Long-term glycaemic outcome of structured nurse-led diabetes care in rural Africa

C. PRICE1,2, D. SHANDU2, M. DEDICOAT2, D. WILKINSON3 and G.V. GILL1

From the 1Liverpool School of Tropical Medicine, Liverpool, Pembroke Place, Liverpool L3 5QA, UK, 2Hlabisa Hospital, Hlabisa, Kwazulu Natal, South Africa and 3University of Queensland, Brisbane, Australia

Address correspondence to Prof. G.V. Gill, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK. email: g.gill@liv.ac.uk

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Summary

Background: Diabetes care delivery in rural Africa is difficult. Problems include lack of dedicated personnel, monitoring systems, laboratory support and drugs. Few structured intervention projects have been undertaken, none with long-term follow-up.

Aim: To determine the long-term (4 years) glycaemic outcome of a structured nurse-led intervention programme for type 2 diabetic patients in rural Africa.


Methods: The programme was delivered in the scattered primary health clinics of Hlabisa District, in northern Kwazulu Natal, South Africa. Monthly diabetic clinics were held at which empowerment-based education was delivered and regularly reinforced. Oral hypoglycaemic agents (OHAs) were titrated according to a previously validated clinical algorithm. Outcome was measured by glycated haemoglobin (HbA1c), as well as body mass index (BMI). Data were collected at baseline, and then 6, 18, 24 and 48 month’s post-intervention.

Results: Eighty patients had data available at all time collection points. They were of mean ±SD, age 56 ± 11 years, 70% were female, BMI 31.5 ± 7.2 kg/m² and HbA1c 10.8 ± 4.2%. HbA1c fell significantly to 8.1 ± 2.2% at 6 months and 7.5 ± 2.0% at 18 months. By 24 months, it had risen (8.4 ± 2.3%), and at 4 years post-intervention it was 9.7 ± 4.0% (still significantly lower than baseline, P = 0.015). BMI rose significantly at 6 and 18 months, but by 48 months was not significantly different from baseline.

Conclusions: We conclude that the intervention led to marked HbA1c improvements up to 18 months follow-up, but thereafter there was ‘glycaemic slippage’. This may be not only due to educational ‘wear-off’, noted in other education-intervention programmes, but also to the expected glycaemic deterioration with time known to occur in type 2 diabetes. Nevertheless, 4-year HbA1c levels were still significantly lower than at baseline. The programme was also well received by staff and patients, and we believe is an appropriate and effective diabetes intervention system in rural Africa.
Introduction

Diabetes mellitus, particularly the predominant type 2 variant, is globally increasing in prevalence, and rises over the next 20 years will be most marked in resource-limited developing countries. Delivering care to these growing numbers is already problematic, and is particularly difficult in the rural tropics where drugs, equipment and staff are in short supply. The current and future burden of diabetes in such areas requires that systems of health-care delivery are appropriate to local resources and geography; and sensitive to indigenous cultural, socio-economic and educational factors.

Attempting to respond to these problems, we initiated in 2001 the ‘Hlabisa Diabetes Project’ in a remote, rural area of KwaZulu Natal in South Africa to deliver diabetes care to the scattered population by nurses in primary health clinic (PHC) situations. Using clinical algorithms for oral hypoglycaemic agent (OHA) titration, and structured education programmes, we have demonstrated highly beneficial falls in glycated haemoglobin (HbA1c) over an 18-month period since the programme was introduced (mean HbA1c at baseline 11.6 ± 4.5% and 18 months later 7.7 ± 2.0%).

In this article, we report longer term outcome (4 years since initiation) from the Hlabisa Diabetes Project, to examine whether such improved control could be maintained.

Patients and methods

Details of the location of the project, the study population and the management intervention delivered have been published in full elsewhere. Briefly, Hlabisa District is a rural area of northern KwaZulu Natal in South Africa. The area has a central hospital with 14 peripheral PHCs, many of which are very remote. A previous study in the area had demonstrated a relatively large diabetic population with high rates of complications (e.g. retinopathy 40% and microalbuminuria 46%) and also poor glycaemic control—mean HbA1c 11.3%.

The intervention study involved a local diabetes-trained nurse visiting each PHC every month to see diabetic patients. OHAs—glibenclamide and metformin—were initiated and titrated according to a clinical algorithm, which had been previously validated. These two OHAs were the only ones available. The algorithm included confirmation of diagnosis, trial of lifestyle modification and education. OHAs were then added if necessary—glibenclamide if the body mass index (BMI) was <27.0 and metformin if >27.0. Patients attended monthly and doses were titrated upwards as necessary. The algorithm later allowed combination OHAs, and if these failed, patients were referred to medical staff at the central hospital for insulin initiation. The target for ‘control’ was largely clinical. Neither self-blood glucose monitoring nor HbA1c assay was available (though the latter was used in the study as a research end point). Even random blood glucose could not be always measured. Control of osmotic symptoms (nocturia less than once) and absence of OHA-related hypoglycaemic side effects were therefore the key targets.

In addition to drug titration, structured empowerment-based diabetes education was delivered in groups and regularly reinforced. This was adapted from the ‘Zahke Programme’—a simple pictorial based flip-chart system that had been previously successfully field tested. The education was sensitive and appropriate to the low literacy rates in the community. It was delivered to groups in the clinic at the start of the project and was reinforced at each clinic visit. The educational programme was also delivered via community support workers, and a handbook was developed for PHC nurses when the diabetes nurse team was not available. As the research element of the programme was carried out in remote areas, and in the context of a busy clinical service, data collection was kept to a minimum. Outcome was, therefore, measured only by HbA1c and BMI. Data were collected prior to initiation of intervention, and then at 6 months, 18 months, 2 years and 4 years afterwards. HbA1c was measured by high-performance liquid chromatography and was aligned to the Diabetes Control and Complications Trial (reference range 4.5–5.7%). Samples were transported to Durban (240 km away) for assay, and the results were not available for routine control purposes.

Statistical analysis was by paired t-tests, using Statistical Package for Social Sciences computer package version 15.0. Local ethical committee approval was obtained.

Results

We originally recruited 320 diabetic patients to the programme. As with all diabetes services, intermittent missed appointments were common, and we therefore identified a core of 80 patients who had attended at all the five data collection points (0, 6 and 18 months, 2 and 4 years), thus allowing paired t-test comparisons at these follow-up times. All the 80 patients had type 2 diabetes, age (mean ± SD) was 56 ± 11 years, diabetes duration 7 ± 6 years, 70% were female, BMI was 31.5 ±
Table 1 Changes in HbA1c and BMI during 4 years of follow-up of the Hlabisa diabetes intervention programme (n = 80)

<table>
<thead>
<tr>
<th>Time (months)</th>
<th>HbA1c (%)</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10.8 ± 4.0</td>
<td>31.5 ± 7.2</td>
</tr>
<tr>
<td>6</td>
<td>8.1 ± 2.2</td>
<td>32.0 ± 7.1</td>
</tr>
<tr>
<td>18</td>
<td>7.5 ± 2.0</td>
<td>32.0 ± 6.5</td>
</tr>
<tr>
<td>24</td>
<td>8.4 ± 2.3</td>
<td>–</td>
</tr>
<tr>
<td>48</td>
<td>9.7 ± 4.0</td>
<td>32.2 ± 6.3</td>
</tr>
</tbody>
</table>

There was incomplete BMI data collection at 24 months. BMI at 6 and 18 months was significantly higher than at baseline (both P < 0.01), but the 48-month value was not significantly different from 0 months. Compared with baseline, HbA1c falls were all significant (P < 0.01) for 6, 18 and 24 months and P = 0.015 for 48 months.

Changes in HbA1c and BMI over the 4 years of follow-up are shown in Table 1. BMI showed a small but significant rise from baseline to the 6- and 18-month testings (31.5 ± 7.2 to 32.0 ± 7.1 to 32.0 ± 6.5, P < 0.01 for both 6 and 18 months). However, the 4-year value of 32.2 ± 6.3 was not significantly different from baseline. HbA1c fell significantly (P < 0.001) from baseline to 6 and 18 months (10.8 ± 4.0% to 8.1 ± 2.2% to 7.5 ± 2.0%). There was a small rise to 8.4 ± 2.3% at 2 years, and a larger rise to 9.7 ± 4.0% at 4 years. The 4-year level, however, still remained significantly lower than at baseline (P = 0.015).

Of the 80 patients followed, 26 (33%) were ‘non-obese’ (BMI < 27.0) and 54 (67%) ‘obese’ (BMI ≥ 27.0). The non-obese group showed a consistently greater change in HbA1c—baseline was 13.1 ± 5.2% and 24-month level 6.7 ± 0.2%. Similar figures for the obese group were 11.8 ± 4.3% and 9.3 ± 1.7% (P < 0.001).

Discussion

In our report on 18 months of follow-up of this intervention programme, we demonstrated that HbA1c falls were related to both OHA introduction and titration, and also the associated education programme. Thus, in a subgroup analysis of a cohort of patients who had no drug manipulations (only education), HbA1c also fell significantly. Education programmes for type 2 patients in Europe have shown variable effects on glycaemic control, and when improvement occurs, there is some evidence that this may be short term, with a later ‘wear-off’ effect. The fall in HbA1c we noted in the first 18 months was dramatic and far greater than noted in European education programmes; this may be related to the initial very poor control of our patients (baseline mean HbA1c 10.8%) as well as the fact that they had never had any significant previous diabetes education.

As well as ‘education fatigue’ being a possible cause of the post-18 months glycaemic slippage, a further problem is likely to be the natural history of type 2 diabetes to deteriorate, a factor only detectable in long-term studies. Steady deterioration in HbA1c with time in type 2 diabetes was clearly demonstrated in the United Kingdom Prospective Diabetes Study, and was found in both the intensively treated and control groups. Data from this study would predict a 0.7% deterioration in HbA1c for type 2 patients of mean diabetes duration 7 years (as in our study) over the subsequent 4 years of follow-up (again, the same follow-up period of our cohort). Our cohort improved mean HbA1c by 1.1% over the same time period.

Our protocol used only glibenclamide and metformin—other oral agents such as glitazones were not available. Though we do not have quantitative data, sulphonylurea use and dosages clearly increased with time, and it is known that these drugs may accelerate beta cell failure, and be less ‘glycaemically durable’ in the long term. This could be a factor in the later glycaemic deterioration which we noted. However, most (67%) of our patients were overweight or obese (BMI > 27.0) and would therefore have been treated with metformin, at least initially. Those with BMI levels < 27.0 (33%) also appear to improve glycaemically more than the overweight group (see ‘Results’ section).

We believe ours is the only long-term outcome study of structured diabetes management in rural Africa using objective glycaemic outcomes. Positive hospital-based initiatives have been reported from Soweto (South Africa), Ghana and Eritrea. A system of devolved care of non-communicable disease, including diabetes, to rural health centres has been described from the Jimma area of Ethiopia, but was not evaluated by HbA1c measurement.

Glycaemic improvements are especially important for diabetic patients in resource-poor areas, as complication occurrence and progression will be reduced in the long term. The management of complications such as significant retinopathy, nephropathy or foot ulceration is difficult or impossible in remote primary care areas of Africa.

A final implication of our work is that the model of care we used, based on patient education and...
treatment algorithms, could be adapted to other chronic diseases such as hypertension, asthma and epilepsy. We have some short-term experience of such initiatives in Hlabisa District, but more structured and long-term trials would be well worthwhile.

In conclusion, our study has shown that structured nurse-led diabetes intervention in rural Africa can be associated with dramatic improvement in HbA1c. Though there is certainly longer term glycaemic escape at 4 years of follow-up, our patients still had a mean HbA1c significantly better than at baseline. We also noted that the programme of care was very warmly and positively received by both staff and patients. ‘You are our saviour’, one man with previously neglected diabetes said to the project diabetes nurse.

Acknowledgements

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Conflict of interest: None declared.

References