

# Glucose monitoring: quality and cost-effectiveness

**D**iabetes has become a global epidemic. It is estimated that 95 million cases are currently undiagnosed and that with the rapid population growth, larger aging populations and increased incidence of obesity, as well as earlier diagnosis, the frequency of diabetes will increase by 72% to a total of 325 million by 2025.<sup>1,2</sup> These calculations are corroborated by findings of King, *et al.*<sup>3</sup>

Type I diabetes currently represents 10% of all cases and these patients are totally dependent on insulin treatment. They need to test their blood glucose levels three to six times daily and have their glycated haemoglobin levels determined quarterly. Of the remaining diabetics, 20% need to be treated with insulin, while the rest of these individuals appear to control blood glucose levels adequately with oral medications, diet and exercise. Their blood glucose levels, however, also need to be tested daily to thrice weekly and their glycated haemoglobin levels quarterly.

From a patient's point of view, self-monitoring and treatment is burdensome. The reality of the condition is that it is unending and 'good' behaviour does not appear to pay off. An analysis performed within the DCCT trial has shown that among patients monitoring their blood glucose levels, only half test as recommended.<sup>4</sup> Easier monitoring of blood glucose levels may lead to more effective management of diabetes.

The customer's requirement for flexibility, convenience and better glycaemic control drives development goals for integrated technologies. Connectivity solutions have been devised as convergence of information and monitoring systems. Continuous non-invasive monitoring systems of blood glucose levels are envisaged to be released by the second half of this decade. The continuous micro-dialysis blood glucose monitoring system will have an infrared port that will transmit the information to a database as well as to a healthcare professional who will prescribe the appropriate treatment dose. The insulin is to be administered with continuous infusion by a pump, or as a bolus. Ultimate ease of use would imply a reduction in the number of devices or a decrease in the number of steps followed.

In approximately 10 years' time, insulin delivery and blood glucose monitoring will occur simultaneously in an open- or closed-loop automated system. The open-loop system requires blood glucose monitoring by the patient as well as adjustment of the insulin dosage. Closed-loop systems employ subcutaneous glucose sensors and external insulin pumps linked with an insulin delivery algorithm to create completely automated administration of insulin.

What appears to be of great concern is that the incidence of type 2 diabetes is reported to be 'exploding' world-wide<sup>5</sup> and that an extremely high (> 80%) prevalence of the metabolic syndrome



Dr R Delport

has been reported in recently diagnosed type 2 diabetics.<sup>6</sup> An in-depth review on the development of atherosclerotic coronary artery disease (CAD) in relation to insulin resistance, type 2 diabetes mellitus and the metabolic syndrome highlights the magnitude of risk of cardiovascular disease (CVD) implied in type 2 diabetes.<sup>7</sup> As mentioned in this review, a two- to four-fold increase in overall risk of development of CAD and associated mortality in patients with type 2 diabetes is observed.<sup>8-10</sup> Furthermore, poorer outcomes after myocardial infarction are observed in patients with diabetes compared with non-diabetic persons.<sup>11,12</sup>

A search to find reports of recent studies on the prevalence/incidence of diabetes in South Africa resulted in the following findings. In South African Indians there is a high incidence (9.5%) of type 2 diabetes.<sup>13</sup> The Mamre study, conducted in a peri-urban, working-class community near Cape Town, reported that 6% of the men and 5% of the women had diabetes<sup>14</sup> and the South African Stroke Risk in General Practice study reported the prevalence of diabetes in black, coloured, Asian and white subjects as 14, 15, 26 and 8%, respectively.<sup>15</sup> It is of importance to note that the risk for acute myocardial infarction is reported to increase with higher income and education levels in the black African group, in contrast to findings in the other African groups (coloured and European/other Africans).<sup>16</sup>

The economic impact of the treatment of CVD should not be underestimated. Two to three per cent of South Africa's gross national income ( $\pm$  25% of South African healthcare expenditures) was spent on the treatment of CVD, according to estimates in

1991.<sup>17</sup> In a recent review on cardiovascular disease in the developing world, and the cost-effectiveness of disease management,<sup>18</sup> South Africa was classified by the World Bank as one of six low- and middle-income countries (gross national income per capita lower than US\$9 200). The leading cause of death in all these developing regions, with the exception of sub-Saharan Africa, is CVD and numbers are expected to increase.

While the elegance of newer blood glucose monitoring and delivery systems is lauded and the improvement in the quality of afflicted individuals' lives is well appreciated, different strategies will probably have to be followed for specific socio-economic groups in South Africa. These strategies should probably focus on early intervention in terms of lifestyle management, early diagnosis of at-risk individuals, and the implementation of cost-effective options for continual diagnostic blood glucose monitoring. It is of paramount importance from a personal point of view that maximal flexibility in lifestyle is made possible, and from a global economic perspective that the quality of blood glucose analyses is assured to ensure the effective treatment of diabetes and prevention of CVD.

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