Asynchronous and synchronous teleconsultation for diabetes care: a systematic literature review
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CRD summary
The review found that both synchronous (face-to-face) and asynchronous teleconsultation for diabetes care were feasible, cost-effective and reliable, although many studies found no significant difference between teleconsultation and usual care. Limitations in the review included poor quality evidence from diverse studies and a lack of reliable effect measures. The authors’ conclusions should be regarded with caution.

Authors’ objectives
To determine the effectiveness of teleconsultation for diabetes care.

Searching
MEDLINE, Science Direct, Web of Science, TIE, PsycINFO, PiCarta databases and Google Scholar and indexes of six named journals were searched from 1994 to June 2009. Search terms were reported. Reference lists of articles retrieved were checked. The search was restricted to articles in English.

Study selection
Studies of teleconsultation for care of diabetes (type 1, type 2 or gestational) were eligible regardless of study design. Studies were required to report not only clinical outcomes (metabolic control and quality of life) but also behavioural outcomes (self care and patient/carer interaction) and/or care co-ordination (cost effectiveness, transparency of care delivery process/compliance with guidelines and protocols, equity of access and usability of equipment).
Teleconsultation was defined as a health care application that facilitated interaction between or among caregivers and patients. Studies were excluded if they solely reported technical or clinical outcomes or included other target groups.

Studies included adults and/or children. Study settings were primary, secondary and integrated care in a wide range of countries; half of the studies were conducted in USA. Few studies used a disease management model. Interventions included information exchange, monitoring, education and/or care co-ordination and were often delivered by an interdisciplinary team. Most interventions were asynchronous (email, internet, cell phone, automated messages). Some interventions were synchronous (real-time face-to-face, video conferencing). Other interventions used both approaches. Technologies used included mobile phone, personal digital assistant, video conferencing and web-based systems (in most cases they were stand-alone devices). Controls received usual care.

Data gathering methods included interviews, focus groups, log files and validated or non-validated questionnaires. Studies reported clinical values (haemoglobin HbA1c, diabetes regulation, lipids, calorie intake, body mass index, weight, blood pressure), behavioural outcomes (intensity of patient-carer contact, perceived provider supportiveness, metabolic data transmission) and care co-ordination (usability, cost, transparency, equity). Intervention durations ranged from two weeks to five years.

Two reviewers independently selected the studies. Disagreements were resolved by consensus or discussion with a third reviewer.

Assessment of study quality
Two reviewers independently rated study designs and graded the level of evidence from 1 (randomised controlled trials, RCTs) to 5 (expert opinion). Disagreements resolved by consensus. RCTs were rated with the Jadad scale of adequacy of reported randomisation, blinding and withdrawals (maximum 5 points).

Data extraction
Descriptive data, effect estimates and/or p values were extracted for each outcome of interest in each study. For HbA1c values (in adults only) in RCTs the mean difference (MD) between groups in change from baseline was calculated, with 95% confidence intervals (CI). Data on variance were extracted, calculated or imputed. Authors were contacted for...
more information if required.

The authors did not state many reviewers performed data extraction.

Methods of synthesis
Data on HbA1c levels in adults were combined using a random-effects model to calculate the pooled mean difference and 95% CI. Heterogeneity was assessed with $I^2$ and $X^2$. Other findings were combined in a narrative synthesis organised by outcomes. Findings were stratified by type of intervention (asynchronous, synchronous and combined).

Results of the review
Ninety studies were included in the review (more than 51,872 participants). The tables reported 28 RCTs (more than 3,649 participants), 13 quasi-experimental studies (1,285 participants), four controlled observational/cohort studies (1,846 participants), one case-control study (5,196 participants), 36 before-and-after studies or case series (39,079 participants including one study with 36,327 participants) and eight expert opinions (more than 817 participants). Jadad scores for the 15 pooled RCTs ranged from zero to 3.

Clinical outcomes: HbA1c levels were reported by 25 RCTs (15 of adults and suitable for pooling). There was no significant difference between intervention and control groups in HbA1c (MD -0.10, 95% CI -0.39 to 0.18, $I^2$=81%, $X^2$<0.00001). Forty-nine studies reported improvement in clinical values associated with the intervention. Twelve studies reported improved quality of life; no significant difference between intervention and control groups in five of the 12 studies.

Behavioural outcomes: The intervention was associated with improved patient-caregiver interaction in 28 of 29 relevant studies and improved self-care in 42 of 47. Only six of these reported a significant difference between intervention and control groups.

Care co-ordination: The general usability of the technology was rated positively by users in 45 of 56 relevant studies and negatively in 11 studies. The most common problems were over-complexity (17 studies), time constraints (15 studies) and lack of infrastructure (10 studies). Seven studies reported that the intervention increased the transparency of health care, but only one reported a significant difference between the intervention and control groups. Four studies reported that the intervention improved equity.

The review also reported findings stratified by type of intervention.

Cost information
In 27 of 33 studies, teleconsultation was associated with reduced costs. Cost-effectiveness measures varied widely and a cut-off point for significant cost saving could not be determined. Six studies reported that the intervention was associated with costs that were higher or not significantly different from usual care.

Authors’ conclusions
Both synchronous (face-to-face) and asynchronous teleconsultation for diabetes care were feasible, cost-effective and reliable, although many studies found no significant difference between teleconsultation and usual care.

CRD commentary
The objectives of the review were clear in most respects. The rationale for classifying outcome measures was not clearly justified. The criterion that all studies report clinical plus other outcomes was not adhered to as several studies did not appear to report any clinical outcomes. Relevant sources were searched for studies. It was possible that studies were missed because the search was limited by language and there appeared to be no specific efforts to retrieve unpublished studies. Steps were taken to minimise risks of reviewer bias and error by having more than one reviewer independently select studies and undertake validity assessment; methods for data extraction were not reported. Reporting of study designs was inconsistent between the text and tables.

In the meta-analysis, controls in studies with more than one intervention group were double or triple counted. Marked statistical heterogeneity was not fully investigated. Most review findings were based on vote counting. It appeared that equal weighting of results was given to studies that differed greatly in design, size, interventions and outcomes. It was often unclear what proportion of studies had positive findings or were statistically significant. The quality of most of
the included RCTs (where reported) was very poor and the quality of non-RCTs was not reported.

Limitations in the review, which included the poor quality and heterogeneity of the evidence and a lack of reliable effect measures, mean that the authors’ conclusions should be regarded with caution.

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

**Practice:** The authors stated that interventions to support diabetes care should combine clinical, educational and informational interventions and that use of mobile technology for monitoring and feedback should be considered.

**Research:** The authors stated that quasi-experimental studies (in preference to RCTs) should investigate which types of technology improved specific aspects of diabetes care, determine the optimal intensity of the intervention, compare feedback mechanisms and assess different types of smart technology. They should use a using a holistic approach and multi-level outcomes. Stakeholders should help design and run trials.

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