Home telemonitoring of patients with diabetes: a systematic assessment of observed effects

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CRD summary
The authors concluded that telemonitoring had positive effects on glycated haemoglobin (HbA1c) levels, complications, patient education and empowerment, and was received well by patients, although variation in the studies means the size of these effects is unclear. The conclusions about HbA1c levels and patient empowerment seem to overstate the evidence.

Authors' objectives
To review the effects of telemonitoring of diabetes at informational, clinical, behavioural, structural and economical levels.

Searching
MEDLINE and the Cochrane Library were searched; the search terms, but not dates, were reported. Reference lists of retrieved papers were examined. Only English language publications were included in the review.

Study selection
Study designs of evaluations included in the review
Any experimental or quasi-experimental studies were eligible for inclusion. Of the included studies, one was a randomised controlled trial (RCT) and a further thirteen had a control group; the remaining three had no control group.

Specific interventions included in the review
Studies of home telemonitoring for diabetes were eligible for inclusion. Telemonitoring was defined as an automated process for the recording, transmission and visualisation of variables relevant to the care of people with diabetes (e.g. blood glucose measures, physical activity), from home to the health care setting, using telecommunication technologies. Studies of teleconsultation and telediagnosis were excluded, as were studies of telemonitoring in settings other than the home.

The majority of the included studies used glucometers or other blood glucose meters connected to phone lines or modems, hand-held computers, electronic diaries or messaging systems, and there were single studies assessing other telemonitoring systems. The frequency of data transmission ranged from twice a day to a minimum of once a month.

Participants included in the review
Studies of people with diabetes were eligible for inclusion. Studies of people with multiple pathologies (e.g. pregnant women with diabetes) were excluded.

The participants in the included studies had insulin-dependent or type 1 diabetes (9 studies) or unspecified diabetes (8 studies). Three studies included only children or adolescent participants (average age 13 to 17 years). The remaining 14 studies included adults or did not specify the age (average age, where stated, 30 to 69 years).

Outcomes assessed in the review
No specific inclusion criteria relating to the outcomes were detailed. The outcomes were reported in the review under the headings: quality of data (9 studies), clinical (16 studies), behavioural (14 studies), structural (8 studies) and economic (3 studies).

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.
Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
The studies were combined narratively, grouped in both the text and tables by type of outcome: quality of data, clinical, behavioural, structural or economic.

How were differences between studies investigated?
Differences between the studies were reported in the tables.

Results of the review
Seventeen studies were included (n=1,449): 1 crossover RCT (n=22), 3 uncontrolled studies (n=149) and 13 controlled studies (n=1,278), including 1 crossover study. It was unclear in the review paper whether any of the 13 controlled studies were randomised.

The following summary is based on the review authors’ description, as the actual outcomes were not reported.

Quality of data (9 studies).
The majority of studies reported positive findings relating to the quality of the data transmitted. Two studies reported potential problems.

Clinical effects (16 studies).
Significant effects were reported in 7 studies. However, another 7 studies did not find a significant effect of telemonitoring on indicators of glycaemic control. Behavioural effects (14 studies).
Positive results were reported for behavioural outcomes, including acceptability to patients, doctors and case managers, increased understanding and increased motivation to self-care.

Structural effects (8 studies).
Equivocal results were reported with regard to the workload of health professionals and use of health services.

Cost information
Three studies reported economic information. One reported no additional cost to patients in the intervention group. The cost of running the Electronic Case Manager system in this study was estimated at $1,000 per month and the cost per patient at $50 per month. The other two reported savings: 650 euros per patient per year in 1 study using a telemanagement system for blood glucose transfer, and a cost of $173 for use of a modem over 6 months compared with $305 for a clinic visit in the other.

Authors’ conclusions
Telemonitoring of patients with diabetes showed a significant reduction in glycated haemoglobin (HbA1c) and complications, as well as increased patient empowerment and education, and was received well by patients. The magnitude of these effects was debatable, however, given the variation in patients’ characteristics, sample selection and treatment of the control group in the included studies.
CRD commentary
The review question and inclusion criteria for this review were a little unclear with regard to exactly which outcomes and participants would be included. It was stated that participants in some of the included studies had type 1 or insulin-dependent diabetes, but for the rest of the included studies it was unclear which type of diabetes the participants had. This could limit the review's applicability and usefulness to readers. The uncertainty in outcome definition could mean that subjective decisions during the study selection process may have been more likely. There were no details of the number of reviewers involved in, or the process used for, the selection of studies and data extraction, which also raises the possibility of subjective decisions at these stages. The validity of the included studies was not assessed and study design was not discussed in relation to study findings; this makes it difficult for the reader to assess the likelihood of bias in the findings. There was a great deal of heterogeneity in the included studies which, as the authors discussed, makes comparison across them difficult. It is also possible that some studies were missed as only two databases were searched and only English language publications were included.

Even without these caveats in mind, the authors' conclusions do not seem to reflect the findings entirely, particularly with regard to HbA1c: the number of studies showing no difference in markers of glycaemic control was equal to the number showing a significant improvement, and the conclusions about complications, education and reception by patients may have been appropriate but were based on limited data. The finding about patient empowerment was based on only 1 study. However, the authors had appropriately introduced a note of caution about the strength of the findings into their conclusions, and did make pertinent recommendations for further research.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.
Research: The authors stated that further investigation of telemonitoring efficacy and cost-effectiveness with stronger study design, longer follow-up and larger sample sizes is required. Differences between urban and rural settings should be considered when assessing the impact of the intervention. The attitudes of health care providers towards telemonitoring should also be assessed in light of workload implications and reimbursement issues.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.