Chapter 5

Major findings, Implications, Limitations, Directions for future research and Conclusion

5.1 INTRODUCTION

Practitioners and researchers require a better understanding of why people resist using healthcare related technology “in order to devise practical methods for evaluating systems, predicting how users will respond to them, and improving user acceptance by altering the nature of systems and the processes by which they are implemented” (Davis et al 1989).

The following research objectives were formulated for studying the technology adoption from a consumer perspective:-

1. To elicit salient beliefs regarding diabetes and motives for adoption of SMBG for self-monitoring of blood glucose in a sample of adults clinically diagnosed with Type 2 diabetes;
2. To identify illness beliefs and specific behavioural, normative and control beliefs that is related to adoption intention of SMBG for self-monitoring of blood glucose among the aggregate sample and sub samples - Adopters Users, Adopters Rejecters, and Non Adopters;
3. To test the fit of the traditional TPB model, two component TPB model and their extensions for the prediction of adoption intention to use SMBG regularly for self-monitoring in a sample of adults clinically diagnosed with Type 2 diabetes among the aggregate sample and sub samples;
4. To compare the strength of the association of TPB constructs in predicting adoption intention to use SMBG regularly for self-monitoring in a sample of adults clinically diagnosed with Type 2 diabetes among the aggregate sample and sub samples;
5. To test and compare the mediating effect of illness acceptance towards intention to use SMBG regularly for self-monitoring in a sample of adults clinically diagnosed with Type 2 diabetes and the sub samples; and 6. To test
and compare the moderating effects of age and gender towards intention to use SMBG regularly for self-monitoring in a sample of adults clinically diagnosed with Type 2 diabetes and the sub samples.

This research consisted of two phases: the belief elicitation and the main study. Participants were type 2 adult diabetic patients visiting a World Health Organization (WHO) certified diabetic centre and its satellite centres in Tamil Nadu, India. A belief elicitation study was conducted to elicit specific behavioural, normative and control beliefs based on TPB theoretical framework as well as illness beliefs (based on Self-Regulation Model) relevant to the sample population. A belief elicitation study using semi structured interview schedule, based on the theoretical background of TPB and Self-Regulation Model for eliciting illness beliefs was used for face to face discussion with adult type 2 patients visiting the diabetic clinic. Content Analysis was carried out which resulted in identifying salient TPB beliefs (48 items) - behavioural beliefs (9 items), normative beliefs (18 items), and control beliefs (21 items) held by the sample as well as 27 items under illness beliefs-consequences (13 items), Timeline (3 items), cure/control (5 items) and emotional beliefs (8 items). Based on Ajzen’s recommendations and after checking for content validity (expert opinion), pretesting and pilot testing, the final number of beliefs (TPB beliefs-36 items and illness beliefs-15 items), were incorporated into the final questionnaire with the well validated adopted scales used for measuring direct TPB determinants (attitude, subjective norm and perceived behavioural control) along with the extraneous variables (personal norm and facilitating conditions), as they reported acceptable reliability. Using a formative assessment method, the specific beliefs (behavioural, normative, control and illness beliefs) for each of the sub samples- Adopters Users, Adopters Rejecters and Non Adopters significantly related to behavioural intention were also determined. The formative assessment of the study results were examined based on their indicator weights, their significance, their loading and the degree of multicollinearity (Chin 1998; Tenenhaus et al 2005; and Hair et al 2011). The English questionnaire was also translated to Tamil (official language of Tamil Nadu) and was submitted for expert opinion, back translated, tested with 10 patients, and modified before using it for final survey. Informed consent from the participants was mandatory and all subjects were assured of strict confidentiality and the freedom to withdraw from participation at any
time. This practice was compulsorily followed for belief elicitation study, pilot study and the main survey.

For the main study, multi stage sampling was undertaken in the study as selection of the centres were based on the procedure of simple random sampling using lottery method, followed by non-probability sampling – judgemental sampling of T2DM patients. The sample size was based on data analysis methods and techniques (Fowler 2002). As per the recommendation of Hair et al (2011), the minimum sample size should be equal to 160 as the largest number of formative indicators used to measure the construct was 16 (for construct belief). After data-screening, the final model was tested with 282 subjects. Data analysis was carried out in two stages - preliminary data analysis and evaluation of structural model. Preliminary data analysis was carried out using SPSS 16.0 version. Hypothetical relationships were examined using partial least squares (PLS).

5.2 MAJOR FINDINGS
5.2.1 BELIEF ELICITATION FINDINGS FROM QUALITATIVE STUDY
Based on the recommendation of Ajzen and Fishbein (1980) and Ajzen (2006), beliefs were elicited providing a set of behavioural, normative and control beliefs which were then formatively assessed and beliefs were identified for Adopters Users, Adopters Rejecters, and Non Adopters. Table 5.1 provides a comparison of the various beliefs with respect to SMBG adoption for regular blood glucose monitoring of the sub samples under study, followed by the discussion of the findings.
Table 5.1 Comparison of beliefs across the sample - Outer Weights & Outer Loadings (t-stat)

<table>
<thead>
<tr>
<th>Behavioural Beliefs</th>
<th>Aggregate</th>
<th>Non Adopters</th>
<th>Adopters Users</th>
<th>Adopters Rejecters</th>
</tr>
</thead>
<tbody>
<tr>
<td>will cause unnecessary anxiety</td>
<td>0.89 (***2.88)</td>
<td>0.77 (*1.75)</td>
<td>1.07 (**2.08)</td>
<td>1.04 (**2.26)</td>
</tr>
<tr>
<td>is painful</td>
<td>0.82 (**2.24)</td>
<td>0.84 (*1.92)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not beneficial in managing diabetes</td>
<td></td>
<td></td>
<td>0.68 (**2.30)</td>
<td>0.92 (**2.73)</td>
</tr>
<tr>
<td>make one addicted to SMBG use</td>
<td></td>
<td></td>
<td>0.66 (**2.88)</td>
<td></td>
</tr>
<tr>
<td>is an additional burden</td>
<td></td>
<td></td>
<td>0.75 (**2.77)</td>
<td></td>
</tr>
<tr>
<td>will not be reliable</td>
<td></td>
<td></td>
<td>0.63 (**2.71)</td>
<td></td>
</tr>
<tr>
<td><strong>Control Beliefs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is wastage of strips</td>
<td>0.28 (*1.89)</td>
<td></td>
<td>0.53 (*1.68)</td>
<td>0.61 (**2.04)</td>
</tr>
<tr>
<td>no benefit in using glucometer for monitoring</td>
<td>0.35 (***4.48)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know my body and can detect whether my sugar is</td>
<td>0.51 (**3.78)</td>
<td></td>
<td>0.61 (**2.07)</td>
<td></td>
</tr>
<tr>
<td>under control or not</td>
<td>0.91 (**24.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>will use glucometer, if it helps to adjust my</td>
<td>0.25 (**3.33)</td>
<td>0.25 (**3.33)</td>
<td>0.54 (**2.0)</td>
<td></td>
</tr>
<tr>
<td>medicine/insulin usage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I do not have time</td>
<td>0.68 (***11.4)</td>
<td></td>
<td>0.33 (*1.67)</td>
<td></td>
</tr>
<tr>
<td>Doing regular monitoring using glucometer is</td>
<td>0.33 (***4.33)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Normative Beliefs (Influencers)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetologist</td>
<td>0.94 (***2.86)</td>
<td></td>
<td>0.72 (**2.96)</td>
<td></td>
</tr>
<tr>
<td>General Physician</td>
<td></td>
<td></td>
<td>0.53 (**2.08)</td>
<td></td>
</tr>
<tr>
<td>Other people with diabetes</td>
<td>0.76(**2.28)</td>
<td>0.76 (*1.88)</td>
<td>0.51 (**2.25)</td>
<td></td>
</tr>
<tr>
<td>It is my decision</td>
<td></td>
<td></td>
<td>0.87 (**1.8)</td>
<td>0.92 (**4.9)</td>
</tr>
<tr>
<td>Family</td>
<td></td>
<td></td>
<td></td>
<td>0.66 (**3.1)</td>
</tr>
</tbody>
</table>
Normative Beliefs (Likely Users) – Individuals with

<table>
<thead>
<tr>
<th>Controlling personality</th>
<th></th>
<th>0.55 (**2.36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recently diagnosed with diabetes</td>
<td></td>
<td>0.47 (**2.23)</td>
</tr>
<tr>
<td>Who have seen others using SMBG</td>
<td></td>
<td>0.77 (**2.83)</td>
</tr>
<tr>
<td>No control over diabetes</td>
<td>0.68 (**2.13)</td>
<td>0.53 (**1.72)</td>
</tr>
<tr>
<td>Older individuals with diabetes</td>
<td>0.64 (**2.59)</td>
<td>0.63 (**1.98)</td>
</tr>
<tr>
<td>Women with diabetes</td>
<td>0.87 (**2.97)</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Figures given in bold represent the loadings*

The behavioural belief, using SMBG for regular monitoring ‘will cause unnecessary anxiety’ was found with significant weight across all the sub samples. However it is likely that for the *Adopters Users*, they overcome their anxiety in viewing the blood glucose readings, as they are more concerned about their health (as expressed in illness beliefs) and feel that it is better to know the values than be ignorant. However for both *Non Adopters* and *Adopters Rejecters*, anxiety acts as a deterrent to SMBG adoption intention. Only *Non Adopters* stated the following beliefs, ‘is painful’ and ‘not beneficial in managing diabetes’ as significant contributors to the behavioural beliefs they hold about SMBG usage. This clearly gives an indication to their lack of adoption of SMBG for monitoring their blood glucose level. This group also had the highest number of indicators which had absolute importance for its construct (loading), clearly stating the need to work on their behavioural beliefs to make changes.

Wastage of strips (control belief-barrier) was mentioned as a significant contributor affecting regular monitoring by *Adopters Users*. This is a technology issue and the need for proper orientation regarding operation of the device needs to be provided. If this issue is tackled, this may increase the frequency of monitoring by the participants. The control belief (facilitators), ‘will use if it helps to adjust medicine/insulin dosage’ was found significant for *Adopters Rejecters* and *Non Adopters* but not for Adopters *Users*. It seems that just as *Adopters Users* are concerned about their illness, they may also be worried about the extent to which SMBG readings can be considered to make independent decisions by patients regarding their diabetic management. They may prefer consultation with their doctor before they make changes.
in their medicine or insulin dosage (where applicable). For the other two sub samples, these are likely to influence their adoption intention.

The normative beliefs were significant only for **Adopters Rejecters**, and not for **Adopters Users** and Non **Adopters**. Personal decision was found as a significant influencer for the **Adopters Rejecters**. Further they mentioned likely users as those who have observed other diabetic patients practising self-monitoring behaviour. This finding provides a way to reach out to this group through engaging them with patients who undertake self-monitoring behaviour, thereby influencing their decision to undertake self-monitoring.

Thus in nutshell, the significant indicators mentioned by **Adopters Users** was anxiety about undertaking self-monitoring behaviour (behavioural belief) and wastage of strips (control belief–barriers). Neither normative beliefs nor control belief–facilitators were found to have any significance for this sub sample. At initial stage, they would have been persuaded by normative influences, but as they practice monitoring, it is likely that it has become a habit, which does not involve much thought from their side. They are also not looking for empowerment in terms of adjusting their medicine or insulin usage, as they are likely to follow advice from their diabetologist. It can also mean that they understand the seriousness of diabetes and would overcome their fear and apprehensions to make sense of their diabetic status. Further they are also aware about the services the SMBG can provide, and that it cannot take over the services provided in a medical setting. Since they are conscious of diabetes as a lifelong disease, they seek ways to improve their diabetic management regime. Monitoring one’s blood glucose level is an essential part of this. For the **Adopters Rejecters** sub sample, the decision to monitor is seen as a personal decision (normative belief–influencer), considered monitoring as causing anxiety (behavioural belief) and expressed their willingness for monitoring; provided they can adjust their medicine/insulin usage (facilitators). The group also mentioned individuals with diabetes who have seen others using glucometer as likely users. So it is likely that it will prove fruitful to provide avenues for interaction with patients who practice monitoring whereby they get to have first-hand information. Social media and user friendly mobile applications can also be put to use in this context.
For the **Non Adopters** sub sample, the behavioural beliefs about SMBG monitoring behaviour were found to have a significant influence—that it will cause anxiety, is painful and that it is not beneficial in managing diabetes. They also mentioned their ability to adjust their medicine or insulin usage as a highly significant facilitator for influencing their adoption intention.

It is noted from the following indicators, namely; ‘convenience’ and ‘detecting high/low sugars’ with neither significant weight nor loading and did not contribute to the participants’ behavioural beliefs in any of the sub samples under study. It may be that these are essential attributes for SMBG device and does not gain significance in the eyes of the participants as persuading their monitoring behaviour.

For **Adopters Users**, the weight for the indicator, ‘convenience’ was practically zero and even then they have used SMBG. So there is a need for healthcare professionals and other stakeholders to rethink their communication to the patients and really understand the factors that aid adoption. From the perspective of **Adopters Rejecters**, diabetes is considered difficult to manage and self-monitoring does not alleviate this. The findings are in line with those reported in other studies, that regular monitoring with SMBG in daily practice is not just a small effort (Mol 2000; Dedding 2010 and Hortensius et al 2012). “Manufacturers also present SMBG as a tool with which diabetes may be controlled, thereby allowing patients to live a normal life”, (Hortensius et al 2012). These overly positive representations that marketers provide may in fact have an opposite effect than envisaged. Technology usage in a healthcare situation is entirely different from the other contexts. It is therefore extremely crucial that marketers communicate what regular monitoring with SMBG can achieve as otherwise it may result in one time purchase of the device, without it being put to use. Further, the groups need some mechanism to compensate the anticipated emotional turmoil about negative blood glucose readings. Additionally, an individual care plan, mutually agreed goals and a treatment plan with shared responsibilities may result in improved health care outcomes and lower costs (World Health Organization: WHO, 2003). It is important that professionals discuss both the positive and the potentially negative aspects of SMBG as it will serve to enhance the patient’s feelings of personal control and help to cope with the inevitable disappointments, thereby enhancing positive perceptions of SMBG (Snoek 2002 and Thoolen et al 2009). Additionally, incorporating usage of SMBG
during medical consultation may also enhance the visibility, thereby bringing in a change in perception about the benefits of SMBG usage.

5.2.2 ASSESSMENT OF THE TPB MODELS

This study also empirically tested the predictive power of TPB models (TPB model, two component TPB model and the extensions of both the models with personal norm and facilitating conditions with respect to technology adoption intention of the aggregate sample and the subsamples—Adopters Users, Adopters Rejecters and Non Adopters.

Path analysis was employed for testing the fit of the core TPB model, two component TPB model and their extended models for adoption of self-monitoring behaviour. The overall explanatory power of the structural model, the amount of variance explained by the independent variables, and the magnitude and strength of its paths, where each of the hypotheses corresponds to a specific structural model path was examined for the aggregate sample as well as the sub samples.

5.2.2.1 FINDINGS FOR THE AGGREGATE SAMPLE

In the case of core TPB model, only attitude–BI hypothesised path was supported. The findings indicate that the perception about the advantages and disadvantages of adopting SMBG has an influence on BI, while social pressure and self-efficacy did not affect BI. For two component TPB model, the relationships and effects of attitude (instrumental)—BI, affective attitude—BI, injunctive norm-BI and descriptive norm-BI were supported.

In the case of extended core TPB model, the relationships and effects of personal norm—BI and attitude (instrumental)—BI supported the proposed relationships. In the case of extended two component TPB model, it is noted that the results of personal norm-BI, facilitating condition-BI and descriptive norm-BI supported the proposed relationships between the variables.

However, the findings were different for the subsamples, which are discussed below, emphasizing the fact the need for taking into consideration the heterogeneity of the sample (Table 5.2).
5.2.2.2 FINDINGS FOR THE ADOPTERS USERS GROUP

In the case of core TPB model, although the relationship between attitude–BI was significant, the relationship was negative, which contradict the expected positive relationship. Although the attitude is negative, it seems that due to social pressure especially from referent others; they may exhibit greater intention to perform the behaviour on a regular basis. Considering attitude-BI, in the case of Adopters Users, attitude (instrumental) was found to have a small effect (0.08) with respect to core TPB model and negligible to insignificant effect in two component as well as extended models. Instrumental attitude was found to have a negative influence on intention to use. The advantages like ‘convenience’ and ‘can help in detecting blood glucose fluctuations’ as propagated by healthcare providers and manufacturers are likely seen as pre requisites as they were not found to be significant with respect to behavioural beliefs in this study.

**Affective attitude–intention** relationship was not supported in any of the subsamples under study. The effect was also very small to insignificant. This finding is however not consistent with other studies. Hansen et al (2004) found attitude, especially affective attitude as the strongest predictor in determining online grocery buying intention. Hung (2003) reports that attitude has a positive impact on intention to adopt WAP services. Nysveen et al (2005) found that attitude influences intention to use text messaging, mobile contact, payment, and gaming services. In the study by Lawton et al (2007), the affective component of attitude was found to play a more important role in predicting exercise participation.

For Adopters Users they know the seriousness of diabetes and are practical enough to understand that diabetes management can never be a pleasant experience. It may be difficult to have a positive affective attitude and create positive experience (pleasant and exciting or enjoyable experience). It is something which has to be carried out for maintaining one’s health status. A great deal of anxiety was reported as the participants’ beliefs about intention to undertake self-monitoring. This however was not related to technology anxiety, but the effect on seeing the readings (outcome of the behaviour). Since the level of anxiety felt by Adopters Users when they are not aware about their blood glucose level is higher compared to the anxiety level felt on seeing
their readings, they undertake monitoring, although the frequency of usage may differ. Although this group were found to have negative affective attitude about performing the behaviour (anxiety), they differed only in the way in which they coped with this negative emotion. The users displayed problem focused coping strategies, where attempts to act on the stressor were followed (Compas et al 1993 and 2010). Another factor could be that majority of the studies are carried out with the aggregate sample, often ignoring population heterogeneity (Sarstedt et al 2009), thereby showing biased results.

Table 5.2: Hypotheses testing Results of the sub samples

<table>
<thead>
<tr>
<th>Hypo.</th>
<th>IV-DV</th>
<th>Relationship Established in the study</th>
<th>Adop. Users</th>
<th>Adop. Rejecters</th>
<th>NonAdopters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core TPB Model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1a</td>
<td>Attitude-BI</td>
<td>NS</td>
<td>Supported</td>
<td>Supported</td>
<td>NS</td>
</tr>
<tr>
<td>H1b</td>
<td>Subjective Norm-BI</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H1c</td>
<td>Self- efficacy-BI</td>
<td>Supported</td>
<td>NS</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Two component TPB Model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2a</td>
<td>Instrumental Attitude-BI</td>
<td>NS</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H2b</td>
<td>Injunctive Norm-BI</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H2c</td>
<td>Self- efficacy-BI</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H2d</td>
<td>Affective Attitude-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H2e</td>
<td>Descriptive Norm-BI</td>
<td>Supported</td>
<td>NS</td>
<td>Supported</td>
<td>NS</td>
</tr>
<tr>
<td>H2f</td>
<td>Perceived Control-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Extended Core TPB Model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3a</td>
<td>Attitude-BI</td>
<td>NS</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H3b</td>
<td>Subjective Norm-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H3c</td>
<td>Self- efficacy-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H3g</td>
<td>Personal Norm-BI</td>
<td>Supported</td>
<td>NS</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>H3h</td>
<td>Facilitating conditions-BI</td>
<td>Supported</td>
<td>NS</td>
<td>Supported</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Extended Two component TPB Model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H4a</td>
<td>Instrumental Attitude-BI</td>
<td>NS</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H4b</td>
<td>Injunctive Norm-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H4c</td>
<td>Self- efficacy-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H4d</td>
<td>Affective Attitude-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H4e</td>
<td>Descriptive Norm-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>Supported</td>
</tr>
<tr>
<td>H4f</td>
<td>Perceived Control-BI</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>H4g</td>
<td>Personal Norm-BI</td>
<td>Supported</td>
<td>NS</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>H4h</td>
<td>Facilitating conditions-BI</td>
<td>Supported</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

Ajzen (1991) has stated that it not surprising that one or another of the social cognitive predictors are likely to predict intention poorly or insignificantly in some circumstances. This is in agreement with Armitage and Conner (1999) and

Nevertheless as pointed out by Ajzen (1991 and Fishbein and Ajzen (1972), attitude is a core construct in the TPB framework. If attitude does not predict intention, it will result in rejection of the theory. Although it may seem that attitude is not significant, a careful analysis shows that attitude towards the context (diabetes) is significant and has an effect on attitude towards health care behaviours. Technology usage in healthcare is considered as part of healthcare behaviour and therefore should be considered when undertaking similar studies.

Moreover, the difference in significance of attitude across the models can be explained taking into account the strength of the attitude. Attitude strength is defined as the degree to which attitude manifests itself in the form of temporal persistence, resistance to counter persuasion, and predictability of behaviour (Petty and Cacioppo 1986). Attitude toward system use (unfavourable, neutral, or favourable) is conceptually and empirically distinct from the strength in the attitude (weak or strong). An attitude affects an individual’s behaviours by filtering information and shaping the individual’s perception of the world (Fazio, 1986), whereas the strength in the attitude amplifies or neutralizes the effect of the attitude on behaviours (Krosnick and Petty 1995). In this study, personal norm and descriptive norm do affect the strength of the attitude, and therefore should be considered while considering intervention strategies.

Other than injunctive norm-BI, for all the other relationships there was no strong evidence of any influence on BI, in the case of core TPB and two component TPB model. In the case of both extended models, only the facilitating condition-BI relationships was supported at p<0.10. It is likely that since this is the Adopters Users group, facilitating conditions have more influence on the adoption /continuation intention.

In the case of Adopters Users, injunctive norm was found as a positive and significant influence on BI in the core TPB model and two component model. However, only a small effect was reported. In the extended models, where personal norm is measured, injunctive norm was found to have no influence and only very small effect. No significant influence of descriptive norms was reported for this group. According to Venkatesh and Davis (2000), factors having an influence on the acceptance of technology may have different predictive power over time. The effects on intentions from subjective
norms may well subside over time with increasing experience. This is likely the reason why subjective norm was found to lose its significance when personal norms were measured. However the significance of injunctive norm may be due to the specific context under study. Diabetes being a lifelong disease and especially since the user group were found to be influenced by seriousness of the illness, the influence of referent others and significant others cannot be discounted totally for this group.

For *Adopters Users*, self-efficacy was found as a significant factor ($\rho<.10$) in influencing BI. Since they are users, they have experience and are confident about using it. Therefore this study reveals that self-efficacy influence BI, similar to Luarn and Lin (2005) study regarding intention toward mobile banking adoption. In the present situation, although regular monitoring is advised, it is not mandatory that patients need to perform this behaviour. They have the discretion regarding the monitoring and so the behaviour is under their volitional control. Further, as pointed out by Trafimov et al (2002) and Spark et al (1997) measuring perceived difficulty (extent to which individuals consider behaviour to be easy or difficult to perform) may have been relevant in this case. The most significant control belief (barrier) for this group was the ‘wastage of strips’, a technology glitch, also supporting inclusion of perceived difficulty as component of PBC. However Trafimov et al (2002) has cautioned that perceived difficulty may not be significant in all behaviours.

5.2.2.3 FINDINGS FOR THE ADOPTERS REJECTERS GROUP

For *Adopters Rejecters*, in the case of **core TPB model and two component TPB model**, the results supported the relationship between attitude (instrumental) and BI as hypothesized, although negative. It seems that they are not fully convinced about the advantages of regular monitoring, even though they possess SMBG. It is likely they have tried it out and found it not advantageous as their expectations, as they were looking for options to make diabetes management easier. In both the extended models, only instrumental and personal norm were found to have a significant influence. However in the case of the sample of *Adopters Rejecters*, instrumental attitude reported near to high (0.31) to medium (0.180-0.16) and near to medium effect (0.12). Attitude–intention relationship was found as significant but negative across the models. Since participants do not hold positive attitudes about SMBG usage, it affects their usage.
intentions. The advantages mentioned by manufacturers and healthcare experts are seen as a requirement. This is likely to have an effect on its usage. So the need for understanding what constitutes perceived usefulness for consumers need to be understood by the stakeholders.

A lack of support for effect of both injunctive and descriptive norms on intention to adopt SMBG for regular monitoring was reported by the *Adopters Rejecters* group.

This lack of significance is congruent with Armitage and Conner’s (2001) meta-analysis that found subjective norm to have less utility in the TPB.

Further, as suggested by Fishbein and Ajzen (1975), variations in the extent to which behaviours are predominantly under attitudinal control (AC) or normative control (NC) may have resulted in SN failing to account for a significant amount of variance in intentions. This was the only group which reported significant influence of instrumental attitude across models. As the attitudinally controlled respondents represented the sample, subjective norms failed to account for a significant amount of variance in intentions. This result was similar to findings of Trafimow and Finlay (1996, 2001) who found that most of the respondents (79 per cent in the 1996 study and 66 per cent in the 2001 study) were under attitudinal control. Thinking in similar line, it can also be stated that the *Non Adopters* were under normative control, since subjective norm (descriptive) having significant relationship but with medium effect with BI when compared to attitude and PBC. This was not in support of studies which showed the SN influence as weaker than that of attitude and PBC, even when SN had a positive and direct impact on behavioural intention (Ajzen and Fishbein 1980; and Armitage and Conner 2001). The reason may be that they have considered injunctive norms in their studies.

To sum up, this line of research suggests that one should not dismiss the value of social norms in predicting technology adoption in a healthcare context since social norms tend to vary with the situation and behaviour under consideration, and are highly dependent on the saliency of the reference groups (Ryan and Bonfield 1975).

Similarly for *Adopters Rejecters*, self- efficacy and control issues were insignificant. They own the SMBG device and they are confident of using it. What they are worried about is the lack of control they perceive about the outcome- with respect to having a
fluctuating blood glucose reading. The group mentioned managing diabetes as difficult (illness belief), as suggested by Darker et al (2010) individuals like performing behaviours that they find easy and in this case, it was clearly the opposite. Unlike the Adopters Users who are able to understand and accept the issues in diabetes management, this group seems to be overwhelmed by the disease. Thus, the type of person performing a given behaviour may also influence the importance they attach to control factor, which may ultimately affect the strength of relationship between perceived control and intention (Sheeran et al 2002).

5.2.2.4 FINDINGS FOR THE NON ADOPTERS GROUP

In the core TPB model, the Non Adopters subsample showed instrumental attitude and self- efficacy were having significant influencing on BI. It seems that the group is not convinced about the advantages of regular monitoring using SMBG and also do not have the confidence to perform the behaviour. With respect to two component TPB model, the results supported only the effect between descriptive norm and BI. It seems that the awareness that others perform regular monitoring using SMBG can influence the adoption intention of the Non Adopters. Thus only H3e is supported. In the case of extended TPB model, only personal norm–BI and facilitating conditions– BI (ρ = 0.10) were supported. This shows that the intention to perform regular monitoring of blood glucose level is a personal choice among the Non Adopters and facilitating condition is likely to have an influence on personal norms. Unless they think that it is good for them, they will not have an intention to adopt regular monitoring. In the case of extended two component TPB model, descriptive norm- BI and personal norm-BI supported the proposed relationships and effects.

Considering subjective norm, in the case of Non Adopters, injunctive norm was not supported and reported very small to practically no effect (0.03-zero). Descriptive norm however reported medium effect (0.28-0.16) and had a positive influence on behavioural intention. Descriptive norms contributed to the prediction of intentions independently of injunctive norms, thereby improving the explanatory power of the model (Rivis and Sheeran 2003 and Povey et al 2000).Fishbein and Ajzen (1975) have admitted that attitudinal and subjective influences might be dependent on each other. Chang (1998) suggested that individual’s favourableness or unfavourableness towards behaviour is affected by how those of importance to her think of the behaviour in question.
However, descriptive norm seems to influence attitude in the case of *Non Adopters*. This means that the effort of healthcare provider and dear ones in influencing patients to adopt SMBG usage for monitoring may not result in positive results. Group norms may play a significant influence as they refer to the explicit or implicit prescriptions regarding one’s appropriate attitudes and behaviours as a member of a specific group in a specific context (White et al 2002). Regular monitoring is not a common practice among general public and therefore observing monitoring behaviour by diabetic patients may be of great significance to this group.

In the case of *perceived behavioural control*, except for a significant influence of PBC (self-efficacy) in core TPB model for the *Non Adopters* group, all the other groups and models reported in significant influence of PBC on BI. Unlike patients who believe they have control over their illness and are more likely to seek treatment and engage in healthcare behaviours (Hampson et al 1995 and Kavanagh et al 1993), this group mentioned ‘no control over diabetes’ (illness belief), and therefore do not undertake healthcare behaviours. Self- efficacy seems to lose its significance in the models where personal norm and descriptive norms are measured. Personal norm–BI is significant, but negative in this group, representing that they do not feel the need to undertake the behaviour. In such a situation, self- efficacy is not important. “The outcome expectancies can be seen as precursors of self-efficacy because people usually make assumptions about the possible consequences of a behaviour before contemplating whether they can really take the action themselves” (Schwarzer et al 2003). It is also likely that the perception that if they observe others using SMBG for monitoring (descriptive norm) they can easily operate the technology, as easy to use is how manufacturers market the product. Since control over illness was not present, control over regular monitoring behaviour was not even considered by the respondents.

In the case of *personal norm*, other than for the *Adopters Users*, personal norm was found to be significant factor for all the other groups. As mentioned earlier in the discussion, this group displayed problem focused coping strategies, where as other groups adopted emotion focused coping strategies (Carver et al 1989). So in those cases they give more importance to personal norms. Since it had a negative influence on BI, it reflects on their non-adoption of monitoring behaviour. Given the findings, it can be concluded that personal norm represents an active and deliberate cognitive process that
needs to be considered with respect to behavioural intention. In the case of the other extraneous variable, **facilitating conditions** (FC) reported a very small effect (0.02) and positive influence on BI, although not strong for the **Non Adopters** in the extended core TPB model. However, even this effect is lost when descriptive norm were considered in the extended multi component model. This means that even if they have all the facilities for supporting the behaviour, they need to be convinced that other diabetics are undertaking monitoring behaviour and has found it useful. As pointed out by Titah and Barki (2009) in their article in MISQ, a formative conceptualization of facilitating conditions may be more appropriate, rather than modelling it as a reflective construct. However, they also observed that FC could not be modelled as a formative construct because “general reflective items for FC were not available to help with the identification problem that occurs when it is modelled as a formative construct (Jarvis et al 2003).”

5.2.2.5 OVERALL FIT OF THE TPB MODELS

The fit of the TPB model is discussed in terms of the variance accounted for by the model predictors in the prediction of outcome variables.

The aggregate sample in the present study reported a $R^2$ value of 43.7 per cent for intention when tested with core TPB model, a $R^2$ value of 53.3 per cent for intention when tested with extended core TPB model, a $R^2$ value of 47.7 per cent for intention when tested with two component TPB model and a $R^2$ value of 55.8 per cent for intention when tested with extended two component TPB model.

The **core TPB** model accounted for 35.2 per cent of the variance in intention in the case of **Adopters Users**, 34.4 per cent for **Adopters Rejecters** and only 15.6 per cent of the variance in intention with respect to **Non Adopters**. The **two component TPB model** accounted for 36.8 per cent of the variance in intention in the case of **Adopters Users**, 37.8 per cent for **Adopters Rejecters** and only 34.9 per cent of the variance in intention with respect to **Non Adopters**. The extended **core TPB** model accounted for 38.2 per cent of the variance in intention in the case of **Adopters Users**, 51.2 per cent for **Adopters Rejecters** and only 29.0 per cent of the variance in intention with respect to **Non Adopters**. The extended **two component TPB model** accounted for 39.4 per cent of the
variance in intention in the case of Adopters Users, 55.8 per cent for Adopters Rejecters and 44.4 per cent of the variance in intention with respect to Non Adopters. The variance was seen to increase across the models, the lowest reported by the core TPB model, followed by two component TPB model, extended core TPB model and the highest by the extended two component TPB model. However for Non Adopters, the core TPB model and its extension reported a lesser variance compared to two component TPB model and its extension.

Given that the models were not specifically developed to predict technology usage intention or continued usage intention, this variance accountability for Adopters Users can be considered good, especially as per the suggestion of Hair et al (2011) where $R^2$ values of 0.20 can be considered as high in consumer behaviour studies. The need to incorporate facilitating conditions when explaining adoption intention of this group also needs to be noted.

The relative poor fit of the core TPB model for the Non Adopters suggests that it is less suitable for the prediction of SMBG adoption intention behaviour in this subsample. However the extended two component TPB model was found to be the best predictor for this group, signifying the need to include descriptive norm and personal norm in explaining intentions for Non Adopters.

Compared to the other sub samples, the models were found to provide a better fit in explaining adoption intention of Adopters Rejecters group. The inclusion of personal norm in the extended models acts as a decisive factor along with instrumental attitude which was found to explain variance across the models is also called for.

Comparing TPB’s explanatory power with other studies, it was found that TPB explained 60 per cent variance in predicting user’s intention to accept spreadsheet programmes with a student sample (Mathieson 1991) while 57 per cent variance was reported by Taylor and Todd (1995) study with students. Shish and Fang (2004) found that TPB explained 54 per cent in the context of Internet banking adoption intention, 46 per cent with respect to online shopping acceptance (Lin 2007) and 59 per cent in the context of information system acceptance (Huh et al 2009).

This difference in explanatory power is likely due to the specific context under study.
Considering healthcare technology, TPB explained 32 per cent variance in predicting telemedicine technology acceptance of physicians (Chau and Hu 2002). The study findings about self-monitoring using SMBG reported better explanatory power with both the core TPB model and the extended models. It is also likely that aggregate samples have been taken into account in the earlier studies as in this study too, the aggregate sample reported $R^2$ between 0.432 – 0.555.

Further all the models under study provide support for the predictive relevance of TPB as $Q^2$ values are considerably above zero. The extended two component model reported the highest $Q^2$ value across the sub samples and was found to be the best model across all the samples under study.

5.2.2.6 MEDIATION AND MODERATION EFFECT

Tests of mediation and moderation were conducted by examining the eight paths (attitude – instrumental and affective, subjective norm- injunctive and descriptive, PBC- self- efficacy and perceived control, personal norm and facilitating conditions on behavioural intention) with the proposed mediator - illness acceptance, long term orientation and quality of life and age and gender as moderators.

Out of this, only illness acceptance was found to be partially mediating instrumental attitude–intention for the non-adopter group category. No mediation effect was found with long term orientation and quality of life.

The attitude towards using SMBG for regular monitoring affects illness acceptance and illness acceptance affects intention to adopt SMBG among Non-Adopters. SMBG practice which is an integral part of diabetic management is not viewed favourably by the Non Adopters and therefore, it has an effect on their illness acceptance. They perceive diabetes as unmanageable, causing lot of stress and anxiety and affecting their quality of life. Adoption of regular monitoring is likely to be seen as an unwanted chore, without any perceived benefit. This finding is substantiated by the behavioural beliefs elicited in this study. The Non Adopters stated that SMBG usage is, ‘not beneficial in managing diabetes’. They also gave the highest significant weight to the following illness belief indicator, ‘I do not have any control over diabetes’. Since they do not have any control over diabetes, they perceive that regular monitoring is not going to help
them in anyway and that may be the reason they have not even brought the SMBG.

There needs to be a sustained effort from healthcare professionals and other stakeholders to change the mindset of this group regarding acceptance of their diabetic status. This shift in focus will eventually have a positive effect on their practice of diabetic management skills. SMBG usage will be an extension of this understanding.

For the other two groups- Adaptors Users and Adopters Rejecters, illness acceptance does not mediate the attitude – intention relationship. This can be due to the fact that they have accepted their diabetic status and had taken steps for monitoring their blood glucose - as they own SMBG. The difference in adoption and rejection lies in their expectation from the usage. It is more likely that illness acceptance moderates the attitude-intention relationship. Contrary to a mediation effect, a moderation effect is often sought after when a hypothesized causal relationship is weak or not found empirically (Baron and Kenny 1986; Chaplin 1991 and Frazier et al 2004).

For the Aggregate sample, the moderating effect of gender was significant (t= 2.384, p= 0.0178) for facilitating conditions-BI relationship, which was found to be stronger for females than males. Gender was found to have no moderating effect in the case of any of the hypothesised paths for Adopters Users category. For Non Adopters, the moderating effect of gender was significant for Self- efficacy-BI relationship, such that it was found to be stronger for males than females.

In the case of Adopter Rejecters, the moderating effect of gender was significant for affective attitude-BI (stronger for females than males) and perceived control-BI which was found to be stronger for males than females.

In the case of Non Adopters, It is surprising to note that self- efficacy was found to act as a personal barrier for the adoption of SMBG and that this issue is stronger for males which can be due to the fact that females perceive support from others even if they fail, while it is difficult for a male to ask for help. This finding is similar in line to the observation by Watt and White (1999) regarding men’s role as the household “technology expert”. The greater extent to which men are motivated by achievement needs Hoffman (1972) and task orientation (Minton and Schneider 1980) than women can also be considered as reasons. Further, as men are more concerned about the cost (Cruz et al
this can also be a reason as lower self- efficacy will result in wastage of time and resources (strips used in the device), thereby increasing the costs. The system that is easier to use will generate the best cost/benefit ratio for achievement - oriented individuals (Venkatesh and Morris 2000). However descriptive norm and personal norm were crucial factors for individual intention to use SMBG for both the genders belonging to the Non Adopters group.

In the case of Adopters Rejectors, the moderating effect of gender was significant for Affective attitude-BI (stronger for females than males) and perceived control-BI (stronger for males than females). In the present situation, it is highly impossible to consider SMBG usage as a pleasant experience due to the physical hindrances (pain while pricking) as well as the anxiety regarding the readings. However, if patients are made aware of the new facilities in the machine whereby pricking can be carried out according to skin thickness (soft-hard) and they are given proper counselling to view their readings as only a pointer and not an end to their diabetic status can make a difference in their approach. Adopters Rejectors who initially perceived self-monitoring of blood glucose as helping in controlling their diabetes might have been let down by the fact that regular monitoring is an additional chore requiring resources and can also result in anxiety due to fluctuation in readings. Since men are perceived to have a greater need for control, this lack of control is a deciding factor in foregoing self-monitoring behaviour. The feelings of being permanently controlled could provoke ambivalent feelings towards medical technologies.

For all the other relationships tested, no significant effect of gender was reported. With respect to subjective norms, Karahanna and Straub (1999) argued that the influence of ‘compliance’ might become insignificant over time. Venkatesh and Davis (2000) confirmed that SN had a significant direct effect on intentions in the mandatory context, but not so in the voluntary usage context. Therefore voluntariness was considered as a moderating factor of SN-BI relationship. Furthermore, the researchers found that influence of the SN became smaller over time in both the studies in the mandatory context, which might imply that along with internalization, the effect of mandatory contexts might become smaller (Oliver and Bearden 1985; and Warshaw 1980). ‘Users may depend more on their own beliefs (through internalization), rather than others’ opinions’ (Venkatesh et al 2003). These findings also holds true in the present context.

Gender was also found to have no moderating effect in the case of any of the
hypothesised paths for the *Adopters Users* category. This can be explained in that if a system is perceived to be useful, people may have a high BI even though they do not have a positive attitude toward it (Davis et al 1989). Most often the technology there is a gender difference with respect to how it is put to use - more men use the Internet to access news or financial or hobby information compared to women (Cole et al 2000) or women spending more time using e-mail to solidify relationships with friends and family and men more likely to use e-mail for instrumental reasons (Boneva et al 2001). However with respect to SMBG device, it is a utility product for monitoring their blood glucose. In such a situation, the respondent’s identity as a patient suffering from type 2 diabetes is much more important than gender differences for adopter user category. It is also interesting to note that this also disagrees with the view of feminist scholars who seek to demonstrate that women are less likely to use new technological tools because the value system underlying new technologies is fundamentally masculine (Frissen 1992).

The general idea is that new technologies are designed by and for men in ways that discourage use by women. But in the case of healthcare related technology products, the utility factor is the core issue. Recent empirical researches which investigated the gender differences in IT acceptance and usage shows that the expected gap between genders are diminishing as the technologies are more widely diffused (Zhou et al 2007). Bigne et al (2005) found that men and women did not show significantly different behaviours in shopping through the mobile technology in Spanish context.

Concerning the moderating effects of age, the influence of instrumental attitude -BI was stronger for younger group (up to 50 years) than the older age group (above 50 years) in the *Aggregate sample*. This influence was however reversed with respect to the influence of affective attitude on BI. Affective attitude–BI was stronger for the older age group (above 50 years). For the *Non Adopters*, influence of facilitating conditions on BI was stronger for younger age group. Again in the *Adopters Users* category, influences of instrumental attitude, injunctive norm and personal norm on intention were found to be stronger for younger age group. However, age was found to have no moderating effect in the case of *Adopters Rejecters* category.

Joshua and Koshy’s (2011) finding that age considerably moderated the effect of facilitating conditions and was found to be more important for the respondents of the
younger age group in the mobile banking context, was replicated in the Non Adopters sub sample of this study. This is likely because both technologies caters to utilitarian services and requires knowledge and ability and financial and time resources. The effort of social influence was markedly augmented for young respondents (Venkataesh et al 2003; Venkataesh and Zhang 2010; and Foon and Fah 2011). One possible explanation for this fact could be that the younger age group are practically new to the illness itself and to diabetic management skills. Bettman and Sujan (1987); Mervis and Rosch (1980); Venkataesh et al (2003); Venkataesh and Zhang (2010); and Foon and Fah (2011) has suggested that in the absence of direct behavioural experience with the target object, individuals anchor their perceptions to general/abstract criteria, which in this case includes complying with the ideas of medical practitioners and significant others. With increasing experience, user judgments reflect specific/concrete criteria that result from the interaction with the new system and less from normative influences. The direct effect of subjective norm on intention is strong in the early stages of a new behaviour and tends to wear off over time (Reinecke et al 1996). Empirical evidence from studies by (Evans et al 1979; Cook and Wall 1980; Hackman and Oldham 1976; and Aldag and Brief 1977) as cited in the work of Morris et al (2005) indicates that younger workers have a significantly higher need for autonomy than older workers. Yi-Shun Wang et al (2009) in their study regarding adoption of an advanced m-learning system states that ‘younger people appear to have higher levels of self-worth than older people, and thus tend to decide for themselves without being influenced by those around them.’ This finding hold true in this health context also, where higher influence of personal norm on behavioural intention is reported for the younger group. The widely held perception is that older adults do not use certain technologies to the extent that younger adults do (Adler 2006 and Pew 2000). Healthcare is one context where technology does not enhance an individual’s self-image nor provide any recreation, but is utilitarian in nature. Further, it is likely that this presents a perception that an individual is weak and is in need of constant attention. However studies by Czaja et al (2006) and Mitzner et al (2010) suggest that the relationship of older adults with technology is much more complex than would be suggested by the stereotype of older adults simply being afraid and unwilling to use technology.
5.3 IMPLICATIONS

The following section discusses the theoretical and methodological implications, followed by the managerial implications of the study.

5.3.1 METHODOLOGICAL AND THEORETICAL IMPLICATION

According to Ajzen (1991 and 2000) indirect measurement of attitude is done by measuring behavioural beliefs and outcome evaluations, indirect measurement of subjective norm is made by measuring normative beliefs and motivation to comply and indirect measures of PBC is made by measuring control beliefs and their perceived power to influence behaviour. The decision to avoid inclusion of the scale to evaluate the value component of each belief was supported by studies of Rhodes et al (2009) and Gagne and Godin (2000). Therefore, the respondents were asked to express their level of agreement or disagreement with the elicited beliefs of behavioural, normative and control belief on a five point likert scale. This methodology can be incorporated by the future researchers in their studies.

The study also took into consideration population heterogeneity which resulted in testing of the aggregate sample as well as Adopters Users, Adopters Rejecter and Non Adopters. The study findings were able to capture each group’s perceptions about technology adoption which differed from the aggregate sample findings. “Thus ignoring population heterogeneity when performing PLS path modelling on an aggregate data level can seriously bias the results and thereby yield inaccurate management conclusions” (Sarstedt et al 2009). Future researchers should also address this issue in their studies.

In this study, formative assessment of the indirect determinants (behavioural, normative and control) as well as illness beliefs were carried out using Smart PLS. Formative measurement models are examined based on their indicator weights, their significance, their loading and the degree of multicollinearity (Chin 1998; Tenenhaus et al 2005; and Hair et al 2011). This helped to identify the significant indicators for each target group under study – Adopters Users, Adopters Rejecter and Non Adopters, which then can be utilized for designing interventions for target group giving a richer understanding of the issue at hand.

Context is an important aspect of understanding the technology and its use, as
technology is embedded in a context (Orlikowski and Iacono 2001). Moon and Kim (2001) also highlighted that the context, target users, and technology, are major contributing factors facilitating the acceptance of a new technology. Similarly, the criticality of contextual factors in individual assessments of technological products or services has also been pointed out by Shih and Venkatesh (2004), demonstrating the need for taking into account different contexts in the study of the consumer–SST relationship. The elicitation of illness beliefs were found to provide a richer more meaningful understanding of the elicited TPB beliefs (behavioural, normative and control) regarding SMBG technology adoption intention in this study. This supports the need to identify context specific determinants in future technology adoption studies.

This study also added to the existing literature on TPB by empirically testing the TPB models (core TPB model, two component TPB model, and the extensions of both the models with personal norm and facilitating conditions) with respect to technology adoption intention of Adopters Users, Adopters Rejecters and Non Adopters. TPB was found to be a comprehensive theoretical framework, as it was able to predict technology adoption intention of Adopters Users, Adopters Rejecters and Non Adopters.

“A Monte Carlo study carried out compare performance of theoretical models to the currently existing PLS indices, in selecting the best model among a set of competing models under various conditions of sample size, effect size and data distribution” by Sharma and Kim (2012) reported that while “R² and GoF were able to identify the true model only 10 per cent and 23 per cent of times respectively, Q² performed the best overall (average identification rate 47 per cent) in selecting the best model. All the models under study provide support for the predictive relevance of TPB as Q² values are considerably above zero. The extended two component model was found to be the best model across all the samples under study.

In this study, Iacobucci and Dunhacheck’s (2003 and 2007) simultaneous assessment of mediation effect approach was adopted as this was found to provide superior results unlike the other existing methods like the traditional Baron and Kenny (1986); and Hoyle and Kenny (1999) approaches (Helm et al 2010 and Iacobucci et al 2007).

Further, the study of moderation effect using multiple-group analysis (MGA) technique was also employed. The study of mediation and moderation effect using PLS path
model are also methodologies that researchers can incorporate in their studies.

5.3.2 MANAGERIAL IMPLICATION

Based on the discussion above, stakeholders (medical practitioners, manufacturers and marketers) can gain greater insight into the relative influence of attitudinal, normative and control variables (and their antecedents) on intention to adopt SMBG for regular monitoring. They can make more informed decisions regarding how much effort to invest in order to make attitudinal beliefs more positive or whether or not to foster the development of strong subjective norms. Based on the SMBG ownership and SMBG usage profile, four clusters were recognized – Adopters Users, Adopters Rejecters, Non Adopters and group who use but do not own. This study discusses the first three groups as these were identified in this study.

![Figure 2 Technology Adoption Clusters](image_url)
Adopters Users (SMBG owner and user group)

Adopters Users mentioned the following as the most significant illness beliefs’ - that diabetes is a serious medical problem, it makes them tired and that diabetes will last for their entire life. As this group is aware about the seriousness of the disease, they are more open to adopting diabetic management skills, of which regular monitoring is a vital component. This group is involved about their diabetic management, has clear knowledge about what regular monitoring can achieve. They see monitoring of blood glucose only as an aid in their diabetic management and not as an answer to all their diabetic problems. One interesting finding with respect to control beliefs was that this was the only group which did not mention their need for adjusting medicine or insulin dosage as a facilitator for undertaking monitoring behaviour. The role played by medical practitioners in helping patients to manage their diabetes is seen as very vital by this group. So although they make use of technology, they also want support from the experts and look forward to human contact. ‘People–People Pragmatists’, a classification discussed by Walker et al (2002) in their conceptual study supports these findings. The group was categorized as willing users of technology facilitated services; with an above average preference for human contact and perceive only average benefits from technology.

Adopters Users also discussed wastage of strips as a significant control belief. Although from a manufacturer perspective SMBG device is touted as easy to use, it may not be so for the patients. Using SMBG for monitoring involves a series of steps, which needs to be done properly to give accurate results. So steps taken to address technical issues in SMBG usage are likely to enhance their frequency of usage. Marketers must provide a dedicated customer cell to address the technological concerns of this group and also reach out to them through various communication channels to inform them about the latest developments in this field.

Further, Adopters Users can serve as referrals to adopt blood glucose monitoring behaviour. The results of moderating effect of demographic variables (age and gender) showed that Adopters Users require an age specific communication as gender did not moderate any hypothesised relationship.
**Adopters Rejecters (SMBG owners but non users)**

The *Adopters Rejecters* views managing diabetes as difficult and mentioned this as the most significant illness belief. Similar to observations by Bhattacharjee and Premkumar (2004), *this study also cautions against ‘product hype and marketing gimmicks’ which results in high expectations, which when not validated lead to user disappointment and rejection of the technology*. This group which owns SMBG must have expected self-monitoring will make diabetes management easier, while in reality this is not so. There is a need for dedicated involvement from the patient’s side and diabetes management is anything but easy. The group mentioned that self-monitoring behaviour using SMBG as causing anxiety as the most significant behavioural beliefs. Healthcare experts and marketers need to address these beliefs so as to encourage an informed decision from the patient side regarding self-monitoring and develop realistic user expectations about self-monitoring behaviour.

Under normative beliefs (likely users) they mentioned ‘individuals with diabetes who have seen others using glucometer.’ So it is likely that they may be influenced by other users. Therefore, providing ways to understand other patients’ diabetic management methods are likely to prove useful. This can be either through interaction with Adopters *Users* or through visual or print media, so that they get the opportunity to redefine their beliefs. This is likely to help them realise that there is no easier way to manage diabetes but practicing diabetic management skills will subsequently help in effective illness management. Since regular monitoring is part of diabetic management, it is highly likely that they may restart monitoring their blood glucose level.

Since they also expressed their intention to undertake self-monitoring behaviour using SMBG if it helps to adjust their medicine/insulin usage, this also can be an option to be considered for this group as per the discretion of the medical practitioner.

Marketers need to address the above discussed issues in their health communication campaigns by incorporating mass media, selective and personal communication approaches so that it helps to address the apprehension and achieve commitment (Kotler et al 2002) regarding regular monitoring. Further for *Adopter Rejecters*, interventions should be gender sensitive, as the moderating effect of gender was established for this group.
**Non Adopters (Do not own SMBG)**

For the *Non Adopters*, the following behavioural beliefs about SMBG monitoring behaviour were found to have a significant influence – that it will cause anxiety, is painful and that it is not beneficial in managing diabetes. They pointed out that they do not have any control over diabetes as the most significant illness belief. This was also reiterated when illness acceptance was found to partially mediate instrumental attitude–intention relationship for this group. This finding suggests that for *Non Adopters*, interventions should first target and address their issues about illness acceptance, which will ultimately have an effect on their diabetic management skills. Personal norm and descriptive norm were found to be significant predictors in their intention to use SMBG. This group need to observe others usage of SMBG for monitoring and the help of the *Adopters Users* can be made use of in this regard. This may help to alleviate their beliefs about monitoring being painful. Since personal norm is very crucial, the medical fraternity along with the support staff consisting of dieticians should take necessary steps to address and integrate patient views, such that it is seen as a patient initiated change rather than something forced down on the individual. Initially, they should be made comfortable about the usage without taking into account the readings. This will help to reduce the anxiety. Once they are ready and willing, small easily achievable goals should be set with respect to blood glucose readings as this involves behavioural modification in terms of diet control, exercise and proper medication, to name a few. This should be followed by ways to manage the fluctuation in readings and advice given regarding adjusting medicine and insulin dosage, per the discretion of the diabetologist. This gains more significance as *Non Adopters* had mentioned their ability to adjust their medicine or insulin usage as a highly significant control belief for influencing their adoption intention. This may help them to see the behaviour as self-initiated and may help them to undertake regular monitoring using SMBG. Since they have interacted with users, they will have clear ideas as to what this entails. This may help in this group not becoming rejecters after use.

The moderating effect of age and gender was also found to have an influence for *Non Adopters*, thereby stressing the need to plan health related and marketing communication interventions accordingly.
The belief, ‘doing regular monitoring using glucometer is costly’ did not report significant weight nor loading for Adopters Users, Adopters Rejecters and Non Adopters. It is likely that they are more worried about the outcome of the behaviour, based on which they need to adjust their diet, exercise, medicine and insulin dosage as opposed to financial costs. Moreover for a diabetic patient, monitoring blood glucose is a requirement – whether it is self-monitored or carried out in a laboratory context.

5.4. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The following paragraphs discuss the limitations of the current study which are pertinent for further investigations.

5.4.1 GENERALISATION OF THE STUDY

The context chosen for the study were the centres of a WHO certified diabetic centre in Chennai, India. It also holds the distinction of being the first ISO 9001:2000 Certified Diabetes Centre in the world. Therefore, the processes are all streamlined so as to provide an effective healthcare service to the patients. One noteworthy effort is the orientation given to registered patients about diabetes and diabetes management in their first visit itself. Further, along with the medical practitioners’, there is a dedicated team of dieticians with whom the patients' interacts on a one-one basis. This provides the patients with more avenues to discuss his/her health issues than that is available in a regular hospital setting. Thus, the participants are likely to be more aware about diabetes and diabetic management skills than the general diabetes population. Therefore it is likely that adult type 2 diabetic patients visiting a general practitioner may differ in their adoption intention from the group considered for study. Additionally, the findings may not hold true with other diabetic groups like juvenile diabetic patients, Type 1 diabetic patients and gestational diabetic patients.

Apart from this, the study also contains limitations as to how it can be generalised at a cross-cultural level, as the present study was based in India which is quite distinct from European countries. Therefore, further research is necessary to collect data across different cultural context and technologies in order to establish the generalizability of the findings in this study.
5.4.2 MEASUREMENT ERROR

Although single item measures have been employed in the study, it is advisable to include multi items for each construct, so that construct validity can be tested. However, Bergkvist and Rossiter (2007), in their article in Journal of Marketing Research has observed that ‘for the many constructs in marketing that consist of a concrete singular object and a concrete attribute, single-item measures should be used.’ Their study had compared ‘the predictive validity of single-item and multiple item measures of attitude towards the advertisement (AAd) and attitude towards the brand (ABrand), which are two of the most widely measured constructs in marketing.’

Another issue can be that the study was based on self-reported measures from type 2 diabetic patients (T2DM) regarding self-monitoring behaviour using SMBG. The responses could have been influenced by poor recall, response bias, or social desirability factors associated with an expected behaviour. But the fact that the patients have one-one interaction with their dieticians (before and after medical consultation) where they discuss about their diabetes status and diabetic management issues, based on their clinical reports do not seem to encourage providing misleading information. Further, during the qualitative phase and pilot study phase, steps were taken by the researcher to verify the elicited responses with their medical records and were found to be satisfactory. Additionally, the final instrument was also administered in a clinical setting. Nevertheless, the inclusion of measures (maintaining a log book about blood glucose monitoring) to assess technology adoption behaviour in an objective manner needs to be explored.
4.3 MODERATION EFFECT

This study is limited to observing the effect of age and gender as moderators in the eight paths discussed in the research. However, testing the moderating effect of other socio demographic variables like income, occupation, education; illness/diabetes related variables like family history, duration of diabetes, need for insulin dosage, intensity of hypoglycaemic episodes and situational variables like distance of nearby laboratory facilities are likely to provide a better understanding of the healthcare technology adoption intention.

5.5. CONCLUSION

The intent of the present study was to compare the efficacy of the TPB based theoretical models in explaining regular monitoring of blood glucose using SMBG from the perspective of type 2 diabetic patients in an Indian clinical setting. A qualitative study to identify the beliefs held by the participants and an empirical study to test the hypothesised relationships were carried out.

TPB asserts that the assessment of specific beliefs is essential for understanding why people hold certain attitudes, subjective norms and perceptions of behavioural control, thus informing targets for behavioural intervention (Ajzen 2006). The belief elicitation study carried out in the study helped to identify the specific beliefs held by participants regarding intention to use SMBG device for regular monitoring, thereby supporting Ajzen’s recommendations. This provides a richer understanding and helps in identifying specific strategies for interventions for each group.

This study also empirically tested the four TPB models (core TPB model, two component TPB model, and the extensions of both the models with personal norm and facilitating conditions) with respect to technology adoption intention of Adopters Users, Adopters Rejecters, and Non Adopters. The extended two component TPB model was found to have better explanatory power for Adopters Users and Adopters Rejecters, followed by extended core TPB model, two component model and core TPB model. However in the case of Adopters Users, the variance explained by the models showed only a slight increase from one another. Given that TPB and its extended models were not specifically developed to predict technology usage intention or continued usage intention, this variance accountability can be considered good. Facilitating
conditions-BI was the only significant path in the extended two component TPB model which needs to be considered in future research explaining continuance intention. In the case of Adopters Rejecters, the extended models explained variance above 50 per cent with instrumental attitude and personal norm gaining significance in explaining intention. Thus the extended TPB models were found to be suitable in explaining adoption intention of this group. For Non Adopters, the highest variance was reported by the extended two component model, two component model, extended core TPB model and core TPB model respectively. However core TPB model was able to explain only a very low variance, thereby discounting its usefulness in explaining Non Adopters adoption intention. Descriptive norms and personal norm were found to be significant in explaining intention for this group, thus suggesting their need for inclusion in future research. Further all the models under study provide support for the predictive relevance of TPB as $Q^2$ values are considerably above zero. The extended two component model reported the highest $Q^2$ value across the sub samples and was found to be the best model across all the samples under study.

Apart from the direct effects, mediating effect of illness acceptance and moderating effect of age and gender were also discussed in the study. Tests of mediation reported illness acceptance as partially mediating instrumental attitude–intention relationship for Non Adopters, signifying the need to consider context specific variables in technology adoption studies.

For the other two groups - namely, Adopters Users and Adopters Rejecters, illness acceptance does not mediate the attitude–intention relationship. This can be due to the fact that they have accepted their diabetic status and had taken steps for monitoring their blood glucose, as they own SMBG.

For Adopters Users category, influences of instrumental attitude, injunctive norm and personal norm on intention were found to be stronger for younger age group. However gender did not moderate any of the hypothesised paths for this group. In the case of Adopter Rejecters, the moderating effect of gender was significant for affective attitude-BI (stronger for females than males) and perceived control-BI which was found to be stronger for males than females. However, age was found to have no moderating effect in the case of Adopters Rejecters category. For Non Adopters, the moderating effect of gender was significant for Self- efficacy-BI relationship, such that it
was found to be stronger for males than females. Further, influence of facilitating conditions on intention was stronger for younger age group for Non Adopters.