

Structured education in diabetes: A review of the evidence

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Article points

1. The literature and current UK health policy are both rich in affirmations of the critical nature of self-management in long-term conditions, particularly diabetes.
2. Four key diabetes education programmes and their accompanying evidence are highlighted in this article.
3. Evidence is the first step to implementation, but to ensure success, the choice of a structured education intervention must be complemented by other elements: stakeholder engagement, organisational infrastructure, social marketing and continuing investment.

Key words

- Implementation
- Self-management
- Structured education

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People with type 2 diabetes should have access to quality structured education to successfully self-manage their condition. Education interventions that are adopted should demonstrate their quality by meeting national standards and criteria, and be supported by evidence from gold standard randomised controlled trials to demonstrate efficacy and effectiveness, including cost-effectiveness. Currently, the provision of structured education in primary care is variable. Mostly provision remains ad hoc, is vulnerable to the tough prevailing economic climate, and has become a postcode lottery. Good evidence now exists for the benefits of structured education, through national programmes that can be adopted by primary healthcare. This article reviews the evidence from four key diabetes structured education programmes.

People with diabetes and educators come away from a course encouraged, enthused, re-energised and even “evangelised”. Clinicians have a “love or hate” relationship with it, depending on whether or not they have experienced a session for themselves, or seen the effects at work in their patients. Commissioners often do not understand it and in common with managers, in times of austerity, seize on it as a prime candidate for cost savings. All too frequently, it fails to make it inside the vital funding barrier, and in this climate of exiguous resources, several areas in the UK have either abandoned structured education for people with type 2 diabetes altogether, or fallen back on a “cheaper” option that is without evidence, unevaluated and fails to meet agreed national quality standards.

Why bother with structured education?

The literature and current UK health policy are both rich in affirmations of the critical nature of self-management in long-term conditions, particularly diabetes. From the diabetes National Service Framework (Department of Health [DH], 2001; 2003) to the Darzi report (DH, 2008), and beyond that to *Equity and Excellence: Liberating the NHS* (DH, 2010), and the NICE (2011) *Diabetes in Adults Quality Standard*, policy affirms and reaffirms the key contribution of self-management to ongoing clinical care. Without effective self-management on the part of the individual with diabetes, who can only share the burden of diabetes with healthcare professionals for the small proportion of the time they have contact with them, the continuing ability of the NHS to fulfil its obligations, whether in terms of

economic or healthcare service capacity, is inevitably compromised.

So, how is it, that given the universal agreement about self-management, support for structured education – the key mechanism for successful self-management – is so poor?

Reaching for the evidence

Until recently, the evidence base for structured education was indeed poor. It was for this very reason that the NICE Health Technology Assessment failed initially to recommend a structured education intervention for type 2 diabetes (NICE, 2003). But that situation has greatly improved over the past 10 years. Not only have a number of key systematic reviews (Loveman et al, 2008) and guidelines, which were informed by multidisciplinary and expert opinion, been published by NICE (National Collaborating Centre for Chronic Conditions, 2008) and the DH (2008; 2010), but also, a number of well-conducted studies have generated good evidence of the benefits of structured education (Deakin et al, 2006; Davies et al, 2008; Sturt et al, 2008; Trento et al, 2010).

The interventions in these studies meet the general expert consensus that there are four essential components of a quality self-management education intervention: a structured, written curriculum; trained educators; quality assurance process; and audit (NICE, 2003). These criteria have been enhanced with further detail by the Patient Education Working Group, a joint initiative between the DH and Diabetes UK. For example, a programme worthy of being regarded as treatment should: be founded on a patient-centred philosophy; have a curriculum underpinned by identifiable and stated psychological theories of learning; be appropriate for a range of learning styles; be delivered by educators who understand the psychological theories by which their programme attains its objectives; and use these same theories to form the basis for educator quality assurance. Together, these now form the current standards by which all structured education programmes in the UK can and should be assessed (DH and Diabetes UK, 2005).

NICE revisited the evidence in its updated guideline for type 2 diabetes in 2008 (National Collaborating Centre for Chronic Conditions, 2008), supported by a systematic review conducted by Loveman and colleagues (2008). The guideline concluded that the increased evidence base reaffirmed the efficacy of structured education interventions meeting national standards and criteria, and recommended the Diabetes Education and Self Management for Ongoing and Newly Diagnosed (DESMOND) and the Expert Patient Education Versus Routine Treatment (X-PERT) programmes as meeting these standards. Since then, structured education has featured prominently on the Quality, Innovation, Productivity and Prevention agenda, and most recently, as the first recommendation of the NICE Quality Standards in Diabetes (NICE, 2011). But although national policy and recommendations create a good starting point, there are obstacles in many areas of the UK in translating the benefits seen in research studies into structured education established as part of a routine diabetes care pathway. Addressing the evidence in greater detail and identifying the key points relevant to implementation is the next step.

Evidence for the benefits of structured education

The body of evidence supports structured education *per se* as an effective agent for biomedical and psychological benefit to participants (Jarvis et al, 2010; Carey and Heller, 2011). But the variety of settings, the heterogeneity of the instruments measuring psychological outcomes and quality of life, the difference in length of follow-up and the variable generalisability of findings, or lack thereof, makes comparing the results of the various key structured education programmes something of a challenge (see *Table 1*), particularly when viewed with comprehensive implementation in mind.

Four key programmes and their accompanying evidence are highlighted in this article. These programmes are the most referenced, and have the most relevance to a UK context, not only because three of them were developed in the UK in an NHS environment, but also because they all involve a large sample size and have a

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2. This situation has greatly improved over the past 10 years. Not only have a number of key systematic reviews and guidelines, which were informed by multidisciplinary and expert opinion, been published by NICE and the Department of Health, but also, a number of well-conducted studies have generated good evidence of the benefits of structured education.
3. There are four essential components of a quality self-management education intervention: a structured, written curriculum; trained educators; quality assurance process; and audit.
4. The body of evidence supports structured education *per se* as an effective agent for biomedical and psychological benefit to participants.

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1. The Expert Patient Education Versus Routine Treatment (X-PERT) study was the first to report on a structured education programme in a UK context.
2. X-PERT has succeeded in conducting an impressive audit of outcomes in nearly half the participating centres, developed additional modules based on the original approach and introduced an educator training programme.
3. Rethink Organization to Improve Education and Outcomes, a multi-centre trial following a successful pilot in a single centre in Turin, Italy, also studied people with established type 2 diabetes and reported 4-year results in 2010.
4. At the 5 year follow-up, the intervention group showed significant improvements in HbA_{1c} level and other clinical outcomes, including blood pressure, lipids, weight and BMI, improved quality-of-life and improved diabetes knowledge.

respectable length of follow-up. Three of the four are group interventions – the default mode of delivery recommended by NICE. Two of these programmes are already widely implemented in routine care in the UK.

X-PERT

The X-PERT study (Deakin et al, 2006) was the first to report on a structured education programme in a UK context. It was conducted in a single primary care centre in North-West England and involved 314 participants from a multi-ethnic population (white European and south Asian) with a mean of duration of diabetes of 6.7 years. The intervention was delivered by one research dietitian, the programme's originator, and consisted of six 2-hourly group sessions held once per week. The control group received routine care and additional individual reviews and education with members of the primary healthcare team. Data were collected at baseline and 4 and 14 months post-intervention.

There were significant reductions in HbA_{1c} level, total cholesterol, weight, BMI and waist measurements in the intervention group at 14 months compared with the control group. The intervention group also showed significantly improved diabetes knowledge, treatment satisfaction and feelings of empowerment, and reported improved dietary habits and increased levels of physical activity. Although beginning in an NHS context, the programme has been subsequently commercialised, first as a Community Interest Company and latterly trading as a charity (www.xperthealth.org.uk/), and adopted widely by UK primary care. It has succeeded in conducting an impressive audit of outcomes in nearly half the participating centres, developed additional modules based on the original approach and introduced an educator training programme.

ROMEO

Rethink Organization to Improve Education and Outcomes (ROMEO), a multi-centre trial following a successful pilot in a single centre in Turin, Italy, also studied people with established type 2 diabetes and reported 4-year results in 2010 (Trento et al, 2010). A total of

815 participants received group education in sessions 40–50 minutes long, delivered at 3- to 4-monthly intervals, followed by a brief one-to-one consultation with a physician at the end of each session. The control group received standard routine care. The educators, whose background is unclear, received some training for their role.

At the 4-year follow-up, the intervention group showed significant improvements in HbA_{1c} level and other clinical outcomes, including blood pressure, lipids, weight and BMI, improved quality-of-life and improved diabetes knowledge.

Although two of the participating centres were unsuccessful in implementing the education programme, 72.6% of the original participants completed the trial.

Although it is a non-UK study, ROMEO is an important study in structured education, for both the length of follow-up, and the use of “group clinics” with education and opportunities for one-to-one appointments at the same visit, offering one example of an integrated model of care and education that is deserving of further study in a UK context.

DESMOND

The DESMOND study (Davies et al, 2008), a multi-centre RCT of a group structured education intervention, was designed by a multi-disciplinary collaborative following an extensive review of the evidence at the time, including visits and discussions with key European structured education programmes (including the ROMEO team). Although always having the vision of an integrated model of education and clinical management, incorporating lifelong learning, the group chose to first address the needs of people newly diagnosed with type 2 diabetes, a population infrequently studied. The RCT of 824 participants took place in 13 primary care organisations around the UK, providing evidence of generalisability.

The intervention consisted of 6 hours of education delivered in either one day-long, or two half-day sessions by two trained healthcare professional educators – a total of 34 were trained in the course of the study, using a formalised training programme conceived as

an integral component of the programme and delivered by a multidisciplinary expert group. Participants in both the intervention and the control arms of the study received routine care, with the intervention group additionally attending the DESMOND programme. The control group was given resources to provide equivalent healthcare professional contact time. Follow-up was at 4, 8 and 12 months post-intervention.

In this first study in a newly diagnosed population there was a reduction in HbA_{1c} level in both intervention and control groups of around 16.4 mmol/mol (1.5 percentage points) but no significant difference between the groups. Thus, both groups reduced HbA_{1c} to below-target levels of 53 mmol/mol (7%) at 12 months.

In terms of secondary outcomes, the intervention group showed significant weight loss (3 kg as compared with 1.8 kg), reduced levels of smoking, reduced levels of depression and reduced cardiovascular risk scores maintained at 12 months, compared with the control group. The intervention group also demonstrated significant positive changes in health beliefs about their diabetes, sustained at 12 months, and at 3 years post-intervention (Khunti et al, 2012). There has been some criticism of the HbA_{1c} outcomes of this study. However, HbA_{1c} levels will fall in almost all individuals after diagnosis, and the trial coincided with the introduction of QOF targets in primary care. Reassuringly, and not surprisingly, subsequent studies conducted in different patient sub-groups with diabetes, in which DESMOND structured education was an integral part of a complex intervention, in particular the ADDITION-Leicester (Webb et al, 2011) and Microalbuminuria Education and Medication Optimisation (MEMO; Crasto et al, 2011) studies, have shown significant reductions in HbA_{1c} level.

A sub-study of the RCT explored the relationship between educator competencies and outcomes of people with diabetes, and reported that educators who were less didactic in their education delivery (i.e. where people with diabetes spoke more), positively affected outcomes, for example in terms of weight loss (Skinner et al, 2008).

The DESMOND intervention remains the only recommended NHS programme in type 2 diabetes in the UK (www.desmond-project.org.uk). It has since been widely implemented in primary care in the UK and Ireland, and successfully adopted in Gibraltar and Australia. Following evidence on the efficacy of educator training, the group has continued to explore and develop methods and mechanisms to evaluate educator competency, establishing and evaluating a formal pathway of mentorship and accreditation for educators (Cradock et al, 2011; Harding et al, 2011). The programme has retained a research base in the Leicester Diabetes Centre, and the model of education has influenced new, scientifically proven

Table 1. Characteristics and outcomes of key structured education programmes.

Study (country), reference	Patient group	Intervention (I) and control (C)	Deliverers and follow-up period	Outcomes (I versus C)		Comments
				Biomedical	Psychological, lifestyle, quality of life	
X-PERT (UK), Deakin et al (2006)	Type 2 diabetes n=314 Participants: White European and south Asian Established diabetes; Duration of 6.7 years	6 x 2-hour group sessions (weekly) versus individual appointments <i>Some sessions in Urdu with interpreter</i>	1 x educator (diabetes research dietitian) Follow-up at 4 and 14 months	HbA _{1c} (%) ↓ -0.6 vs +0.1‡ TC (mmol/L) ↓ -0.3 vs -0.2‡ Weight (kg) ↓ -0.5 vs +1.1‡ BMI (kg/m ²) ↓ -0.2 vs +0.4‡ Waist (cm) ↓ female -4 vs -1‡, male -2 vs 0‡ BP, HDL, LDL, TG No difference	↑ Diabetes knowledge(I)‡ ↑ Treatment satisfaction(I)† ↑ Exercise (I)† ↑ Footcare (I)† ↑ Fruit and veg consumption (I)† ↑ Empowerment, psychosocial adjustment, readiness to change, goal setting (I)† QoL – no difference	Other Results 1/7 patients reduced medication (I) Comments Depression scores not measured Only one educator delivered Follow-up 95.5% follow-up (I); 89.9% follow-up (C)
DESMOND (UK), Davies et al (2008)	Type 2 diabetes n=824 94% White European Newly diagnosed diabetes (within 12 weeks of diagnosis)	6-hour group education session delivered over 1 day or 2 half-days versus usual care <i>Practice-level randomisation</i>	2 x educators (diabetes specialist nurses, dietitians, practice nurses) per session (34 educators in total) Follow-up at 4, 8 and 12 months	HbA _{1c} (%) ↓ -1.49 vs -1.21 Weight (kg) ↓ -2.98 vs -1.86† TG (mmol/L) ↓ -0.57 vs -0.34‡	↓ Smoking status (I)† ↑ Physical activity ↑ Improved illness beliefs (I)‡ ↑ Depression (I)† Emotional impact on diabetes and QoL – no difference	Other results UKPDS Risk Engine – (I) had ↓ in 10-year CVD risk score‡ Comments Widespread generalisability Large sample size Large number of educators Follow-up 89% follow-up (C); 92% follow-up (I)
ROME (Italy), Trento et al (2010)	Type 2 diabetes n=812 Established diabetes (non-insulin treated)	40- to 50-minute group education every 3–4 months following brief one-to-one consultation with physician versus usual care	Training given to physicians, dietitians and nurses, but unclear which of these were educators 4-year follow-up	HbA _{1c} (%) (I) ↓ -1.49‡ FBG (mmol/L) (I) ↓ -1.1‡ Weight (kg) (I) ↓ -3.15‡ BMI (kg/m ²) (I) ↓ -1.09‡ Systolic BP (mmHg) (I) ↓ -4.4‡ Diastolic BP (mmHg) (I) ↓ -3.3‡ TG (mmol/L) (I) ↓ -0.51‡ TC (mmol/L) (I) ↓ -0.67‡ HDL (mmol/L) (I) ↑ +0.13‡	QoL ↑ (I)‡ Knowledge ↑ (I)‡ Better health behaviours‡	Comments Two clinics failed to implement programme Follow-up 72.6%
Diabetes Manual (UK), Sturt et al (2008)	Type 2 diabetes n=245 Established diabetes HbA _{1c} >53 mmol/mol (>7.0%)	Delayed-intervention RCT One-to-one education with a 12-week diabetes manual versus usual care for 6 months then the manual <i>Practice-level randomisation</i>	Educators were practice nurses; number not stated, but inferred to be n=48 over life-time of study (half in delayed intervention group) 6 and 12 months' follow-up	HbA _{1c} No difference BP No difference TC No difference BMI No difference	Diabetes-related stress ↓ (I)‡ Confidence to self-care ↑ (I)‡	Comments (I) received relaxation audiotape, FAQs audiotape and telephone support from nurse at weeks 1, 5 and 11; qualitative study within RCT; low response rate to questionnaires (18.5%) Follow-up 85% follow-up (C) – delayed intervention 72% follow-up (I)

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BP=blood pressure; BMI=body mass index; (C)=control group; CVD=cardiovascular disease; FAQ= frequently asked question; HDL=high-density lipoprotein; (I)=intervention group; LDL=low-density lipoprotein; QoL= quality of life; RCT=randomised controlled trial; TC=total cholesterol; TG=triglyceride; UKPDS=UK Prospective Diabetes Study.

interventions in diabetes prevention (Yates et al, 2009) and specialist areas of diabetes education (Daly et al, 2011).

Diabetes Manual

The RCT of the Diabetes Manual (Sturt et al, 2008) involved 245 participants in primary care. The intervention used a self-study approach, augmented with one-to-one support, and was designed to encourage self-management. The study used a delayed-intervention RCT design in which participants used the manual over a 12-week period, while the control group received usual care for 6 months before also receiving the manual. Telephone support at 1, 5 and 11 weeks was given by trained practice nurses. Follow-up was at 6 and 12 months.

Results showed no differences in biomedical outcomes between the groups, perhaps because the study was underpowered. However, the intervention group showed significantly reduced diabetes-related stress and increased confidence to self-care.

The Diabetes Manual continues to be used in primary care, with originators, Warwick University, offering facilitator training courses on a regular basis. This intervention offers an alternative approach for those individuals who choose not to, or who cannot, engage with group education.

Counting the cost

Clinical effectiveness alone will not support implementation of any programme. In today's climate, programmes must also demonstrate cost-effectiveness as a necessary step to attracting funding for implementation. There are an increasing number of economic reviews of structured education programmes adding to the general evidence base on the cost-effectiveness of structured education (Boren et al, 2009; Jacobs-van der Bruggen et al, 2009).

The DESMOND group has published a programme-specific economic evaluation (Gillett et al, 2010). This cost utility analysis was carried out by an independent team at Sheffield University, and reported the cost of the intervention both during the RCT and as an implemented intervention adopted by 80

primary healthcare trusts (as at 2009). The DESMOND programme was shown as low cost, and likely to be cost-effective as a one-off intervention, equating to £2092 per quality-adjusted life year (QALY) gained. NICE uses the threshold of £20 000 to £30 000 per QALY as cost-effective, with this estimate of the DESMOND programme falling well below this threshold. This is despite the programme only ever being envisaged as the first step in an integrated diabetes pathway of care and education. The benefits were driven by the long-term effects of improvements in smoking status and by weight loss, the two lifestyle changes most frequently targeted by participants on the education programme.

Using the evidence to choose, commission and provide structured education

Evidence is the first step to implementation, but to ensure success, the choice of a structured education intervention must be complemented by other elements: stakeholder engagement, organisational infrastructure, social marketing and continuing investment.

In areas of the UK where structured education has been adopted on an ad hoc basis, or where it has been championed only by a sole individual, rather than an organisation, the likelihood is that its foundation will be insecure, success compromised, and a long-term future precarious.

But where all stakeholders, from commissioners, through health service managers, to GPs and practice staff, and ultimately the local community, are engaged, informed and give their support, and where the structured education is embedded in the local diabetes care pathway, the intervention is primed for success and longevity (Cumbria Partnership NHS Foundation Trust, 2012).

Embedding education can also create a foundation for further developments. Where programmes offer quality training for educators with a value and relevance to wider areas of clinical practice, or provide additional programmes in the portfolio (provided these are also supported by the same level of evidence), service provision can be improved and enhanced over and above the basic programme. For example, consider the impact of the DESMOND

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programme on education for microalbuminuria (Craστο et al, 2011) and diabetes prevention (Yates et al, 2009).

Like any service, structured education needs the support of an appropriate infrastructure, a dedicated team of educators, and a local coordinator or administrator. Systems to support patient recruitment, course arrangements, local evaluation and ongoing audit will increase efficiency and support quality assurance.

Marketing and public relations have an important ongoing role in promoting the service to users and highlighting benefits. Structured education invariably generates “good news” stories with a human dimension as well as clinical benefits. Both are valuable as a means of disseminating health messages to the wider community and facilitating referrals to structured education. The rise of social marketing and development of new technologies provide innovative opportunities not only for raising awareness of the importance of structured education, but also for creating an environment for emerging diabetes prevention strategies, such as the health checks programme, where lifestyle education is likely to be the main driver of the cost-effectiveness.

Conclusion

With news headlines outlining the massive rise in the UK diabetes population to 6.25 million by 2035, accompanied by blunt truths about the cost of diabetes care (currently £22 billion in direct and indirect costs, and set to rise to over £35 billion in 2035; Hex et al, 2012), we should consider that the time to ask the question “Why not structured education?” has arrived. If we fail to engage with this particular treatment, we risk losing a crucial opportunity to address fundamental issues of diabetes self-management destined to become ever more pressing.

The evidence for structured education viewed from all perspectives strongly indicates that provided such education meets national criteria and standards, and is supported by evidence of effectiveness, it can be both clinically and economically effective.

When giving feedback on structured education, one participant said: “I found that

a lot of my questions were answered before I had even thought to ask them! So here are my grateful thanks to the [...] programme for making a slightly scary diagnosis a lot less scary and for giving me confidence to go forward managing my own condition” (2012 participant).

So choose wisely, implement courageously and support wholeheartedly. ■

- Boren SA, Fitzner KA, Panhalkar PS, Specker JE (2009) *Diabetes Educ* **35**: 72–96
- Carey ME, Heller, S (2011) Structured education for people with type 2 diabetes mellitus. In: Wass JA, Stewart PM (eds). *Oxford Textbook of Endocrinology and Diabetes* (2nd edn). Oxford University Press, Oxford
- Cradock S, Taylor C, Stribling B et al (2011) *Diabet Med* **28**(Suppl 1): P300
- Craστο W, Jarvis J, Khunti K et al (2011) *Diabetes Res Clin Pract* **93**: 328–36
- Cumbria Partnership NHS Foundation Trust (2012) *DESMOND referrals*. Available at: <http://bit.ly/LMHqU7> (accessed 15.05.12)
- Daly H, Martin-Stacey L, Hassanein M (2011) *Diabet Med* **28**(Suppl 1): P304
- Darzi A (2008) *High Quality Care for all: NHS Next Stage Review Final Report*. DH, London. Available at: <http://bit.ly/Jnukyj> (accessed 24.05.12)
- Davies MJ, Heller S, Skinner TC et al (2008) *BMJ* **336**: 491–5
- Deakin TA, Cade JE, Williams R, Greenwood DC (2006) *Diabet Med* **23**: 944–54
- Department of Health (2001) *National Service Framework for Diabetes: Standards*. DH, London. Available at: <http://bit.ly/hiKMxT> (accessed 15.05.12)
- Department of Health (2003) *National Service Framework for Diabetes: Delivery Strategy*. DH London. Available at: <http://bit.ly/114Hbe> (accessed 15.05.12)
- Department of Health (2008) *High Quality Care for all: NHS Next Stage Review Final Report*. DH, London. Available at: <http://bit.ly/e7V1VB> (accessed 15.05.12)
- Department of Health (2010) *Equity and Excellence: Liberating the NHS*. DH, London. Available at: <http://bit.ly/LMN7kT> (accessed 15.05.12)
- Department of Health and Diabetes UK (2005) *Structured Patient Education in Diabetes: Report from the Patient Education Working Group*. DH, London. Available at: <http://bit.ly/LMNIwr> (accessed 15.05.12)
- Gillett M, Dallosso HM, Dixon S et al (2010) *BMJ* **341**: c4093
- Harding A, Cradock S, Stribling B et al (2011) *Diabet Med* **28**(Suppl 1): P306
- Hex N, Bartlett C, Wright D et al (2012) *Diabet Med* **Apr 26** [Epub ahead of print]
- Jacobs-van der Bruggen MA, van Baal PH, Hoogenveen RT et al (2009) *Diabetes Care* **32**: 1453–8
- Jarvis J, Skinner TC, Carey ME, Davies MJ (2010) *Diabetes Obes Metab* **12**: 12–9
- Khunti K, Gray LJ, Skinner T et al (2012) *BMJ* **344**: e2333
- Loveman E, Frampton GK, Clegg AJ (2008) *Health Technol Assess* **12**: 1–116
- National Collaborating Centre for Chronic Conditions (2008) *Type 2 Diabetes: National Clinical Guideline for Management in Primary and Secondary Care (update)*. Royal College of Physicians, London
- NICE (2003) *Guidance on the Use of Patient-Education Models for Diabetes (Technology Appraisal 60)*. NICE, London. Available at: <http://bit.ly/9rjNpi> (accessed 15.05.12)
- NICE (2011) *Diabetes in Adults Quality Standard*. NICE, London. Available at: <http://bit.ly/supP8P> (accessed 15.05.12)
- Skinner TC, Cradock, S, Arundel, F, Graham W (2003) *Diabetes Spectrum* **16**: 75–80
- Skinner TC, Carey ME, Cradock S et al (2008) *Diabet Med* **25**: 1117–20
- Sturt JA, Whitlock S, Fox C et al (2008) *Diabet Med* **25**: 722–31
- Trento M, Gamba S, Gentile L et al (2010) *Diabetes Care* **33**: 745–7
- Webb DR, Gray LJ, Khunti K et al (2011) *Diabetologia* **54**: 2237–46
- Yates T, Davies M, Gorely T et al (2009) *Diabetes Care* **32**: 1404–10

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