

# Diabetes specialist nurse telemedicine: admissions avoidance, costs and casemix

**Dr Nicholas R Evans**, MA(Cantab), MB BChir; at time of writing: Senior House Officer, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospital NHS Foundation Trust; current post: Senior House Officer, Papworth Hospital, UK

**Liesl S Richardson**, RGN, Senior Diabetes Specialist Nurse, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospital NHS Foundation Trust, UK

**Dr Ketan K Dhatariya**, MBBS, MSc, MD, MS, FRCP, Consultant Diabetologist, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospital NHS Foundation Trust, UK

**Professor Mike J Sampson**, BSc, MBBS, MD, FRCP, Consultant Diabetologist, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospital NHS Foundation Trust, UK

**Correspondence to:** Professor Mike Sampson, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospital, Colney Lane, Norwich NR4 7UY, UK; email: mike.sampson@nnuh.nhs.uk

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## Introduction

Diabetes specialist nurses (DSNs) provide a valuable service to people with diabetes and act as a vital link between hospital services, primary care and the patients themselves.<sup>1</sup> This contribution has seen an increase in the number of DSNs over recent years, with 1278 DSNs employed in UK primary and secondary care roles as of 2007.<sup>2</sup> A large proportion of their time is spent in giving telephone advice to people with diabetes. In particular, the DSN telephone service can advise on changes to insulin dosage and education over 'sick day rules'. The education provided by the DSNs may also provide a cost-effective method for avoiding acute

## Summary

This study aimed to describe a diabetes specialist nurse (DSN) telemedicine advice service in a UK university hospital diabetes service in terms of the payment by results (PbR) tariff costs, potential admissions avoidance and casemix.

The source, purpose, duration, outcome and patient age were recorded prospectively over 12 months for every patient-initiated, diabetes-related telephone consultation.

In all, 5703 patient-initiated telephone consultations were recorded. Of these, 3459 (60.7%) involved insulin dose management for those receiving insulin therapy for longer than six months. In contrast, 530 (9.3%) consultations covered dose adjustment for individuals started on insulin therapy within the previous six months. A total of 235 (4.1%) consultations involved managing insulin, food and fluid intake during intercurrent illness ('sick day' advice) – 103 (1.8%) with ketonuria and 132 (2.3%) without ketonuria. Of these, only 17 required referral to their general practitioner for review for a hospital admission, representing 218 potentially avoided admissions over the study period.

Individuals over 60 years of age accounted for 3610 (63.3%) consultations. The PbR tariff for each telephone consultation was £23 (\$37.66; €26.10), with an estimated annual cost of £131 169 (\$214 781; €148 908). The national average unit costs (for 2008–09) for an emergency long-stay admission related to dysglycaemia range from £846 (\$1384; €961) to £2634 (\$4311; €2991), representing potential cost savings of between £179 414 (\$293 759; €203 715) and £569 198 (\$932 008; €646 400) for these 218 avoided admissions.

In conclusion, DSNs provide hundreds of hours of telephone advice annually that improve ongoing diabetes care and represent a cost-effective method of reducing the number of acute hospital admissions.

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## Key words

diabetes; health care commissioning; admissions avoidance; diabetes specialist nurse; telemedicine

hospital admissions, but the evidence that this is the case is limited. This is an increasingly important consideration in view of the emphasis on admissions avoidance in new health care planning and delivery, and has been demonstrated in some high-risk diabetes groups.<sup>3</sup> At a time when the focus of health care throughout the UK and Europe is now fixed firmly on personalised care plans and on the opportunities for patients to access health care at a time and place of their choosing, preferably close to home, the DSN telemedicine service is crucial if we are to achieve these aims. It enables the patients to have individualised specialist advice, education, support and continuity of care, and to receive that care at a time and place that is convenient for them.

The Norfolk and Norwich University Hospital is a large teaching hospital with a geographical catchment area of approximately 2000 square miles, serving a population of about 600 000 people. The Elsie Bertram Diabetes Centre based at the hospital provides care to nearly 4000 registered patients, largely with complex and/or insulin-treated patients. It operates with 5.3 whole-time equivalent diabetes specialist nurses in secondary care, 2 whole-time equivalent diabetes inpatient specialist nurses and a network of 4 whole-time equivalent nurse facilitators providing direct practice support to primary care. The diabetes specialist nurse telephone advice service is available to those registered with the Elsie Bertram Diabetes Centre;

however, advice is also given to other health care professionals, e.g. district nurses or general practitioners for patients not registered at the centre. There is a DSN responsible on a rota for retrieving and answering telephone calls each day of the working week. She also holds a bleep so patients who have an urgent problem can make contact directly. If a message is left for a specific DSN, that message is passed on to the relevant member of staff. The calls are returned at the end of our clinic sessions or between patient appointments so they do not interrupt patient appointments. The telephone service accounts for approximately 50% of our patient contacts *per annum*, within the Elsie Bertram Diabetes Centre.

The UK Department of Health reference costs for 2008–09 show that the national average unit costs for a non-elective long-stay (length of stay lasting longer than one day) admission for hyperglycaemic complications without critical care is £846 (\$1384 or €961) per admission for those aged 69 or below (accounting for 24 795 bed days nationally) and £1492 (\$2441 or €1694) per admission for those aged 70 years and above (accounting for 2599 bed days nationally).<sup>4</sup> Admissions for hyperglycaemia requiring intermediate critical care cost £1132 (\$1852 or €1285) for those aged 69 and below, and £1640 (\$2684 or €1862) for those aged 70 and above (28 166 bed days nationally and 22 641 bed days nationally respectively).<sup>4</sup> Admissions classed as requiring major critical care input had a national average unit cost of between £1918 (\$3138 or €2177) for those aged below 69 (accounting for 9616 bed days nationally) and £2634 (\$4311 or €2991) for those aged 70 years and above (accounting for 20 802 bed days nationally).<sup>4</sup> In contrast, long-stay non-elective admissions due to

Purpose of call	No. of calls
Dose adjustment advice, planning and education (on insulin >6 months)	3459 (60.7%)
Dose adjustment advice, planning and education (on insulin <6 months)	530 (9.3%)
Hypoglycaemic episode advice and education	304 (5.3%)
Dose adjustment advice, planning and education (new insulin regimen)	219 (3.8%)
Antenatal queries	144 (2.5%)
'Sick day rules' without ketonuria	132 (2.3%)
'Sick day rules' with ketonuria	103 (1.8%)
Appointment query	72 (1.3%)
Prescription query	68 (1.2%)
Barium enema guidance	61 (1.1%)
Pre-pregnancy queries	32 (0.6%)
Blood glucose meter problem	30 (0.5%)
Postnatal queries	29 (0.5%)
Not registered at Elsie Bertram Diabetes Centre	22 (0.4%)
District nurse advice	20 (0.4%)
General practitioner advice (not dose advice)	20 (0.4%)
General practitioner advice (dose advice)	12 (0.2%)
Other institution advice	12 (0.2%)
Nursing/residential home advice	7 (0.1%)
Foot problems	6 (0.1%)
Other/not recorded	421 (7.4%)

**Table 1.** Number of consultations grouped by purpose

hypoglycaemia had a national average unit cost of £1177 (\$1926 or €1336) for those aged 69 years and below (accounting for 8633 bed days nationally) and £1585 (\$2593 or €1799) for those aged 70 years and above (accounting for 30 819 bed days nationally).<sup>4</sup>

In contrast, the payment by results (PbR) tariff for the DSN telephone service is £23 (\$37.66 or €26.10), with a market forces factor for the Norfolk and Norwich University Hospital of 1.8074%, resulting in a total cost per telephone consultation of £23.42

Outcome of call	No. of calls
Dose adjustment advice, planning and education given, further contact recommended	4016 (70.4%)
Dose adjustment advice, planning and education given, further contact not recommended	1416 (24.8%)
Referred to health care professional at Norfolk and Norwich University Hospital	160 (2.8%)
Fax sent in response	158 (2.8%)
Outpatient appointment arranged	53 (0.9%)
Referred to health care professional in primary care	22 (0.4%)
Referred to general practitioner (problem unrelated to diabetes)	19 (0.3%)
Referred to general practitioner for possible admission	17 (0.3%)
Other	183 (3.2%)

**Table 2.** Number of consultations grouped by outcome

(\$38.33 or €26.59). This cost applies to all telephone consultations where medical advice was issued regardless of the duration of the telephone consultation.

### Patients and methods

We performed a prospective study of all telephone and fax consultations to the DSN telephone service at the Norfolk and Norwich University Hospital during the period 1 November 2008 until 31 October 2009. The telephone consultations were categorised by the origin, purpose and outcome of the consultation. For the purposes of the study, faxed referrals for advice were included as telephone consultations. Separate telephone consultations with the same individual were classified as separate clinical encounters.

### Results

In total, 5703 phone consultations took place during the study period. Fifty-one (0.9%) of these were faxes that prompted a telephone consultation, the combination of which

was counted as one clinical consultation. These are broken down in Table 1. The majority of telephone consultations lasted less than 5 minutes (3156 consultations, 55.3%) while 1956 (34.3%) calls lasted between 6–10 minutes; 525 (9.2%) calls lasted over 10 minutes. In 66 (1.2%) telephone consultations the length of the call was not recorded. A total of 3610 (63.3%) consultations were with patients aged over 60 years of age, with only 434 (7.6%) telephone consultations with patients aged 16–30 years.

The purposes for the telephone consultation are described in Table 2. Insulin dose adjustment advice in individuals who had been on insulin therapy for longer than six months was the most common, accounting for 3459 (60.7%) telephone consultations. In contrast, consultations regarding dose adjustment advice in individuals on insulin therapy for less than six months accounted for only 530 (9.3%) telephone consultations.

The most common outcomes of the telephone consultation were

dose adjustment advice, planning, education and advice to contact the service again for follow up. Together, these accounted for the outcome of 4016 (70.4%) consultations. In a further 1416 (24.8%) cases, dose adjustment advice, planning and education were given but no further contact was required. Seventeen (0.3%) were referred to their general practitioner (GP) for review for a possible admission related to the diabetes, 19 (0.3%) were advised to see their GP for a problem unrelated to their diabetes, while 53 (0.9%) people had an outpatient appointment arranged with hospital services based at the Elsie Bertram Diabetes Centre.

Of particular importance was the number of calls taken for 'sick day rules'. During the study period, 103 (1.8%) consultations were with individuals who were having ketonuria, with a further 132 (2.3%) consultations with individuals without ketonuria but who had rung because they needed 'sick day' advice. Of these, only 17 (0.3%) were referred to their GP for review for a possible hospital admission.

The insulin regimen being used by those ringing for dose adjustment advice was recorded in 1512 of the consultations. Of these, 582 (38.5%) were on a basal-bolus regimen, 201 (13.3%) on a once-daily regimen and 729 (48.2%) on a twice-daily regimen.

The review of our DSN telephone service also showed that the busiest three-month period was for February to April, with 1608 (28.2%) consultations. This was also the period with the highest frequency of consultations lasting for longer than 10 minutes. In contrast, the quietest three-month period was during November to January, with 1157 (20.3%) consultations in this period.

## Discussion

Individuals with diabetes mellitus are more likely to be admitted to hospital for a range of medical problems unrelated to diabetes compared with non-diabetic controls.<sup>5</sup> While diabetic emergencies (in particular, diabetic ketoacidosis and hyperglycaemic hyperosmotic states) may prompt admission as the primary presenting complaint, diabetes mellitus also plays an important role as a co-morbidity for many patients admitted with other medical problems.

Individuals with diabetes account for 13% of the inpatient population at our trust, and dysglycaemia complicating the presenting complaint can lead to a poorer prognosis and increased length of stay.<sup>6–9</sup> Inpatient DSNs have a vital role in improving glycaemic control while in hospital, resulting in a shortened length of admission.<sup>10</sup> Here we applied the same principle of improved diabetes care to an out-patient population and considered its role in the prevention of avoidable acute hospital admissions. The monitoring and control of diabetes mellitus of either type, as provided by the DSN telephone service, are likely to reduce those admissions resulting directly from diabetes or with diabetes as a co-morbidity. In particular, the 235 telephone consultations for 'sick day' advice (103 with ketonuria, 132 without ketonuria), where only 17 cases required referral to their GP for further review, represents an important cohort of at least 218 patients per year where an acute hospital admission may have been avoided. A similar result was reported by Holmes-Walker *et al.* where, of the 30 individuals contacting their after-hours phone support service over a two-year period, only two required admission for diabetic ketoacidosis.<sup>3</sup> Furthermore, ongoing support in the community

through the telephone service provides a vital network for monitoring and facilitating individuals' glycaemic control.

As discussed above, Department of Health figures for 2008–09 record that emergency admissions related to either hypoglycaemia or hyperglycaemia resulted in a total of 133 612 bed days nationally, with a national average unit cost between £846 (\$1384 or €961) and £2634 (\$4311 or €2991). An avoided admission due to the DSN telephone service, with a PbR of £23 (\$37.66 or €26.10), represents an average saving of between £823 (\$1347 or €935) and £2611 (\$4274 or €2965) for each avoided admission. During our 12-month study period, the potential 218 avoided admissions would account for a total saving of between £179 414 (\$293 759 or €203 715) and £569 198 (\$932 008 or €646 400) after costs.

The recent Joint British Diabetes Societies guideline on the management of diabetic ketoacidosis favours early admission to a high dependency unit environment for those satisfying the criteria for severe ketosis, resulting in higher unit costs. Consequently, reducing admissions by reducing the development of diabetic ketoacidosis should result in increasing cost savings.<sup>11</sup>

Of note was the difference in the calls for dose adjustment advice between those new to starting insulin and those who had been on insulin therapy for longer than six months. The much higher numbers of those in the latter group may be due to the greater number of individuals on established insulin regimens, or may represent the improved education that is now delivered to individuals starting insulin therapy, giving the individuals the knowledge of how to manage their insulin regimens themselves.

Furthermore, the data show that the most frequent users of the service are patients older than 60 years of age. While this may represent the age group with the greatest prevalence of the condition, it may also represent those individuals on long-term insulin who were started on therapy prior to the increasing focus on patient education and who feel less confident in adjusting their therapy on their own. The increasing focus on patient education enables the individual to manage their diabetes themselves, reducing the need to seek advice from health care providers.

The authors recognise that there are limitations to this descriptive work. We are aware of some under-reporting in the review of the service; in particular, there were occasions where the purpose of the telephone consultation or the patient's current insulin regimen was not documented. Furthermore, we recognise that patients frequently contact the telephone service with more than one issue and that there may be more than one outcome from the telephone encounter. We also recognise that this study did not consider the time since the diagnosis of diabetes, whether individuals had undertaken DAFNE training, the level of the individual's education and the type of diabetes (whether type 1 or type 2 on insulin therapy), all of which are areas for future research. However, the results demonstrate that the majority of telephone consultations remain under 5 minutes, representing a vital and efficient resource for patients who may have otherwise consulted their primary care team or the acute hospital admissions department.

The data presented show that the DSNs provide hundreds of hours of valuable telephone advice that would otherwise be directed at primary care or potentially present

to the acute medical services. Extrapolation of these findings suggests that this service is likely to have relieved the pressure on primary care and the emergency services, resulting in fewer acute admissions. Other than avoiding hospital admissions, the availability of this service aids continuity of care and provides an important first point of contact for insulin-treated patients, and for the medical staff who look after people with diabetes. The levels of psychological and emotional support offered to the patients – many of whom are known personally to the DSNs – during these one-to-one conversations are difficult to quantify, although previous research has demonstrated that those patients who have a DSN playing a prominent role in their disease management have a higher self-reported health status score.<sup>12</sup> The education and support the service provides remain insufficiently recognised and remunerated. The data may suggest that in the new health care environment commissioners

should be aware that the DSN team provides a cost-effective service in terms of admissions avoidance.

#### Declaration of interests

There are no conflicts of interest declared.

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