complex interventions. Eysenbach and colleagues considered that this made it impossible to attribute intervention effects to the peer-to-peer community component. This review found that most studies did not show an effect, but that there was no evidence to support concerns over ESG harming people. There was some overlap between the studies included in the review of ESG and our IHCA review (namely Brennan 1995; Brennan 1998; Glasgow 2003; Gustafson 1999; Gustafson 2001). Brennan 1995 was excluded from our meta-analysis as it examined carers. In the remaining four studies, both sets of review authors reached similar conclusions. The overall difference in findings between the two reviews is therefore likely to reflect different inclusion criteria in terms of the intervention (electronic support groups versus IHCA), the population studied (all populations versus patients with chronic disease), and accepted methodologies (all evaluative studies versus RCT only).

Behavioral outcomes

The positive effect of IHCAs on behaviour change demonstrated by the meta-analysis of continuous data is supported by the result of the meta-analysis of binary data, which also showed a positive effect. The lack of statistical significance in the binary data is likely to be due to the small number of studies combined in analysis. Our findings are compatible with other work in this area. A recent narrative review by Nguyen et al of 17 articles reporting studies that evaluated the impact of professionally facilitated internet-based programmes for diverse clinical populations on health outcomes (including behaviour change outcomes), suggested that some outcomes in certain groups can be moderately improved (Nguyen 2004). Again, this review differed from ours in terms of the intervention (professionally facilitated internet-based programmes versus IHCA), the populations studied (all clinical populations versus patients with chronic disease), and accepted methodologies (all evaluative studies versus RCT only).

Wantland (Wantland 2004) undertook a meta-analysis to determine the effectiveness of web-based versus non-web-based interventions on behaviour change. This study included 22 studies, although these authors decided not to continue with the meta-analysis, in view of the heterogeneity of included studies. These authors did report, however, that 16 of the 17 studied effect outcomes revealed improved knowledge and / or behavioural outcomes for participants using the web-based interventions compared to the non-web-based interventions. Five of the studies in the Wantland review are also included in our review (Krishna 2003; Gustafson 1999; Ritterband 2003; Homer 2000; Brennan 1998). Studies that were included in the Wantland review, but not in our review, included those where the intervention was computerised cognitive behavioural therapy, studies which were not randomised con-

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trolled trials, and studies where the study population did not have a chronic disease (for example, exercise promotion in non-clinical populations; weight loss in overweight, as opposed to obese, populations; eating disorder prevention in a non-clinical student population).

Self-efficacy

Only three studies reported data on self-efficacy. Results suggest it is more likely than not that IHCAs have a positive effect on self-efficacy. Further data on this outcome are needed.

Emotional outcomes

We were unable to determine whether IHCAs have an effect on emotional outcomes.

Clinical outcomes

Results suggest that IHCAs have a significant positive effect on clinical outcomes. There was some heterogeneity in this outcome, but despite this, IHCAs are most likely to be beneficial in terms of clinical outcomes.

Economic outcomes

We were unable to determine whether IHCAs have an effect on economic outcomes.

Methodological issues

Study eligibility

Despite earlier concerns that there would not be sufficient RCTs to explore the effects of IHCAs, we were able to identify 24 RCTs for inclusion in the review. This allowed us to revise the threshold for inclusion to cover RCTs only. This raised threshold gives our findings greater robustness than would have been possible if we had included other study designs, which are more susceptible to bias.

Heterogeneity

There was no evidence of heterogeneity in two of the meta-analyses, namely those for self-efficacy and social support. However, there was heterogeneity in three of the outcome categories where meta-analysis could be undertaken (knowledge, behaviour change and clinical outcomes). The I^2 statistic provides a measure of the variation between studies which can be explained by chance (Higgins 2003). Thus in the two meta-analyses where the I^2 = 0%, this suggests that the variations between the results of the studies included in meta-analysis can be completely explained by chance. However, where I^2 is 50%, the implication is that half of the variation in the overall results between the studies is attributable to genuine differences between the studies, and half the variation can be attributed to the play of chance. It has been suggested that the adjectives 'low', 'moderate' and 'high' can be tentatively assigned to I^2 values of 25%, 50% and 75%, although quantification of heterogeneity is only one component of a wider investigation of variability between studies (Higgins 2003). The *Cochrane Handbook for Systematic Reviews of Interventions* suggests that I^2 values over 50% represent 'substantial' heterogeneity (Deeks 2005).

Our meta-analyses showed substantial heterogeneity for two outcomes: knowledge (I^2 = 52.8%) and behaviour change (I^2 for continuous data = 50.4% and for binary data = 48.2%). Clinical outcomes also showed some heterogeneity (I^2 = 30.6%). There are many possible reasons for this heterogeneity. As the aim of this review was to look at the effect of IHCAs in chronic disease, we combined data from very varied studies. The studies took place in different countries. The patients had different conditions, and included both children and adults. The intervention occurred in different settings (outpatient, primary care, community settings or the patient's own home), and there were large variations in the intensity of the exposure to the interventions, ranging from one-off use in a clinical environment to prolonged use in the patient's home. There was also variation in the intensity of the intervention provided to the control groups in the different studies. Further, the primary studies used many different outcome measures to assess similar outcomes, and included a wide variety of outcomes.

The meta-analysis for knowledge contained three studies of adults, and four of children. Three of the studies involved patients with asthma, two involved diabetes, one aimed to achieve weight loss in obese adults and one was aimed at people with eating disorders. The outcome measures used were all knowledge questionnaires. Participants had varying access to the intervention, ranging from single use in a health care setting to home use over a period of twelve months.

The meta-analysis for behaviour contained studies with varied populations: two on children, one on adult women, one where almost all participants were adult men, and three of adults of both genders. The conditions included asthma, diabetes, obesity, breast cancer and HIV / AIDS. The outcome measures varied between studies, including physical activity in minutes / day, participation in health care, dietary intake and self-management. In six of the studies providing continuous data, participants had home access to the intervention for between five and twelve months. In the remaining study by comparison, participants accessed the intervention during visits to a healthcare facility. The meta-analysis of binary data also contained studies with varied populations: two involved children with asthma and one involved adolescents with diabetes mellitus. Outcome measures were different for each study. In one study, users accessed the intervention over three visits to a

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healthcare facility. In the other two studies, participants had home access to the intervention for three to four months.

The meta-analysis for clinical outcomes contained studies with varied populations: five on children, five on adults; and with varied conditions including asthma, diabetes, obesity, breast cancer, HIV / AIDS and faecal soiling. The outcome measures varied between studies, except in studies of diabetes, where glycosylated haemoglobin was widely reported as a clinical outcome. Seven studies provided home access to the intervention, with duration of home access ranging from three weeks to twelve months. The remaining three studies provided sessional access.

It has been argued that we should not have attempted meta-analyses in the face of this heterogeneity (Eysenbach 2005). On the other hand, approximately one-quarter of Cochrane meta-analyses have been reported as having I^2 values over 50% (Higgins 2003). Our reason for pooling data from such varied sources was that the question asked by this review, that is, 'what are the effects of IHCA for patients with chronic disease?', could only be answered by looking across all situations where IHCAs have been used to date. The unifying theme was the intervention, namely an IHCA, as defined and operationalised in the Background. We hypothesised that the different IHCAs worked in a similar way across different disease conditions (Figure 1). Ideally, we would wish to combine data from studies that examined the same intervention used in similar populations, but we did not have sufficient studies to be able to do this. Hence we decided to combine the available data. However, the resulting heterogeneity does mean that these results must be treated with caution. There is evidence of an average benefit for IHCAs, but there is also evidence that the magnitude of the effect varied between studies, possibly because different studies looked at different interventions for different conditions. Thus for a particular intervention and condition, while the magnitude of the effect is unknown, the evidence suggests that the effects of IHCAs are most likely to be positive. Although no study reported on any unintended consequences of IHCAs, theoretically, the possibility of harm cannot be totally ruled out.

Other methodological issues

Many of the trials had small numbers of participants, and would therefore not have been able to detect small effects. There were also deficiencies in reporting of the data, which meant that while some studies reported outcomes relevant to this review, the data could not be included in the meta-analyses because the standard deviation (or other measure of variation) was not reported. Many of the trials relied on self-reported data from participants. Given the nature of the intervention, it was not possible to blind participants as to whether they had been in the control or intervention group. This lack of blinding may have introduced bias into the primary studies. Moreover, not all the studies used previously validated measures to assess outcomes, again introducing the possibility of bias into the primary data reported.

For all these reasons, the results reported in this review must be regarded with some caution. Further high quality trials with large numbers of participants are required.

AUTHORS' CONCLUSIONS

Implications for practice

The main implications of this review are for policy, not practice. As health policy tends to be nation-specific, these implications are likely to vary from country to country. We have tried to outline the main implications for policy for countries with highly-developed healthcare systems, as most of the work on IHCAs to date has been done in these countries.

1. Our review suggests that IHCAs have significant positive effects on knowledge, social support and behavioural and clinical outcomes, and are more likely than not to have significant positive effects on self-efficacy. These results support continued cautious investment in IHCAs, coupled with a rigorous programme of evaluation.

2. There is no evidence of the effects of IHCAs on health service utilisation. Thus IHCAs should not be used as a method of cost containment, pending further research.

3. It was not possible to examine formally whether IHCAs promote equity or result in greater health disparities between advantaged and disadvantaged populations. Available data suggests that IHCAs can benefit underserved populations (Gustafson 2001) - whether they will do so in practice has yet to be determined.

Implications for research

Despite the significant sums of money invested in IHCAs, there are a large number of unanswered questions. These are listed below.

1. What is the mechanism of action of IHCAs? Some authors cite health psychology theories as a basis for why IHCAs should work, but it is not yet possible to determine from the available data how they actually do work. We hypothesised that clinical change would depend on behaviour change, which in turn would depend on enhanced self-efficacy, but it was not possible to test this hypothesis with our data. Further research to test this hypothesis is needed, as is work to determine which features of an IHCA are needed to achieve particular outcomes; which features are important for which group(s) of users; and what the optimal intensity of use may be. Another issue to be examined includes whether home access to an IHCA is essential?Or can intermittent access through public access points be equally effective?

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2. Can IHCAs benefit carers? If so, in what way? What outcomes can be affected? If IHCAs can benefit carers, how do they do this? What are the essential features of an IHCA which are associated with benefit?

3. What are the effects of IHCAs on health service utilisation? Do knowledgeable active patients demand more from the health service (more medication, more preventive care) and if so, is the cost of this demand offset by reductions in complications or emergency care?

4. Are there unintended adverse effects of IHCAs? If so, what are they? How can they be detected? If these are rare events, post-marketing surveillance may be the appropriate methodology for detecting them, as it may be difficult to power RCTs for these outcomes.

5. How do IHCAs affect the doctor-patient relationship and patients' interactions with clinicians?

6. What support or training do clinicians need to consult effectively with enabled active patients?

7. What are the effects of IHCAs on equity? Do they increase or decrease health disparities, and what factors impact on this effect? Are there specifics of IHCA design, methods of delivery, or other organisational issues which are important?How do their effects vary in different cultures and economies?The importance of home access is also relevant to this question.

Implications for consumers

Consumers with chronic disease are likely to benefit from using an IHCA through their positive effects on knowledge, social support, health behaviour and clinical outcomes. IHCAs are also more likely than not to positively affect self-efficacy, that is, a person's belief in their capacity to undertake specific action or achieve a goal, and this may also benefit consumers. There is a need for more large, high quality studies to confirm these preliminary findings, to determine the best type and best way to deliver IHCAs, and to establish how IHCAs have their effects for different groups of people with chronic illness.

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* *Indicates the major publication for the study*

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CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Andrewes 1996

Methods	RCT. 2 arms: intervention versus control
Participants	54 patients with Diagnostic and Statistical Manual (3rd ed., revised) (DSM-III-R)diagnosed eating disorders. 14 with anorexia, 9 with bulimia, 4 with both in each group. Mean age 22 years. Intervention group n = 27, control group n = 27.
Interventions	DIET = 11 psychoeducational modules about eating disorders. Control = non-directional computer based counselling.
Outcomes	Eating Disorders Knowledge Questionnaire; Eating Disorders Attitude Questionnaire
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Bartholomew 2000

Methods	RCT. 2 arms: intervention versus control
Participants	171 children with asthma and their primary caregivers, recruited from inner-city asthma clinics. 112 males; mean age 10.9 years (range 7 to 17); 42% Hispanic, 53% African-American. N given for completers only: intervention group n = 70, control group = 63.
Interventions	Interactive multimedia computer programme (Watch, Discover, Think and Act), provides intensive, tailored, self-management. Text, graphics, animation, sound, video clips. Data input = child's personal asthma symptoms, environmental triggers, medications, PEFR. Control = no intervention.
Outcomes	Knowledge of asthma and asthma self-management; self-efficacy of child; symptoms and functional status; and hospitalisation/ER visits.
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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Brennan 1995

Methods	RCT. 2 arms: intervention versus control
Participants	102 caregivers with primary responsibility for a person with Alzheimer's disease. 67% female; median age = 64 years; 72% white participants; average education = completed high school. Intervention group n = 51, control group n = 51.
Interventions	ComputerLink (information encyclopaedia, online discussion group and decision support). Control = no intervention.
Outcomes	Decision confidence; decision-making skill; social isolation; depression; economic analysis
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Brennan 1998

Methods	RCT. 2 arms: intervention versus control
Participants	57 people living with AIDS. 93% male; mean age = 33 years; 61% white participants; 34% working; mean years of education = 13.5. Intervention group n = 31, control group n = 26.
Interventions	ComputerLink (information encyclopaedia, discussion group and decision support). Control = printed brochures, monthly telephone call.
Outcomes	Decision confidence; decision making skill; social isolation; patient health status; depression
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Brown 1997

Methods	RCT. 2 arms: intervention versus control
Participants	59 children with Diabetes Mellitus, aged 8 to 16 years, recruited from two paediatric endocrinology outpatient clinics. Intervention group n = 31, control group n = 28.
Interventions	Computer video game (Packy and Marlon). Two adolescent elephant friends at diabetes summer camp. Players must save camp from rats and mice. Help monitor blood glucose, take insulin, review diabetes

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Brown 1997 (*Continued*)

	logbook, find correct foods, self care, social situations. Control = entertainment video.
Outcomes	Enjoyment of game; self-efficacy; social support; knowledge; diabetes self-care; HbA1c; number of urgent care visits
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Dragone 2002

Methods	RCT. 2 arms: intervention versus control
Participants	Children aged 4 to 11 with acute lymphoblastic leukaemia or acute myeloid leukaemia in first remission. 41 children recruited, 31 completed study, (14 x 4 to 6 year olds; 17 x 7 to 11 year olds); 25 white, 3 Latino, 1 African American, 1 Asian, 1 'other' participants. All participants had acute lymphoblastic leukaemia. Of the 31 children completing the study, intervention group n = 15, control n = 16.
Interventions	CD-ROM covering treatment, helping yourself, tests, blood cells, anatomy and physiology, and miscellaneous items including sibling view of leukaemia, living with leukaemia. Control = standard educational book for children with leukaemia.
Outcomes	Health locus of control; knowledge; satisfaction; use of computer
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Glasgow 2003

Methods	RCT. 4 arms: control; coach; social support; social support + coach
Participants	320 adults with Type 2 Diabetes Mellitus. 47% male; mean age 59 years (SD 9.2 years); 83% had no or very limited internet experience; mean time since diagnosis 8 years. Control and intervention groups 'n' not stated. In the absence of any confirmation in the published literature of the numbers recruited to each group, review authors inferred that 80 participants were allocated to each arm of the trial.
Interventions	Information only (control) = computer access to articles providing information only about medical, nutritional and lifestyle aspects of Diabetes Mellitus. Personal coach = information + computer-mediated access to professional coach trained in providing dietary advice to diabetics. This arm included personal

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Glasgow 2003 (*Continued*)

	database and online Q&A with a dietician. Social support = information + e-mail forum (Diabetes Support Conference - peer led but professionally mediated) and some e-mail focus forums. Combined = all three interventions.
Outcomes	Physical activity; Diabetes Support Scale; dietary intake; depression; HbA1c: lipids
Notes	Comparison used for data extraction and synthesis = control (information only) vs information + social support

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Gorman 1995

Methods	RCT. 3 arms: UICS versus booklet vs control
Participants	60 ambulatory, alert, community dwelling women with urinary incontinence defined as accidental urine loss at least twice a week. Mean age = 55 years. Intervention (UICS) group n = 22, booklet group n= 18, control group n = 20.
Interventions	UICS = information about urinary incontinence, bladder training and pelvic muscle exercises. Booklet = AHCPR patient guideline with handout. Control = general health video.
Outcomes	Urinary incontinence episodes; impact of incontinence on life in activities of daily living
Notes	Comparison used for data extraction and synthesis = UICS vs control

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Guendelman 2002

Methods	RCT. 2 arms: intervention versus control
Participants	134 children with asthma, recruited from primary care clinic; 57% male; aged 8 to 16 years; 76% African-American; 93% public insurance. Intervention group n = 66, control group n = 68.
Interventions	Health Buddy = personal, interactive information and advice on self-management. Control = asthma diary.

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Guendelman 2002 (*Continued*)

Outcomes	Limitation in activity; self-reported asthma symptoms; PEFR 50 to 80% of personal best or < 50%; use of health services; self-care behaviours
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Gustafson 1999

Methods	RCT. 2 arms: intervention versus control
Participants	204 HIV-positive patients; 90% male; 84% white participants; 65% experiencing HIV-related symptoms; average education = some college. Intervention group n = 107, control group n = 97.
Interventions	CHESS = information, decision support, online 'Ask the Expert' and online discussion group. Control = no intervention.
Outcomes	Cognitive function; participation in health care; negative emotions; social support; physical function; use of health services
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Gustafson 2001

Methods	RCT. 2 arms: intervention versus control
Participants	295 women with newly diagnosed breast cancer, under age 60. Mean age 44.4 years; 74% white participants; 85% private insurance. Intervention group n = 147, control group n = 148.
Interventions	CHESS: information, social support (discussion groups, personal stories), decision support (health charts, decision aids, action plan). Control = book about breast cancer.
Outcomes	Information competence; participation in health care; emotional well-being; social support
Notes	

Risk of bias

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Gustafson 2001 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Homer 2000

Methods	RCT. 2 arms: intervention versus control
Participants	137 children aged 3 to 12, with physician-diagnosed asthma; recruited from hospital (118) and community clinics (19). 30.7% female; mean age 7.4 years; 60.5% African-American, 5.3% Hispanic. Intervention group n = 76, control group n = 61.
Interventions	Asthma Control = interactive educational computer program. Children help a superhero complete all six levels of game while keeping his asthma under control. Control = age-appropriate asthma educational book + non-educational computer game.
Outcomes	Total number of emergency department and acute office visits during study period; child's average asthma specific symptom severity; functional status;satisfaction; use of PEFR monitoring; number of common triggers and allergens in home environment; knowledge
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Horan 1990

Methods	RCT. 2 arms: intervention versus control
Participants	20 adolescents aged 12 to 19 with Type 1 Diabetes Mellitus for > 1 year. 30% male; 80% white participants. Recruited from paediatric endocrinologists in private practice and from customers at a store for people with diabetes. Intervention group n = 10, control group n = 10.
Interventions	DISC = contained 3 components: data management and review; factual and applied diabetes education; problem solving and goal setting. Control = printed materials.
Outcomes	HbA1c; blood glucose levels; frequency of self-monitoring of blood glucose; knowledge; behaviour change
Notes	

Risk of bias

Item	Authors' judgement	Description

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Horan 1990 (*Continued*)

Allocation concealment?	Unclear	B - Unclear

Huss 2003

Methods	RCT. 2 arms: intervention vs control
Participants	148 children, recruited from hospital discharge records and local paediatric allergy and asthma clinics. 44% male; mean age 9.6 years; 21% non-Hispanic white, 78% non-Hispanic black. Intervention group n = 78, control group n = 70.
Interventions	Wee Willie Wheezie = computer game where children negotiate Wee Willie through various home-like environments and hazards. Control = conventional education (written) and non asthma-related computer game.
Outcomes	Asthma knowledge; spirometry; paediatric asthma quality of life
Notes	Children only had 20 minutes with the intervention.

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Krishna 2003

Methods	RCT. 2 arms: intervention versus control
Participants	228 children (under 18 years) with asthma attending a paediatric pulmonary clinic. 65% male, 86% white participants. Intervention group n = 119, control group n = 109.
Interventions	IMPACT = internet-enabled, interactive multimedia asthma education, principles of self-management, behavioural objectives. Both intervention and control groups also received printed and verbal asthma education.
Outcomes	Asthma knowledge; asthma symptoms; resource utilisation
Notes	

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

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Lehmann 2003

Methods	RCT. 2 arms: intervention versus control
Participants	24 adults with Type 1 Diabetes Mellitus; 50% male. Intervention group n = 12, control group n = 12.
Interventions	Intervention = 6 X 1 hour sessions with AIDA (education, self-management, decision support). Control = 6 X 1 hour sessions of conventional education (slides), same topics.
Outcomes	Knowledge; self-monitoring of blood glucose; forward thinking; well-being and self-confidence; hypoglycaemic attacks; HbA1c; empowerment
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Mahoney 2002

Methods	RCT. 2 arms: intervention versus control
Participants	113 adults concerned about memory loss in a family member; intervention group n = 56, control group n = 57.
Interventions	CD-ROM = information distinguishing normal forgetfulness from dementia; procedures for clinical diagnosis; resources available; family responses. Control = no intervention.
Outcomes	Knowledge about memory loss; user satisfaction; contacts with clinicians
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Ritterband 2003

Methods	RCT. 2 arms: intervention versus control
Participants	24 encopretic children, 19 boys; mean age 8.46 years (SD 1.81 year). Intervention group n = 12, control group n = 12.
Interventions	U Can Poop Too = information about anatomy, physiology and treatment of encopresis; behavioural treatment based on enhanced toilet training. Control = phone calls only

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Ritterband 2003 (*Continued*)

Outcomes	Bowel habits; encopresis knowledge questionnaire (EKQ); VECAT (assesses bowel-specific problems related to encopresis); number of bowel accidents per week
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Shegog 2001

Methods	RCT. 2 arms: intervention versus control
Participants	76 children recruited from clinics and schools. 46 boys, 25 girl; mean age 10.7 years; 47.9% white non-Hispanic participants, 40.8% African-American participants, 11.3% Hispanic participants. N given for 71 children completing the study of which intervention group n = 38, control group n = 33.
Interventions	Interactive multimedia computer programme = (Watch, Discover, Think and Act) provides intensive, tailored, self-management. Text, graphics, animation, sound, video clips. Data input = child's personal asthma symptoms, environmental triggers, medications, PEFR. Control = no intervention.
Outcomes	Knowledge of asthma; self-management; self-efficacy
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Smith 2000

Methods	RCT. 2 arms: intervention versus control
Participants	30 women aged 35 to 60, with Diabetes Mellitus (Type 1 or 2), with a telephone and living at least 25 miles outside the 6 major cities of Montana. Intervention group n = 15, control group n = 15.
Interventions	Women to Women Diabetes Project = 4 components: Conversation (online support group); mailbox (private e-mail correspondence between group members); HealthChat (formal diabetes education)and Resource Rack (bulletin board). Control = usual care.
Outcomes	HbA1c; health status; sources of support; personal resource questionnaire; quality of life index; social readjustment rating scale; psychosocial adaptation to illness scale

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Smith 2000 (*Continued*)

Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Turnin 1992

Methods	RCT. 2 arms: intervention versus control
Participants	105 patients with Diabetes Mellitus. 59% male; 72% Type 1 Diabetes Mellitus; mean age 45 years; 74% working. Intervention group n = 54, control group = 51.
Interventions	Diabeto = Minitel-delivered dietary information and individualised counselling, energy requirements, meal analysis, menus, recipes, e-mail. Both control and intervention groups had 5 days education at start; after 6 months control group received intervention.
Outcomes	Knowledge; eating habits; body weight; HbA1c
Notes	Data reported just before cross-over point.
Risk of bias	

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Turnin 2001

Methods	RCT. 2 arms: intervention vs control
Participants	557 obese patients: BMI > or equal to 33.3 kg / m2. 92.3% female; mean age 41.2 years; salaried workers 36.5%, unemployed or retired 23.1% teaching or health care professions 14.1%. Of the 341 participants who completed the trial, intervention group n = 169, control group n = 172.
Interventions	Nutri-Expert = Minitel delivered information about diet, individualised help in meal analysis and composition. Programme evaluates calorific requirements, records meals eaten during the day and provides suggestions for balance, recipes, discussion and Q&A fora. Control and intervention groups also received usual care, consisting of 7 nutritional visits with physicians and dieticians conjointly.
Outcomes	BMI; waist circumference; weight; knowledge; dietary intake; fasting insulin; lipids
Notes	
Risk of bias	

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Turnin 2001 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Wydra 2001

Methods	RCT. 2 arms: intervention versus control
Participants	174 patients with cancer; 51% male; age range = 21 to 82 years; 81% white participants. Intervention group n = 86, control group n = 88.
Interventions	Interactive Video Disc = 5 modules on: using the computer; fatigue; saving maintaining and restoring energy; managing stress; sleeping better; information and skill training. Control = normal care only.
Outcomes	Self care activities; wide range achievement test; self care ability
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Wylie-Rosett 2001

Methods	RCT. 3 arms: workbook only vs workbook + computer programme vs workbook + computer programme + staff counselling
Participants	588 people with BMI >35.6 kg / m2; recruited from a managed care organisation. Workbook only (control) n = 116, workbook+ computer group (intervention)n = 236, workbook+computer+staff counselling n= 236. Assumptions from previous research were utilised by the study authors to calculate the sample sizes for each intervention arm.
Interventions	Intervention = computer programme containing nutrition, fitness and psychobehavioural content with information, guidance, interactive quizzes, video clips. Control = workbook containing 20 sections with self-help sheets.
Outcomes	BMI; diabetes and cardiovascular risk; medication usage; dietary and exercise habits; costs
Notes	Comparison used for data extraction and synthesis = computer programme + workbook vs workbook only.

Risk of bias

Item	Authors' judgement	Description

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Wylie-Rosett 2001 (*Continued*)

Allocation concealment?	Unclear	B - Unclear

Characteristics of excluded studies *[ordered by study ID]*

Glasgow 1997	2 arm RCT comparing IHCA + personal coach with usual care. Not possible to determine effects of IHCA without personal coach.
Glasgow 2000	2 x 2 randomised controlled trial investigating incremental effects of telephone follow-up or community resources enhancement over and above IHCA. All patients received IHCA, so not possible to determine effects of IHCA alone.
Glasgow 2002	12 month follow-up of 2 x 2 randomised controlled trial investigating incremental effects of telephone follow up or community resources enhancement over and above IHCA. All patients received IHCA so not possible to determine effects of IHCA alone.
Hazzard 2002	Randomisation based on date of admission to hospital; hence a high likelihood of bias.
McKay 2001	2 arm RCT comparing IHCA + personal coach with information only. Not possible to determine effects of IHCA without personal coach.
Shea 2002	2 arm RCT comparing IHCA + nurse case manager with usual care. Not possible to determine effects of IHCA without nurse case manager.
Tate 2001	2 arm RCT comparing IHCA only with IHCA and additional behaviour therapy. Not possible to determine effects of IHCA.
Tate 2003	2 arm RCT comparing IHCA with IHCA + online weekly access to therapist.

Characteristics of ongoing studies *[ordered by study ID]*

Glasgow

Trial name or title	RCT of CD-ROM assisted diabetes care enhancement programme
Methods	
Participants	52 physicians and 886 people with type II diabetes
Interventions	CD-ROM assisted diabetes care enhancement programme
Outcomes	

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Glasgow (*Continued*)

Starting date	
Contact information	russg@ris.net
Notes	

Jones

Trial name or title	RCT of cancer CD-ROM
Methods	
Participants	Children with solid tumours
Interventions	Educational CD-ROM
Outcomes	Communication, self-empowerment
Starting date	
Contact information	jkjones@deggegroup.com
Notes	

Lorig

Trial name or title	RCT of Self- Management @ Stanford
Methods	
Participants	People diagnosed with heart disease, type II diabetes or lung disease
Interventions	Online workshops on disease management
Outcomes	
Starting date	
Contact information	http://healthyliving.stanford.edu
Notes	

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McPherson

Trial name or title	RCT of an Educational CD-ROM for children with asthma
Methods	
Participants	Children with asthma
Interventions	Educational CD-ROM for children with asthma
Outcomes	
Starting date	
Contact information	amy.mcpherson@nottingham.ac.uk
Notes	

Pierce

Trial name or title	RCT of Caring Web
Methods	
Participants	120 caregivers of people with stroke
Interventions	Web-based support system
Outcomes	Improved carer wellbeing, use of healthcare services
Starting date	
Contact information	lpierce@mco.edu
Notes	

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DATA AND ANALYSES

Comparison 1. IHCA versus Control. Knowledge

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Knowledge [Standardised Mean Difference of Final Values]	7	663	Std. Mean Difference (IV, Random, 95% CI)	0.46 [0.22, 0.69]

Comparison 2. IHCA versus Control. Social Support

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Social support [Standardised Mean Difference of Final Values]	5	536	Std. Mean Difference (IV, Random, 95% CI)	0.35 [0.18, 0.52]

Comparison 3. IHCA versus Control. Self -efficacy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Self-efficacy [Standardised Mean Difference of Final Values]	3	268	Std. Mean Difference (IV, Random, 95% CI)	0.24 [0.00, 0.48]

Comparison 4. IHCA versus Control. Behavioural outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Behavioural outcomes [Standardised Mean Difference of Final Values]	7	889	Std. Mean Difference (IV, Random, 95% CI)	0.20 [0.01, 0.40]
2 Behavioural outcomes [Final Odds Ratios]	3	236	Odds Ratio (M-H, Random, 95% CI)	1.66 [0.71, 3.87]

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Comparison 5. IHCA versus Control. Clinical outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Clinical outcomes [Standardised Mean Difference of Final Values]	10	855	Std. Mean Difference (IV, Random, 95% CI)	0.18 [0.01, 0.35]

Analysis 1.1. Comparison 1 IHCA versus Control. Knowledge, Outcome 1 Knowledge [Standardised Mean Difference of Final Values].

Review: Interactive Health Communication Applications for people with chronic disease

Comparison: 1 IHCA versus Control. Knowledge

Outcome: 1 Knowledge [Standardised Mean Difference of Final Values]

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Andrewes 1996	27	44.4 (10.8)	27	37.1 (7.9)		11.1 %	0.76 [0.21, 1.31]
Bartholomew 2000	70	16.4 (5.9)	62	15.8 (4.8)		17.7 %	0.11 [-0.23, 0.45]
Brown 1997	31	17.22 (4.93)	28	16.89 (4.93)		12.2 %	0.07 [-0.45, 0.58]
Krishna 2003	25	53.12 (5.56)	28	47.51 (5.95)		10.6 %	0.96 [0.39, 1.53]
Shegog 2001	38	21.1 (5.4)	33	17.8 (6.3)		13.2 %	0.56 [0.08, 1.04]
Turnin 1992	45	64 (13.42)	50	54 (14.14)		15.0 %	0.72 [0.30, 1.13]
Turnin 2001	94	41.9 (6.79)	105	39.7 (7.17)		20.2 %	0.31 [0.03, 0.59]
Total (95% CI)	**330**		**333**			**100.0 %**	**0.46 [0.22, 0.69]**

Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 12.70$, df = 6 (P = 0.05); $I^2 = 53\%$

Test for overall effect: Z = 3.80 (P = 0.00014)

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Analysis 2.1. Comparison 2 IHCA versus Control. Social Support, Outcome 1 Social support [Standardised Mean Difference of Final Values].

Review: Interactive Health Communication Applications for people with chronic disease

Comparison: 2 IHCA versus Control. Social Support

Outcome: 1 Social support [Standardised Mean Difference of Final Values]

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Brennan 1998	25	-66.08 (13.68)	23	-68 (16.8)		9.1 %	0.12 [-0.44, 0.69]
Brown 1997	31	19.27 (25.1)	28	14.96 (20.57)		11.1 %	0.18 [-0.33, 0.70]
Glasgow 2003	66	5.22 (1.11)	66	4.71 (1.12)		24.4 %	0.45 [0.11, 0.80]
Gustafson 1999	27	4.47 (0.44)	24	4.24 (0.44)		9.3 %	0.51 [-0.04, 1.07]
Gustafson 2001	121	84.2 (13.88)	125	79.3 (13.88)		46.0 %	0.35 [0.10, 0.60]
Total (95% CI)	**270**		**266**			**100.0 %**	**0.35 [0.18, 0.52]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.70$, df = 4 (P = 0.79); $I^2 = 0.0\%$

Test for overall effect: Z = 4.05 (P = 0.000052)

Analysis 3.1. Comparison 3 IHCA versus Control. Self -efficacy, Outcome 1 Self-efficacy [Standardised Mean Difference of Final Values].

Review: Interactive Health Communication Applications for people with chronic disease

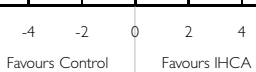
Comparison: 3 IHCA versus Control. Self -efficacy

Outcome: 1 Self-efficacy [Standardised Mean Difference of Final Values]

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Bartholomew 2000	70	75.3 (11.7)	69	73.6 (12.1)		52.4 %	0.14 [-0.19, 0.47]
Brown 1997	31	6 (0.73)	28	5.85 (0.74)		22.1 %	0.20 [-0.31, 0.71]
Shegog 2001	38	56.5 (9.8)	32	51.5 (10.7)		25.5 %	0.48 [0.01, 0.96]
Total (95% CI)	**139**		**129**			**100.0 %**	**0.24 [0.00, 0.48]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.36$, df = 2 (P = 0.51); $I^2 = 0.0\%$

Test for overall effect: Z = 1.97 (P = 0.049)



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Analysis 4.1. Comparison 4 IHCA versus Control. Behavioural outcomes, Outcome 1 Behavioural outcomes [Standardised Mean Difference of Final Values].

Review: Interactive Health Communication Applications for people with chronic disease

Comparison: 4 IHCA versus Control. Behavioural outcomes

Outcome: 1 Behavioural outcomes [Standardised Mean Difference of Final Values]

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Bartholomew 2000	69	36.2 (7.9)	63	33.8 (7.2)		15.6 %	0.32 [-0.03, 0.66]
Brown 1997	31	5.16 (0.94)	28	4.66 (1.34)		9.7 %	0.43 [-0.09, 0.95]
Glasgow 2003	66	30.5 (22.8)	66	32.5 (22.8)		15.7 %	-0.09 [-0.43, 0.25]
Gustafson 1999	24	4.15 (0.65)	23	3.64 (0.65)		8.0 %	0.77 [0.18, 1.37]
Gustafson 2001	119	74.5 (15.66)	125	72.8 (15.66)		20.1 %	0.11 [-0.14, 0.36]
Turnin 1992	43	-36 (5.9)	46	-38.5 (5.43)		12.6 %	0.44 [0.02, 0.86]
Turnin 2001	89	-1542 (452.83)	97	-1510 (531.84)		18.2 %	-0.06 [-0.35, 0.22]
Total (95% CI)	**441**		**448**			**100.0 %**	**0.20 [0.01, 0.40]**

Heterogeneity: Tau² = 0.03; Chi² = 12.08, df = 6 (P = 0.06); I² =50%

Test for overall effect: Z = 2.04 (P = 0.042)

Analysis 4.2. Comparison 4 IHCA versus Control. Behavioural outcomes, Outcome 2 Behavioural outcomes [Final Odds Ratios].

Review: Interactive Health Communication Applications for people with chronic disease

Comparison: 4 IHCA versus Control. Behavioural outcomes

Outcome: 2 Behavioural outcomes [Final Odds Ratios]

Study or subgroup	Treatment n/N	Control n/N	Odds Ratio M-H,Random,95% CI	Weight	Odds Ratio M-H,Random,95% CI
Guendelman 2002	49/58	34/52		38.8 %	2.88 [1.16, 7.17]
Homer 2000	30/57	27/49		44.7 %	0.91 [0.42, 1.95]
Horan 1990	7/10	5/10		16.4 %	2.33 [0.37, 14.61]
Total (95% CI)	**125**	**111**		**100.0 %**	**1.66 [0.71, 3.87]**

Total events: 86 (Treatment), 66 (Control)

Heterogeneity: Tau² = 0.27; Chi² = 3.86, df = 2 (P = 0.15); I² =48%

Test for overall effect: Z = 1.17 (P = 0.24)

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Analysis 5.1. Comparison 5 IHCA versus Control. Clinical outcomes, Outcome 1 Clinical outcomes [Standardised Mean Difference of Final Values].

Review: Interactive Health Communication Applications for people with chronic disease

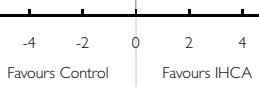
Comparison: 5 IHCA versus Control. Clinical outcomes

Outcome: 1 Clinical outcomes [Standardised Mean Difference of Final Values]

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Bartholomew 2000	58	139.6 (10)	55	137.3 (11.9)		13.3 %	0.21 [-0.16, 0.58]
Brennan 1998	25	13 (1.7)	23	13.65 (1.3)		7.1 %	-0.42 [-0.99, 0.15]
Brown 1997	31	-9.33 (1.69)	28	-8.94 (1.6)		8.5 %	-0.23 [-0.75, 0.28]
Glasgow 2003	66	-7.42 (1.1)	66	-7.68 (1.1)		14.6 %	0.23 [-0.11, 0.58]
Gustafson 1999	26	2.55 (0.42)	24	2.52 (0.42)		7.5 %	0.07 [-0.48, 0.63]
Krishna 2003	42	-23.9 (29.6)	44	-48.2 (80)		11.0 %	0.40 [-0.03, 0.82]
Lehmann 2003	10	-6.4 (0.7)	8	-7 (0.8)		2.9 %	0.77 [-0.21, 1.74]
Ritterband 2003	12	-0.5 (0.85)	12	-8.27 (13.83)		3.8 %	0.77 [-0.07, 1.60]
Tumin 1992	45	-10.1 (2.68)	50	-11 (1.41)		11.8 %	0.42 [0.02, 0.83]
Tumin 2001	110	-30.96 (5.56)	120	-31.55 (5.81)		19.4 %	0.10 [-0.16, 0.36]
Total (95% CI)	**425**		**430**			**100.0 %**	**0.18 [0.01, 0.35]**

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 12.96$, df = 9 (P = 0.16); $I^2 = 31\%$

Test for overall effect: Z = 2.08 (P = 0.038)



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APPENDICES

Appendix 1. MEDLINE search strategy

MEDLINE search strategy
1 (interactive adj health adj communicati$).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
2. IHC.mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
3. Communication/
4. (health adj3 communicat$).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
5. Computers/
6. computer$.mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
7. computer communication networks/ or internet/
8. Medical Informatics/
9. medical informatics applications/or decision making, computer-assisted/or therapy, computer-assisted/
10. decision support techniques/or decision theory/ or decision trees/
11. Software/
12. communications media/ or telecommunications/
13. Multimedia/
14. multimedia.mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
15. cd-rom.mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
16. compact disks/ or cd-i/ or cd-rom/
17. Medical Informatics Computing/
18. (consumer$ adj health adj informatic$).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
19. (world adj wide adj web).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
20. Computer-Assisted Instruction/
21. (interactive adj technology adj application$).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
22. (digital adj2 (tv or television)).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
23. (web adj based adj packages).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
24. hypermedia/or video games/
25. (virtual adj reality).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
26. OR/1-25
27. patient compliance/
28. exp consumer participation/
29. self efficacy/
30. (health adj competence).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
31. quality of life/
32. health education/or patient education/
33. access to information/
34. social support/
35. health promotion/
36. (promot$ adj health).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
37. exp self care/
38. self-help groups/
39. peer group/
40. ((peer$ or patient$ or consumer$ or carer$ or caregiver$) adj support$).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
41. health behavior/
42. knowledge/
43. attitude/ or attitude to computers/or attitude to health/ or knowledge, attitudes, practice/
44. (chang$ adj2 behavio?r).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
45. (behavio?r$ adj change$).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
46. or/27-45
47. 26 and 46

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48. randomized controlled trial.pt.
49. controlled clinical trial.pt.
50. randomized controlled trials.sh.
51. random allocation.sh.
52. double blind method.sh.
53. single-blind method.sh.
54. 48 or 49 or 50 or 51 or 52 or 53
55.(animal not human).sh.
56. 51 not 52
57. clinical trial.pt.
58. exp clinical trials/
59. (clin$ adj25 trial$).ti,ab.
60. ((singl$ or doubl$ or trebl$ or tripl$) adj25 (blind$ or mask$)).ti,ab.
61. placebos.sh.
62. placeb$.ti,ab.
63. random$.ti,ab.
64. research design.sh.
65. 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64
66. 65 not 55
67. 66 not 56
68. comparative study.sh.
69. exp evaluation studies/
70. follow up studies.sh.
71. prospective studies.sh.
72. (control$ or prospectiv$ or volunteer$).ti,ab.
73. 68 or 69 or 70 or 71 or 72
74. 73 not 55
75. 74 not (56 or 67)
76. 56 or 67 or 75
77. ((time adj series) or (pre test or pretest or (post test or posttest))).tw.
78. 47 and (76 or 77)
79. limit 78 to yr=1990-2003

WHAT'S NEW

Last assessed as up-to-date: 29 December 2003.

17 June 2008	Amended	Converted to new review format.

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HISTORY

Protocol first published: Issue 3, 2003

Review first published: Issue 4, 2004

25 August 2005	Amended	This review was extensively revised after the original review version, published on Issue 4, 2004, was withdrawn following identification of errors in the direction of change for some of the behavioural and clinical outcomes. The main changes in this version of the review are: 1. All data extracted have been checked against the original papers and any errors identified have been corrected. 2. Data synthesis has been undertaken using final values for means and standard deviations. 3. Binary outcomes are included, and where possible, a separate meta-analysis for binary outcomes has been undertaken. 4. More information about the individual studies and their individual effect sizes has been presented in the Results section. This includes more detail in the narrative review sections for emotional and economic outcomes. 5. There is more discussion about heterogeneity. 6. As a result of the methodological checks and changes, the results have changed. 7. The change in results has been reflected in the discussion, authors' conclusions, plain language summary and abstract.
25 August 2005	New citation required and conclusions have changed	This review was republished on issue 4 2005 with a new citation, reflecting the substantial amendments detailed above.
17 November 2004	Amended	This review was withdrawn from publication on issues 1 2005 to 3 2005 of The Cochrane Library following identification of errors in the direction of change for some of the behavioural and clinical outcomes.

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CONTRIBUTIONS OF AUTHORS

EM: conceived, designed and co-ordinated the review. Obtained funding. Oversaw collection, management, analysis and interpretation of data. Wrote first and final drafts of review. Contributed to steering group decisions.

JB: screened search results, retrieved papers, screened papers, appraised papers, commented on drafts of review. Contributed to steering group decisions.

IN: designed review and analytical strategy, interpreted data, commented on drafts of review. Contributed to steering group decisions.

RL: developed search strategy, undertook searches, amended strategy for different databases. Contributed to steering group decisions.

SST: designed analytical strategy, extracted and synthesised data. Contributed to steering group decisions.

DECLARATIONS OF INTEREST

Two authors of the review (EM and IN) have submitted a grant application with David Gustafson and the CHESS team for a randomised controlled trial of CHESS for Coronary Heart Disease in the UK.

SOURCES OF SUPPORT

Internal sources

- University College London, UK.

External sources

- Department of Health, UK.

INDEX TERMS

Medical Subject Headings (MeSH)

*Chronic Disease [psychology; therapy]; Adaptation, Psychological; Computer-Assisted Instruction [*methods]; Decision Making; Health Education [methods]; Internet; Patient Education as Topic [*methods; standards]; Randomized Controlled Trials as Topic; Self Care; Self Efficacy; Social Support

MeSH check words

Humans

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