

# Telehealth as adjunctive therapy in insulin pump treated patients: a pilot study

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## Background

In the UK, the National Institute for Health and Clinical Excellence (NICE) has recently published a review of its original technology appraisal related to continuous subcutaneous insulin infusion (CSII insulin pump therapy).<sup>1</sup> Specifically, the review suggests that CSII should be considered as an option for adults and children 12 years of age or over provided that:

- Attempts to achieve target HbA<sub>1c</sub> levels with multiple daily injections result in the person experiencing disabling hypoglycaemia, or
- HbA<sub>1c</sub> levels have remained high (i.e. at 8.5% or above) with multiple daily injections (including using long-acting insulin analogues if appropriate) despite the person carefully trying to manage their diabetes.

As a result of these revised indications it is likely that there will be an increase in the number of patients with type 1 diabetes using this form of insulin delivery. However, data from our own unit and elsewhere have suggested that achieved HbA<sub>1c</sub> levels quickly fall below pre-pump levels and thereafter plateau.<sup>2,3</sup> In addition, experience has suggested that on-going education is essential to maintain good glycaemic control rather than allowing individuals to be 'self-sufficient'.<sup>4</sup> The challenge for specialist diabetes centres is to structure their service in such a way that maximum benefit is achievable for pump treated patients without requiring an increase in resources.

The aim of this pilot project was to determine the feasibility of

## ABSTRACT

New National Institute for Health and Clinical Excellence guidance is likely to increase the use of insulin pump therapy, and the challenge for diabetes teams is to maintain the initial improvement in HbA<sub>1c</sub> without extra resources. A telehealth system has been developed where both health professionals and patients can view downloaded pump and blood glucose data.

A pilot study in patients with HbA<sub>1c</sub> >8%, using pump therapy for more than a year, demonstrated a mean reduction from 9.3% to 8.2% at 12 months after using the telehealth system. Patient satisfaction with the system reported more understanding, insight and control by viewing the data, as well as easy access to the health professional. This pilot study has demonstrated that, for some people, using a telehealth approach has resulted in improved diabetes control. Copyright © 2010 John Wiley & Sons.

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## KEY WORDS

telehealth; insulin pump therapy; patient satisfaction; self-management

using a telehealth system as an aid to improving HbA<sub>1c</sub> levels in patients already established on CSII but who have suboptimal glycaemic control.

## Telehealth system

Locally, we have been involved in developing a telehealth system for use with insulin pump therapy.<sup>5</sup> This is an interactive telemedicine system allowing diabetes treatment data to be viewed simultaneously in the home and in the diabetes centre, and includes a dedicated messaging service. The system allows a patient to download, wirelessly, data from a glucose meter and/or insulin pump into their home computer. These data are transmitted via the internet and stored on a secure files server. The patient sees the results, in graphic form, on their computer and, at the same time, the data enter the medical teams' patient record. Patients can receive or send messages and/or video conference with their health care provider.

## Methods

In January 2005, we identified 25 patients (12 male) with a mean age of 44 years (range 24–57 years) and duration of diabetes 26 years (range 7–43 years), who had an HbA<sub>1c</sub> >8% (mean HbA<sub>1c</sub> of all pump users was 8%) and who had been using insulin pump therapy for three years (range 1–6 years). All were invited to participate in two novel group education sessions which focused on optimising basal and bolus insulin infusion rates. Twenty-one patients participated and the average HbA<sub>1c</sub> fell from 8.7% to 7.9% six months after completion of these two education programmes.

In 2007, following approval by the local research and ethics committee we first identified insulin pump users with HbA<sub>1c</sub> >8% and who had access to a computer, and subsequently invited 16 individuals to participate in the trial of the Axon T4NET system. Only three of these patients had been involved in previous education as described above. There were seven males and nine females with a mean

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age of 44 years (range 22–76 years), duration of diabetes 30 years (range 9–46 years), and use of insulin pump for five years (range 0.5–8 years). Additional inclusion criteria were use of a Roche Accu-Check insulin pump (the only one at that time which could be downloaded by Axon T4NET), and access to a home computer.

Each person was visited at home to set up and demonstrate the system. Participants were informed that downloaded data on their home-based system could be viewed by designated health professionals at home or at the hospital via a remote fileserver. Participants were asked to use the system as much as they liked, but preferably every few days. As soon as data were downloaded, they were viewed by both patient and professional. The computer screen shows the basal rates, boluses and blood glucose levels on the same chart. It was expected that the patients would make their own changes to management, but all had access to a diabetes nurse specialist via a messaging service. Baseline data of HbA<sub>1c</sub>, awareness of hypoglycaemia<sup>6</sup> and Problem Areas In Diabetes (PAID)<sup>7</sup> were collected before starting the telehealth system and after three and 12 months.

## Results

Each day, the educator viewed any downloaded data, made suggestions if necessary and responded to any messages. This took less than 10 minutes each day which was easily incorporated into current workload.

Following initiation of the telehealth system, mean HbA<sub>1c</sub> fell from 9.3% (7.6–12.5%) to 8.4% (7.6–8.7%) at three months and further to 8.2% (7.1–9.6%) at 12 months. There was no change in either the awareness of hypoglycaemia or PAID scores.

Only 12 of the original 16 actually used the system and downloaded data. The reasons for not using the system were that one person returned to using multiple injections, one experienced problems with their computer system and the other two were offered help and support but, although consented to study, declined to use the Axon system. Out of the 12 who used the system, only one has subsequently stopped using it since the finish of the

## Key points

- A telehealth system allows patients to download data in their own homes and the data can be viewed by the health professional
- This pilot study demonstrated a mean reduction in HbA<sub>1c</sub> from 9.3% to 8.2% in patients already established on pump therapy but with an HbA<sub>1c</sub> >8%
- Patients reported increased self-management skills and more understanding after using the telehealth system
- Health professional time was less than 10 minutes each day to review data and was incorporated into current workload

trial. One participant increased their HbA<sub>1c</sub> by 0.4%, another remained the same and 10 participants decreased their HbA<sub>1c</sub>. This system is now offered to new pump users as part of routine clinical care.

All participants were also sent a satisfaction questionnaire which asked how useful the system had been, how easy it had been to use, and what specifically had helped them manage their diabetes, as well as asking for suggestions for improvement. Reported benefits included ease of pattern recognition to aid in adjusting basal and bolus infusions, including correction boluses together with more 'understanding', 'insight and control'. In addition, many expressed the benefit of quick and easy access to the health professional. One person said that using Axon had prevented a hospital admission during a recent illness.

## Discussion

The original education sessions were associated with a 0.8% reduction in HbA<sub>1c</sub> but required eight hours of nurse educators' time. This pilot study demonstrated a 0.9% reduction in HbA<sub>1c</sub> using less dedicated educator time. The emphasis on using this system was to enable self-management. Although the data were viewed by a diabetes nurse specialist and some changes were recommended, most changes were performed by the patient without contacting the nurse.

Previous studies<sup>2,3</sup> suggest that the early fall in HbA<sub>1c</sub>, after initiating CSII, plateaus beyond six months. In this pilot study, we have achieved a further reduction in HbA<sub>1c</sub> for patients established on insulin pump therapy by incorporating a telehealth approach. It remains to be determined whether this offers improved cost-effectiveness value compared to a traditional intensive education approach.

The reduction in HbA<sub>1c</sub> occurred without any deterioration in awareness of hypoglycaemia or change in PAID score. However, it is noteworthy that this cohort had PAID scores which were significantly less than those of their peers using multiple daily injections.

In conclusion, this pilot study has demonstrated that, for some people, using a telehealth approach has resulted in improved glycaemic control.

## Update on Axon T4NET

When this pilot study was started, the Axon T4NET was in the early days of development and several challenges were experienced by the participants. Subsequent to the pilot study, participants formed a user group which has influenced and directed further developments, including the following.

- Originally data could only be seen on weekly or monthly charts. Now the user can choose any three days of data to look at.
- Data can now be demonstrated in various ways.
- The system now also has access to educational material, frequently asked questions and a discussion forum.
- At the time of the study, participants had to have a separate monitor to view the data, but now data can be viewed on their own computer.
- It is also now available to use via the Axon website.<sup>5</sup>
- Two manufacturers are collaborating with further development of this approach (Roche and Animas).

## Conflict of interest statement

David Kerr holds stock in Axon UK; Axon UK funded the pilot study.

## References

References are available at [www.practicaldiabetesinternational.com](http://www.practicaldiabetesinternational.com).



## References

1. National Institute for Health and Clinical Excellence. Final appraisal determination: Continuous subcutaneous insulin infusion for the treatment of diabetes mellitus (review of Technology Appraisal 57). London: NICE, July 2008.
2. Kerr D, Nicholls H, James J. Continuous subcutaneous insulin infusion (CSII insulin pump therapy) for type 1 diabetes: a Bournemouth perspective: *Pract Diabetes Int* 2008; **25**: 114–117.
3. Gimenez M, Conget I, Jansa M, *et al*. Efficacy of continuous subcutaneous insulin infusion in type 1 diabetes: a 2-year perspective using the established criteria for funding from a National Health Service. *Diabet Med* 2007; **24**: 1419–1423.
4. Insulin pump services: Report of the Insulin Pump Working Group. London: Department of Health, March 2007.
5. [www.axonuk.org](http://www.axonuk.org).
6. Clarke WL, Cox DL, Gonder-Fredericks L, *et al*. Reduced awareness of hypoglycaemia in adults with IDDM. *Diabetes Care* 1995; **18**: 517–522.
7. Welch GW, Jacobson AM, Polonsky WH. The Problem Areas in Diabetes Scale. An evaluation of its clinical utility. *Diabetes Care* 1997; **5**: 760–766.

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