

# Chapter 7

## A Transaction Cost Assessment of a Pervasive Technology Solution for Gestational Diabetes

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### ABSTRACT

*Diabetes is one of the leading chronic diseases affecting Australians and its prevalence continues to rise. It is becoming a serious challenge for both the quality of healthcare and expenditure in the Australian healthcare system. The goal of this study is to investigate the development and application of a pervasive wireless technology solution to facilitate the effective management of diabetes in the context of women with gestational diabetes. Gestational diabetes is a form of diabetes that affects up to 8% of pregnant women. A transactions cost assessment of this solution is also provided. Integral to the success of this solution is the pervasive technology solution which serves to support and facilitate superior diabetes self-management.*

### INTRODUCTION

Diabetes mellitus is one of the leading chronic diseases affecting Australians and its prevalence continues to rise. The total number of diabetes patients worldwide is estimated to rise to 366

million in 2030 from 171 million in 2000 (Wild et al., 2004). With increasingly growing prevalence which includes an estimated 275 Australians developing diabetes daily (DiabetesAustralia, 2008), Australia is expected to be a significant contributor to this projected trend. An estimated 700,000 Australians, representing approximately 3.6% of the population, were diagnosed with dia-

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betes in 2004-05. Between 1989-90 and 2004-05 the proportion of Australians diagnosed with this disease more than doubled from 1.3% to 3.3%. Additionally, between 2000-01 and 2004-05, Australian diabetes hospitalizations increased by 35% from 1,932 to 2,608 hospitalizations per 100,000 people (AIHW, 2007, 2008). For every person diagnosed with diabetes, it is estimated that there is another who has yet to be diagnosed, which doubles the number of diabetes sufferers (DiabetesAustralia, 2008). Diabetes is, thus, one of the fastest growing chronic diseases in Australia (AIHW, 2008; Catanzariti, Faulks, & Waters, 2007; Chittleborough et al., 2007). Diabetes and its complications incur significant costs for the health system in Australia, including costs incurred by care providers, government, and the entire health system (DiabCostAustralia, 2002). In 2004-05 direct healthcare expenditure on diabetes was A\$907 million, which constituted approximately 2% of the recurrent health expenditure that is to be allocated in that year (AIHW, 2007, 2008). Further costs include societal costs that represent productivity losses for both patients and their care providers (DiabCostAustralia, 2002).

Gestational diabetes mellitus (GDM) is a common form of diabetes that presents in pregnancy, sometimes with symptoms but often diagnosed in otherwise normal women on routine screening tests. Some women, particularly those in whom the diagnosis of GDM is made early in pregnancy, may have pre-existing undiagnosed diabetes. In Australia and New Zealand, universal screening for GDM is recommended by the Australasian Diabetes in Pregnancy Society (ADIPS) (Hoffman et al., 1998), although the uptake of this recommendation is rather variable (Rumbold & Crowther, 2001). It is estimated that in Australia, 3-6% of pregnant women will develop GDM at around 24-28 weeks gestation, with a smaller number earlier and later in pregnancy. An Australian study of 210 pregnant women found that screening for GDM had an adverse impact on women's perceptions of their own health (Rumbold

& Crowther, 2001, 2002). GDM is more common in older women, in those with a family history of diabetes, in those who are overweight, and in those of non-Caucasian heritage (Carolan, Steele, & Margetts, 2010). Maternal complications of GDM can be serious and include polyhydramnios and premature labor, maternal hypertension, low birth weights and stillbirth (Fan et al., 2006; Hoffman et al., 1998). It recurs in subsequent pregnancy in 30-80% of women, the incidence varying with ethnicity, being lower in Caucasian women (Kim, Berger, & Chamany, 2007).

Treatment of women with GDM aims to control maternal, and therefore fetal, hyperglycaemia and the associated tendency of fetal hyperinsulinaemia which is at the root of the fetal complications (Metzger et al., 2008). After many years of uncertainty as to the value of such treatment in GDM, two trials have now shown benefit for both mother and offspring for antenatal initiation of lifestyle modification and glucose monitoring, coupled with insulin therapy as necessary (Crowther et al., 2005; Landon et al., 2009). Antenatal treatment of detected mild GDM was also associated with improved health status for women during the antenatal period and at 3 months after birth, with less postnatal depression (Crowther et al., 2005). Specifically, there is agreement in the literature that specific self-management activities including glucose monitoring, dietary restrictions, and exercise regimes can result in good outcomes for mothers and babies suggesting that self-management behaviors can be critical (Crowther et al., 2005; Fan et al., 2006).

Recognizing the need to have a solution that can enable the ubiquitous monitoring of GDM patients while also facilitating self-management and continuously educating them, the goal of this paper is to investigate the development and application of DiaMonD – a diabetes monitoring device. To the best of our knowledge, there exists no other software solution that focuses on individuals suffering from gestational diabetes; hence the DiaMonD solution serves as an exem-

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