**Self-Monitoring of Blood Glucose: evidence based or economic driven?**

Diabetes as one of the long-term conditions is a growing global concern and the epidemiology of diabetes is challenging.The rise in the rate of diabetes and its impact on wellbeing in the UK was echoed by Diabetes UK (2012) and National Diabetes Inpatient Audit (2011). Diabetes can be simply defined as abnormal blood glucose level and a poorly managed diabetes may lead to diabetes related complications such as blindness and amputation (NICE 2011; WHO 2011).The goal of diabetes management is to maintain the blood glucose level within the normal range and one of the approaches to improve glycaemic control is self-monitoring of blood glucose levels (Diabetes UK 2013a; CADTH 2010). Thus, this article will focus on the current debate about balancing the economic cost of blood glucose monitoring with clinical need, particularly, in type 2 diabetes patients.

**Blood glucose monitoring**

Blood glucose monitoring refers to measuring the level of glucose in the blood (Lawal 2009)**.** There are various ways to measure blood glucose level such as urinalysis and glycosylated haemoglobin (Alexander et al 2006), however, the use of glucose meters is the commonest accurate method often used by patients (Figure 1). According to Alexander et al (2006), blood glucose monitoring offers a simple and reliable method to monitor patient’s glycaemic control. Jansen (2006) comparative study also suggested that SBGM is likely to be more effective than self-monitoring of urine glucose.

**Benefits of BGM**

There is evidence to support the benefits of self-monitoring of blood glucose (SMBG) in maintaining tight control in people with type 1 and type 2 diabetes on insulin therapy (Malanda et al 2012, Diabetes UK 2013a) . SMBG helps patients to adjust their insulin dosage accordingly and serve as safety checks when they are unwell or prone to hypoglycaemia or hyperglycaemia for any reason such as vigorous exercise or diet. It can also help to aid adjustment of food intake, physical activity and medication in response to their blood glucose test results (CADTH 2010). Hall (2013) stated that SBGM is beneficial to certain categories of type 2 diabetes. NICE (2009) emphasise the importance of effective blood glucose monitoring in reducing diabetes related complications. Diabetes UK (2013a) stated that SBGM is crucial to self-care management of diabetes and it is associated with reduction in long-term complications of the medical condition. Regardless of the benefits of blood sugar monitoring, Hall (2013) and Diabetes UK (2013a) stated that there is an indication that patients are experiencing some difficulties in accessing test strips for various reasons which suggest economic undertone.

**Cost effectiveness of BGM**

The resource implications of diabetes for commissioners and service providers are huge (Table 1) and SBGM is an expensive diabetes related care (Yeaw et al 2012; Simon et al 2008). SBGM represents the largest single component of costs associated with blood glucose control in the UK with costs of test strips rising from £85 to £118 million within two years from 2001 to 2003 (Simon et 2008). NICE (2011) stated that the overall cost of blood glucose lowering agents and blood glucose monitoring represented 7.7% of the cost of prescribing in primary care in 2009/10.

The study of economic analysis of SBGM conducted by Farmer et al (2009) suggested that SBGM increases healthcare cost and its routine use appears not to be cost-effective. The systematic review of 33 articles conducted by CADTH suggested that additional clinical and economic evidence is required to inform the use of SMBG in type 2 diabetes patients (CADTH 2010). The DiGEM study (Simon et al 2008), indicated that there is no convincing evidence to recommend routine SBGM for non-insulin treated type 2 diabetes patient.

Although routine self-monitoring of blood glucose level is a debatable issue, particularly in non-insulin treated patients with type 2 diabetes (Lawal 2009, CADTH 2010, Simon et al 2008, Malanda 2012), NICE (2009) recommended its use based on individual circumstances (Table 2). In addition, Diabetes UK (2013a) stated that accessibility of test strips should be based on individual assessment and all options should be jointly explored by the patient and their clinician to ensure effective use of scarce resources.

**Health systems under financial pressure**

In the context of healthcare delivery of a nation, there is no doubt that economics and politics play a vital role and the United Kingdom is not an exception. Lister (2005) and Baggott (2010) states that the NHS continues to face financial pressures due to rising public expectations and financial pressures resulting from ageing population, new clinical, pharmacological and information technologies. Although, the NHS is largely funded by national taxation in the UK (Baggott 2010), there is an indication that SBGM is important to people affected by diabetes in other countries with a different funding system. A nationwide study (Kjome et al 2010) of non-institutionalised people in Norway found that approximately 70% of diabetes patients purchased test strips with an estimated annual cost of 446 EURO per individual.

Saltman and Cahn (2013) argued that whilst restructuring healthcare sectors in Europe to reduce unsustainable cost is inevitable, policy makers need to minimise undesirable inequality. Davies et al (2000) states that healthcare policy changes in the UK cross party lines with discernible differences. The latest reform by the coalition government brought more changes into effect with the Health and Social Care Act 2012 (DH 2011). However, since the birth of the NHS on the 5th of July 1948, the founding principle was to improve health and prevent disease, not only to treat ill people (DH 2004). Within 1948 to date, the patients have become more active, empowered and encouraged to take more control over their health (DH 2008), nevertheless more has to be done, for example, in relation to SBGM. According to the DH (2008) document on the NHS 60th anniversary, prevention will continue to be high on the health agenda with the NHS promoting good health as opposed to treating ill health. This can justify the policy of offering equitable access to test strips based on needs, treatment regimen or individual circumstances.

**Access to glucose test strips**

Diabetes UK (2013a) and Hall (2013) expressed some concerns that people with diabetes are experiencing restrictions in accessing blood glucose test strips and meters within the last one year. The report of an online survey conducted by Diabetes UK stated that policies and guidance on prescribing test strips across the UK varied considerably in terms of content, format and the level of flexibility allowed in their application. By comparison, most policies covered both type 1 and type 2 diabetes, however, the guidance varies more widely in type 2 diabetes management than for type 1 diabetes patients. Although restriction of test strips focuses on patients with type 2 diabetes in the past, however, there is an increase report that people with type 1 diabetes are also having restricted access to test strips. Diabetes UK (2012) stated that restrictions on the number of test strips being prescribed and lack of choice of meters seems to be driven by financial constraints and argues that such measures is a false economy and have a short-term goal. Hall (2013) also argues that the cost of effective SBGM is lesser than the cost of treating diabetes related complications. Another major disadvantage of this measure is that it causes distress and anxiety and reduces the willingness to take responsibility for self-care (Diabetes UK 2012).

**Evidence based practice**

Evidence based practice (EBP) is defined as giving clinically sound and cost effective care that provides the best outcome for patients (DH 2013). The five domains of the NHS Outcome Framework 2013-2014 focused on measuring health outcomes in order to improve clinical practice (DH 2011b). Two of the domains relate to enhancing the quality of life for people with long-term conditions including diabetes patient and ensuring a positive patient experience. Although, it can be argued that wastage owing to unnecessary distribution of test strips to patients is an unacceptable practice when attempting to cut down cost and provide quality service to the entire citizen. However, EBP implies the delivery of high quality care that considers individual needs and preferences within the limit of the health budget. Frankly, there are situations where SBGM may not be appropriate, however, there are circumstances when there is a valid indication for SBGM in type 2 diabetes patients that are not treated with insulin (case study). Diabetes UK (2013a) argued against blanket policies of prescribing test strips or meter choice and stated that type 2 diabetes patients who find SBGM useful should be supported to do so regardless of whether they are treated with or without insulin.

**Case study**

Mr John is a 45 year old businessman with three year history of type 2 diabetes which is maintained on diet, exercise and gliclazide tablet. He is overweight with a BMI of 29 and a waist circumference of 40” (102cm) and his glycaemic control is poor with a recent blood glucose level of 48 mmol/l (6.5%). John has a family history of diabetes and his both parents are living with chronic complications of diabetes.

**Case study discussion**

Mr John (case study) meets the NICE (2009) criteria to access blood glucose meters. Sulphonyreas such as Chlopropamide, Glibeclamide or Gliclazide work by stimulating the cells in the pancreas to produce more insulin and its possible side effects include hypoglycaemia. The risk of hypoglycaemia for John may be reduced through SBGM. Diabetes UK (2012) recommends that SBGM should be available to patients receiving sulphonylurea and prandial glucose regulators owing to the potential risk of hypoglycaemia.

John appears to have multiple risk factors with poor glycaemic control and may be prone to complications. According to NICE (2011) the cause of type 2 diabetes is more complex and the management is not always easier. The paper also stated that type 2 diabetes has multiple risk factors and wide ranging complications such as retinopathy and neuropathy. NICE (2011) stressed the importance of self-monitoring and education for type 2 diabetes because of the required life changes involved, complexities of management and the side effects of medication.

Similarly, John being a busy man may enjoy better autonomy and greater glycaemic control through SBGM. Farmer et al (2009) research study indicated that some patients felt that SBGM was helpful to maintain their personal wellbeing. In the same way, Diabetes UK (2013a) states that although the exact role of SMBG for people with type 2 diabetes is unclear; however, many healthcare practitioners support its use because self-monitoring empowers the patient and it aids patient’s satisfaction.

Thus, measures to lessen complications and aid prompt management such as offering adequate number of test strips to John may be helpful in enhancing his quality of life.

**Summary**

The prevalence of type 2 diabetes is high and the resultant economic cost of SBGM in this category of patients can be challenging. Whilst routine SBGM could not be economically justified in non-insulin treated type 2 diabetes patient, nevertheless, individual patient is different and their medical condition is not static. Therefore, SBGM in type 2 diabetes patients should be based on individual need and circumstances to minimise the impact of diabetes on affected people. To conclude, it is suggested that evidence based economic evaluations of blood glucose monitoring in relation to type 2 diabetes patients outcome requires more attention.

**Key words:** Self blood glucose monitoring, diabetes mellitus, prescribing challenge, healthcare cost.

**Key points**

* Diabetes is a global long-term condition which requires effective blood glucose monitoring.
* Blood glucose monitoring is a simple, common and reliable method to assess glycaemic control of patient affected by diabetes.
* Effective blood glucose monitoring helps to reduce the risk of long term complications of the medical condition.
* Blood glucose monitoring increases the healthcare cost in diabetes management.
* Healthcare practitioners have a pivotal role to play in ensuring effective patient focused blood glucose monitoring.

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| **Table 1: Cost of blood glucose monitoring agents and devices** |
| Financial year | BGM items (millions) | Cost | % change on previous years |
| 2005/6 | 5.6 | £142.3 | 8.7 |
| 2006/7 | 5.7 | £137.8 | -3.1 |
| 2007/8 | 5.7 | £133.1 | -3.4 |
| 2008/9 | 5.7 | £137.7 | 3.4 |
| 2009/10 | 5.9 | £145.8 | 5.9 |
| 2010/11 | 6.0 | £152.6 | 4.7 |
| 2011/12 | 6.1 | £158.4 | 3.8 |
| Source: The Information Centre for health and social care (2012) |

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| Table 2. Summary of NICE guidance on self-monitoring of plasma glucose in patients with type 2 diabetes. |
| NICE recommended SMBG for type 2 diabetes patients with annual assessment on the following grounds:1. As an integral part of self-management education for newly diagnosed patients.
2. Patients that are on insulin therapy
3. Those that are treated with oral glucose lowering medication
4. During intercurrent illness
5. To ensure safety during various activities which include driving.
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| Source: NICE (2009) The management of type 2 diabetes: clinical guidelines 87. |