A systematic review of interactive computer-assisted technology in diabetes care: interactive information technology in diabetes care
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CRD summary
The authors concluded that computer-assisted interactive information technology could be an important tool and should be evaluated more thoroughly for its potential to improve diabetes care. The authors' cautious conclusions appear appropriate based on the evidence presented, but they should be viewed with some caution given the lack of a validity assessment and the potential for publication bias and language bias.

Authors' objectives
To evaluate how interactive computer-assisted technology may improve care for adults with type 2 diabetes.

Searching
PubMed, PsycINFO, CINAHL and the Cochrane Library were searched to 2003 for articles published in English using the reported search terms. In addition, the bibliographies of eligible studies were screened for relevant articles, Diabetes Care was handsearched from January 1990 to February 2004, and the 'Related articles' search feature of PubMed was utilised.

Study selection
Studies were eligible for inclusion if they assessed computer-assisted interactive information technology as the main component of an intervention for diabetes care in adults. The interventions assessed in the review included internet-assisted education, telephone-automated calls, telemedicine, computer-assisted integration of clinical information (CAL), electronic disease management systems, a personal database manager and computer-assisted flowsheets. The clinical outcomes assessed in the included studies were change in glycated haemoglobin $\text{HbA}_1\text{c}$ levels, body weight, blood-pressure, microalbumin, creatinine, lipids, depression and haematocrit values. The health care utilisation outcomes assessed were hospitalisations, primary care visits, foot, eye and $\text{HbA}_1\text{c}$ examinations. The duration of follow-up ranged from 1 to 24 months. To be included, studies had to include 10 or more adults (aged 18 years or older) with diabetes and also include 50% or more patients with type 2 diabetes. The mean age of patients in the included studies ranged from 43 to 70 years (median 59). The median proportion of men in the included studies was 47% (range: 23 to 95). The median proportion of patients with type 2 diabetes was 86% (range: 50 to 100). Some studies specifically reported including ethnic minorities including Asian Pacific Islanders, Hispanic and African American patients. Randomised controlled trials (RCTs) or observational studies (non-RCTs, pre-test post-test studies and post-only studies) were eligible for inclusion.

Two reviewers independently selected the studies. Any disagreements were resolved through consensus, or with the aid of a third reviewer where required.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
One reviewer abstracted the data using a standardised form, which a second reviewer then checked. Any disagreements were resolved through consensus, or with the aid of a third reviewer where required. Data were abstracted on the decline in $\text{HbA}_1\text{c}$ levels or glycohaemoglobin levels from baseline to follow-up in the intervention groups, and categorised as small (<0.5%), moderate (0.5% to 1%) or large (>1%). Data were also abstracted on the statistical significance of differences between groups in other clinical outcomes and changes in health care utilisation.

Methods of synthesis
The studies were grouped by outcomes and intervention category, and combined in a narrative. Additional descriptive information was tabulated.
Results of the review
Twenty-six studies (over 4,811 participants) were included in the review: 14 RCTs, 3 controlled clinical trials (CCTs), 4 pre-test post-test studies and 5 post-intervention only studies.

Clinical outcomes.
A non-statistically significant decline was reported in the only study assessing HbA\textsubscript{1c} in the internet-assisted education group.

Two of the 4 studies in the telephone-automated calls intervention category that assessed HbA\textsubscript{1c} found a statistically significant decrease in levels (p<0.05). One CCT (n=204) found a large decrease (p<0.05) and one pre-test post-test study (n=184) found a moderate decrease (p<0.05) in HbA\textsubscript{1c} levels. The remaining studies (2 RCTs, n=520) found small to moderate decreases in HbA\textsubscript{1c}, but these were not statistically significant.

In studies assessing telemedicine, one RCT (n=28) found a large statistically significant (p<0.05) decrease in HbA\textsubscript{1c} levels. A second RCT (n=46) found a moderate decrease, but this was not statistically significant.

Six of the 8 studies assessing HbA\textsubscript{1c} in the CAL group found a decline in levels, although this was only statistically significant (p<0.05) in 3 studies (2 RCTs and 1 CCT, n=1,164).

There were no statistically significant differences between treatment groups in the study assessing HbA\textsubscript{1c} for an electronic disease management system.

No studies assessing either a personal database manager or computer-assisted flowsheets reported assessing HbA\textsubscript{1c} levels. Generally no statistically significant differences between intervention and control groups were found in studies assessing change in body weight, blood-pressure, microalbumin or creatinine levels (data not reported). Studies assessing lipids and depression found significant and non significant decreases (data not reported).

Health care utilisation.
Eight studies evaluated health care utilisation. In the group of studies assessing automated calls, there were no changes reported in terms of hospitalisations (1 RCT, n=248) and no change in the number of eye examinations (1 RCT, n=272). Mixed results were reported in terms of primary care visits (4 studies, n=908) and the number of foot examinations (2 RCTs, n=520). However, none of the changes were reported to be statistically significant.

In studies assessing CAL, mixed results were found for number of eye examinations (2 studies, n=728) and for the number of HbA\textsubscript{1c} tests (3 studies, n=928). One study (n=169) assessing the use of a personal database manager found a decline for number of hospitalisations and primary care visits, but these differences were not reported to be statistically significant.

Cost information
Nine studies reported data on the costs associated with the interventions. The costs of systems used to conduct the interventions ranged from US$5 per patient to US$6,340 for a complete system.

Authors' conclusions
The results suggest that computer-assisted interactive information technology could be an important tool and should be evaluated more thoroughly for its potential to improve diabetes care.

CRD commentary
Inclusion criteria were defined in terms of the intervention, participants and study design, but not in terms of the outcomes. Several relevant sources were searched but no attempts were made to minimise publication or language bias. Two reviewers selected studies and extracted the data, thus reducing the potential for reviewer bias and error. Study validity was not assessed, so the results from these studies and any synthesis may not be reliable. In view of the differences between the studies, a narrative synthesis with studies grouped by intervention category was appropriate. However, some discussion of the results with respect to the validity of study designs would have allowed a clearer
picture of the strength of the evidence to emerge. The authors' cautious conclusions appear appropriate based on the evidence presented. However, they should be viewed with some caution given the lack of a validity assessment and the potential for publication and language bias.

**Implications of the review for practice and research**

Practice: The authors did not state any implications for practice.

Research: The authors stated that further good-quality well-conducted studies, particularly RCTs, should be conducted to compare a concomitant control group for a period of more than 1 year to assess the effects of the interventions. In addition, cost-effectiveness should be assessed and participants should include those from ethnic minorities and underserved populations in order to evaluate effectiveness in these groups. Future studies should assess the participants' perceptions of information technology, and internet-assisted intervention studies focusing on patient education should evaluate HbA1c, health care utilisation and costs associated with the interventions.

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