University of Twente
School of Management and Governance
Chair of Business Administration

Master Thesis Business Administration
September, 2014

Thesis topic: The effect of stakeholders' general beliefs of technology on perceived usefulness and eventually intention to use a product in medical innovation management: A review of type 1 diabetes patients and physicians in the Netherlands

Submitted by: Christopher E. Uncu
Admn. No. 1381172

Contact e-Mail: c.e.uncu@student.utwente.nl
Number of pages/words: 100/43.864

Supervisors: Dr. A.M. von Raesfeld Meijer
PhD(c) T. Oukes

Enschede, 18th of September 2014

Abstract

In the field of technology adoption, discovering the antecedents of technology use is of major importance. This study will focus on the effects of the four dimensions of the Technology Readiness Index (optimism, innovativeness, discomfort, and insecurity), complexity, and compatibility on the mediator perceived usefulness and eventually the dependent variable intention to use an Artificial Pancreas. The Artificial Pancreas is currently being developed by an SME in the Netherlands and is different from other diabetes treatment methods available on the market. The Artificial Pancreas combines the functions of two continuous glucose monitors and two pumps, in which the administration of the appropriate amount of insulin and glucagon is fully automated. This study assessed two respondent groups involved in the future adoption of the product, namely, physicians in the Netherlands, Germany, and Austria and type 1 diabetes patients in the Netherlands. The Technology Acceptance Model (TAM) measures usage behaviour and has been widely applied in many domains and also it proved to hold in a physician- and patients' context. However, this study's aim is to investigate technology acceptance of a medical innovation not yet available on the market. The Technology Readiness Index (TRI) measures general beliefs towards technology and has proven to be a useful antecedent of TAM in predictive settings. Theory indicates that more than half of innovations fail to enter or reach the intended market. Therefore, a key factor for novelty products to succeed is how well-prepared the target audience is for this new technology. A sample of 398 type 1 diabetes patients was collected with most of the patients residing in the Netherlands. Furthermore, a sample of 66 physicians in the Netherlands, Germany, and Austria was collected. Multiple hierarchical regression analyses were performed to test the relationships between the TRI and TAM. This study was able to prove that also within this context the TRI can be used as an antecedent of TAM. Moreover, this paper found empirical evidence of a positive effect of optimism, innovativeness, and compatibility on perceived usefulness among diabetes patients. On the other hand, complexity was negatively related to perceived usefulness. In the physician group, this research found evidence of a positive effect of optimism on perceived usefulness and a negative effect of insecurity on perceived usefulness. In both groups, the mediator perceived usefulness had a strong positive effect on the dependent variable, intention to use. In addition, in the patients group evidence was found for a partial mediation between innovativeness and compatibility and intention to use through perceived usefulness. This study's results indicate that several personality dimensions in the TRI and perceived usefulness in TAM are important when adopting a medical innovative product. This should be considered when marketing managers in the medical domain develop implementation strategies.

Keywords: Technology Acceptance · Technology Readiness · Adoption · Diabetes · Artificial Pancreas · Physician · Patient

Preface

Enschede, September 2014

After an intensive period of six months researching, the end-product is finally here. I started in September, 2013 simultaneously with two Master programmes at the University of Twente, namely, Business Administration and Communication Studies. After obtaining my Bachelor degree in Business Administration in applied sciences I decided to pursue an academic career and after a successful pre-master programme in Communication Studies I was approved to continue with two challenging Master programmes. I have always been fascinated with entrepreneurship and therefore I chose the Innovation and Entrepreneurship track in my Master of Business Administration. My study advisor advised me not to do both Masters at the same time and I received many questions on how to deal with the study pressure and above all on how to write two Master theses. Fortunately, after a successful Business Development course and completion of all but one course of both Masters within one semester, I came in contact with Ariane von Raesfeld who asked me to continue within the framework of the Business Development course. The question was to write a Master thesis to help identify and assess several stakeholders in the future acceptance of the Artificial Pancreas in order to help Inreda Diabetic, who is developing the AP, to develop a sound dissemination strategy. Also the department of Behavioural Sciences was involved and the idea was born to incorporate two Master theses within the same project. Basically the idea was to start making the first steps in identifying the major stakeholders in the network, namely the type 1 diabetes patients who will be the end-user of the product and also to investigate the role of the physician in the acceptance of the AP. I personally found it interesting to combine different theories to be better able to predict technology acceptance since the product is not available yet and therefore I took a more fine-grained approach by assessing the stakeholders' general beliefs of technology first. Based upon this thesis' outcomes the idea is to adapt dissemination and positioning strategies from Inreda Diabetic accordingly. Although in the beginning it was difficult to get a good grip on the projects' objective, my supervisors and I managed to set clear objectives and also I felt fortunate to be able to work with a group of five motivated and professional IBA Bachelor students within my Master thesis' framework. Giving a sort of guidance to Bachelor students was also a new and meaningful experience for me.

As a final note, I would like to personally thank a few people who were involved in the process of writing my thesis in the past few months and in my educational career in general. First of all, I would like to thank my supervisor Ariane von Raesfeld for her help and support during the past few months and above all for taking the initiative and giving me the opportunity to write my thesis in the context of the Artificial Pancreas. Also I would like to thank my second supervisor, PhD student Tamara Oukes for her help, feedback, and support regarding my Master thesis. Tamara was always very approachable during my Master thesis and I wish her good luck in her PhD trajectory. Furthermore, a special thanks to the IBA-Bachelor students Wesley Klabbers, Lukas Schönbeck, Jasmin Schnarr, Ricarda Schnarr, and Dyonne Bolks for their professional attitude and excellent work in helping me construct and translate the questionnaires and to recruit enough physician respondents. Last, but certainly not least, I would like to thank my parents for the support and also for enabling me to focus on my academic study career.

Christopher E. Uncu

Table of contents

Index of Tables

Index of Figures

Index of abbreviations

AP……Artificial Pancreas
CGM……Continuous Glucose Monitor
e.g.……exemplī grātiā (for example)
GP……General Practitioner
i.e.……id est (that is to say)
IS……Information System
ITU……Intention to Use
IT……Information Technology
PEOU……Perceived Ease of Use
PBC……Perceived Behavioural Control
PCA……Principal Component Analysis
PU……Perceived Usefulness
SN……Subjective Norms
TA……Technology Acceptance
TAM……Technology Acceptance Model
TPB……Theory of Planned Behaviour
TRA……Theory of Reasoned Action
TR……Technology Readines
TRI……Technology Readiness Index

1. Introduction

1.1. Background

1.1.1. The current situation and treatment of type 1 diabetes patients

Diabetes mellitus, or simply diabetes, is one of the most common chronic diseases in nearly all countries, and continues to increase in numbers and significance, as changing lifestyles lead to reduced physical activity, and increased obesity (Shaw, Sicree, & Zimmet, 2010). It is estimated that 171 million people worldwide had diabetes in 2000, and by 2030 this number is expected to reach 366 million (Hovorka, 2006). Diabetes is a chronic disorder of impaired blood glucose control which can be classified into two categories, namely, type 1- and type 2 diabetes patients (Hovorka, 2006). The context of this study mainly lies in the field of type 1 diabetes. Treatment for type 1 diabetes is non curative. Type 1 diabetes is a disease in which the pancreas has lost its ability to make insulin. A deficit in insulin leads to increases in blood glucose levels, these elevated blood glucose levels can lead to complications which may affect the eyes, kidneys, nerves and the heart and blood vessels (Langendam, Luijf, Hooft, DeVries, Mudde, & Scholten, 2012). Since there is no cure for type 1 diabetes mellitus, patients need to check their blood glucose levels often by finger prick and use these blood glucose values to decide on their insulin dosages. Finger pricks are often regarded as uncomfortable by patients (Langendam et al., 2012). Furthermore, finger prick measurements only provide information about a single point in time, so it is difficult to monitor trends in decline of rises in blood glucose levels. In order to obtain a more physiological replacement therapy different approaches have been pursued since the early 70s to create an artificial wearable pancreas able to deliver insulin according to the blood glucose values as determined by continuous monitoring (Brunetti, Orsini Federici, & Massi Benedetti, 2003). The concept of an "Artificial Pancreas," or an external closed-loop control system that regulates blood glucose levels in patients with diabetes, has gained momentum (Kovatchev, 2010). Research indicated that due to the economic burden on healthcare insurance systems in Europe, the insurance systems do not facilitate wider use of current treatment methods, such as the insulin pump, but the market is still growing due to an increasing interest of diabetes patients to use technology to improve their control of diabetes and health-related *quality of life* (Renard, 2010).

1.1.2. The managerial gap

When developing new technologies for human use the developer should take into consideration not only the efficacy and safety of the product or technology but also the desire and capabilities of the potential user (Liberman, Buckingham, & Philip, 2011). Any chronic disease is a challenge for both the patient and the caregiver. Liberman et al. (2011) mention that the aforementioned statement is especially true in the case of patients with type 1 diabetes where adherence to therapy is crucial 24 hours a day 365 days a year. Therefore, any new technology which is developed for helping patients cope with their disease should take into consideration the "human factor" before, during and after the production process starts (Liberman et al., 2011). Diabetes treatment has substantially improved the last years and changed the life of many patients but despite the availability of new meters, new syringes, new sophisticated insulin pumps and continuous glucose sensors and communication tools, these technologies have not been well utilised by many patients (Liberman et al., 2011). Therefore, it is important to understand people's behavioural intentions towards adopting a new product and their views on technology in general to understand the patient's capabilities and technology readiness state. However, there are also developments in

diabetes treatment which have the potential to revolutionise diabetes treatment. Over the past three decades, automated, electromechanical closed-loop insulin delivery (the so called 'Artificial Pancreas') has been named by some as the 'holy grail' of diabetes mellitus, as it is anticipated to restore the normal amount of glucose in patients with this disorder (Hovorka, 2011). Since 2004 a Dutch company named Inreda Diabetic B.V. has been developing a "closed-loop bihormonal Artificial Pancreas" (AP) which is different from other devices on the market. The AP combines the functions of two continuous glucose monitors and two pumps, in which the administration of the appropriate amount of insulin and glucagon is fully automated. The value proposition of the AP is that patients will not have to continuously prick themselves anymore to check their glucose levels and therefore improving the *quality of life*. The goal of the company is to bring a bihormonal AP system to the home of the patients to improve their quality of life and eventually to decrease societal costs. In 2014 the AP will be extensively tested during clinical trials and from 2015 the AP will be marketed across Europe. Since the product is not available yet it is not yet possible for Inreda Diabetic to get a good insight on how to market the device into different European markets. The next section will elaborate on the relevance of studying the (future) acceptance of the AP amongst important stakeholders, such as physicians and type 1 diabetes patients.

1.1.3. The academic gap

Relevant actors in the diabetes market include; physicians, diabetes patients, diabetes nurses, general practitioners (GPs), hospitals, health insurance companies, pharmacies, and medical device suppliers. In comparison to other stakeholders, particularly physicians are noticeably lagging in the adoption of innovative technologies (Yarbrough & Smith, 2007). In most markets, often only the end users are most relevant when formulating an implementation strategy. Also in the diabetes market it is important to understand how the diabetes patient stands in adopting technology. However, in the European diabetes market, physicians have also proven to play an important role in the decision making process alongside the diabetes patients (Renard, 2010). Therefore, this study will focus on the stakeholder diabetes type 1 patient (i.e., the end-user) and the physicians who deal with diabetes type 1 patients. Since the AP is a new product which is not on the market yet, there is few literature regarding the acceptance of the AP amongst the target group, type 1 diabetes patients (e.g., van Bon et al., 2011), and no literature on the AP technology acceptance by physicians. This study assumes that it is first necessary to predict a stakeholder's future acceptance before an effective marketing strategy and dissemination strategy can be implemented. Therefore, the purpose of this study is to assess diabetes patients and physicians' technology readiness in the Netherlands to be better able to predict future acceptance. Also Godoe & Johansen (2012) mention that a combination of the two models comprises a holistic view. It indicates that adoption of new technologies involves individual- and system, or product, specific factors. The mediating variable of this study can be identified as "perceived usefulness of the Artificial Pancreas" and the dependent, or outcome variable as "the intention to use/ prescribe the Artificial Pancreas". Several independent variables can be identified such as the four dimensions of technology readiness as set forth by Parasuraman (2000), optimism, innovativeness, insecurity, and discomfort. Also this study adds Rogers' (2003) diffusion variables complexity and compatibility to the model as independent variables. The theoretical contribution this research is trying to make is that in this study the Technology Readiness Index (where general beliefs towards technology are measured) is combined with several variables in the Technology Acceptance Model (where a persons' usage behaviour is assessed), because the four dimensions

of TRI are presumed to have a predictive influence on perceived usefulness, which eventually could also influence intention to use through its mediating effect. Because the AP is not available yet, the variable perceived ease of use is left out of the model. More specifically, in this context, Yarbrough and Smith (2007) found that the TAM constructs generally hold in a physician-specific context but the perceived ease of use component of the model does not prove to be consistently related to either attitudes or perceived usefulness. This is discussed further in chapter 3. Since the AP is a new product which still has to be introduced, this study attempts to contribute to existing literature regarding the technology readiness and acceptance of the AP among physicians and diabetes type 1 patients. This study also assumes that a good dissemination strategy is preceded by a thorough analysis of stakeholder's general beliefs towards technology and their attitude regarding future acceptance of the product.

1.1.4. Filling the managerial and academic gap

In order to fill the managerial and academic gaps mentioned in the previous sections, a clear research objective for this study is formulated, namely:

"This study intents to examine the effects of general beliefs of technology (i.e., the TRI dimensions) among diabetes type 1 patients and physicians in the Netherlands, Germany, and Austria on perceived usefulness and eventually intention to use/ prescribe an Artificial Pancreas in order to help marketing managers in the diabetes market to be better able to formulate positioning- and dissemination strategies"

Based upon the research objective, one central overarching research question is formulated which captures the research objective and is meant to fill the managerial and academic gaps. The research question for this study is:

"To what extent do stakeholders' general beliefs of technology have an influence on perceived usefulness and eventually intention to use an Artificial Pancreas among type 1 diabetes patients and physicians in the Netherlands, Germany, and Austria?"

This thesis will use a structured approach to answer the research question whereas firstly in chapter two an extensive literature review will examine all relevant literature available at this moment. Furthermore, in chapter three a conceptual background is described which is deducted from the literature review and also conceptual models are discussed for both stakeholder groups. In chapter four, the methodology, it is elaborated on which research tools are used to answer the research question. Furthermore, in chapter five the results will be described in detail and these results will ultimately lead to chapter six, where the conclusions, discussion, and practical and managerial implications are discussed which are derived from this study. Firstly, the state-of-the art literature is discussed in the next chapter.

2. State-of-the Art Literature

2.1 Adoption and diffusion theory

2.1.1 The adoption of innovations and barriers to adoption

Before this paper delves into the question whether the APs' stakeholders are ready for acceptance, a more holistic understanding of the adoption- and diffusion process is necessary. As technology is diffused into numerous spheres of life, technology-based products and services are becoming increasingly unavoidable (Mick & Fournier, 1998; Meuter et al., 2005). A better comprehension of why and how innovations are adopted or not can be helpful when developing more realistic plans (Tidd & Bessant, 2013). For example, Tidd and Bessant (2013) state that half of all innovations never reach their intended markets. Conventional marketing approaches usually apply very well for many products and services, but not for innovations. Often marketing literature refer to "early adopters" and "majority adopters", but these simple categories are based on very early (state sponsored) diffusion of hybrid seed varieties in farming communities and are far from universally applicable (Tidd & Bessant, 2013).

To make a better planning for innovations, a deeper understanding of what factors promote and constrain adoption is necessary and also how these influence the rate and level of diffusion within different markets and populations. Four examples of barriers to widespread adoption of innovations are, firstly, *economic barriers*, personal costs versus social benefits, access to information, and insufficient incentives. Secondly, there are *behavioural barriers*, i.e., priorities, motivations, rationality, inertia, propensity for change or risk. And thirdly, there are *organisational barriers*, such as goals, routines, power and influence, culture and stakeholders. And lastly, there are *structural barriers*, which includes infrastructure, sunk costs, and governance. For all these reasons, historically, large complex social-technical systems tend to change only incrementally (Tidd & Bessant, 2013). However, more radical transformations can occur but often begin in strategic niches, with different goals, needs, practices and processes. As these niches demonstrate and develop the innovations, through social experimentation and learning, they may begin to influence or enter the mainstream (Tidd & Bessant, 2013). In the next chapter, diffusion theory and relevant factors in adopting new technologies are discussed.

2.1.2 Diffusion and relevant factors in adopting new technologies

Based on the observation of successful diffusion and the testing of diffusion theory, Rogers (2002) has described the process of the decision to adopt an innovation and five key factors that must be considered in attempting to disseminate an innovation. Tidd and Bessant (2013) refer to these five factors as characteristics of innovation. The first factor is *perceived, or relative advantage* (i.e., does the innovation have an advantage over current procedures). The second factor is the innovations *compatibility*. With regards to the AP, how readily can type 1 diabetes patients adopt the AP, the more accommodation needed, the less readily changes will be accepted, according to Rogers. The third factor relates to the innovations *complexity*, so the more simple the alteration is; the easier will be the likelihood of acceptance. Fourth, the innovation is more readily accepted if *gradually implemented* in small steps and stages. For example, initially training a few motivated diabetes patients and/or physicians to use the AP may help the acceptance throughout a whole social system. Lastly, the innovation is more likely to be adopted if its presence is

observable. In relation to the AP, it has to be observable in a positive way that diabetes treatments would significantly change after using the AP. These five characteristics have been widely used in (technology) innovation theory (Moore & Benbasat, 1991). The factors relative advantage, observability, and whether the system is gradually implemented are difficult to test in a predictive setting, such as the AP. However, complexity, relative advantage and compatibility can, to a certain extent, be measured among patients and physicians when an explanation about the system is given beforehand. In the next chapter, the technology acceptance theory is discussed.

2.2 Technology Acceptance theory

2.2.1 The Technology Acceptance Model; its strengths and its shortcomings

With growing technology needs in the 70's, and increasing failures of system adoption in organisations, predicting system use became an area of interest for many researchers (Chuttur, 2009). Despite the potential benefits offered by innovative products and services, some people choose to ignore, refuse, or delay their adoption (Mick & Fournier, 1998). Therefore, gaining an in-depth comprehension of what drives or inhibits consumers' technology acceptance (adoption and usage) is an important research priority (Lam, Chiang, & Parasuraman, 2008). However, most of the studies carried out failed to produce reliable measures that could explain system acceptance or rejection (Davis, 1989). In 1985, Fred Davis introduced the Technology Acceptance Model (TAM) in his doctoral thesis where he proposed that system use is a response that can be explained or predicted by user motivation, which, in turn, is directly influenced by an external stimulus consisting of the actual system's features and capabilities (Chuttur, 2009). This figure is depicted in figure 2.1.

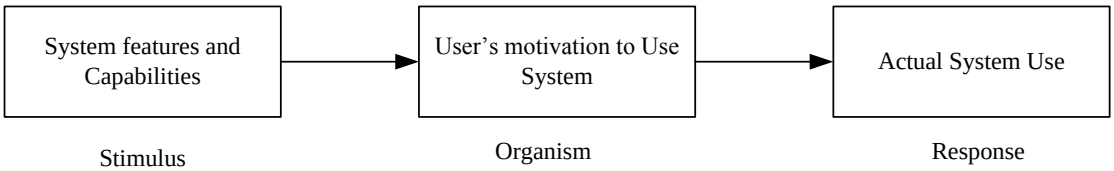


Figure 2.1: Conceptual model for technology acceptance (Davis, 1989, p. 10)

The TAM, based on the theory of reasoned action (TRA), has been widely applied to explain information systems (IS) usage behaviour; in TAM, the system features and capabilities of an information system have been shown to affect the use of information technology (IT) (Fishbein & Ajzen, 1975; Davis, 1989). User acceptance of technology has been an important field of study for over two decades now. Although many models have been proposed to explain and predict the use of a system, the Technology Acceptance Model (TAM) has been the only one which has captured the most attention of the Information Systems community. Thus, as stated by Chutter (2009), it is essential for anyone willing to study user acceptance of a product or technology to have an understanding of the Technology Acceptance Model.

Furthermore, previous meta-research has indicated that the TAM is a flexible tool for measuring user acceptance and for examining and evaluating strategies that promote user acceptance (Lee, Kozar, & Larsen, 2003). The TAM has been empirically replicated or extended to explain various behaviours with adopting technologies (e.g., Gefen, 2003; Gefen & Straub, 1997; Gefen, Karahanna, & Straub, 2003; Lu, Yu, Liu, & Yao, 2003; Pavlou, 2003; Wang, Wang, Lin, & Tang, 2003). There are two central determinants in TAM: *perceived usefulness*, which refers to "the

degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320) and *perceived ease of use*, which refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). The TAM as illustrated in Figure 2.2 is one of the most popular models for studying information system acceptance (Al-Gahtani, 2001; Venkatesh & Davis, 1996; Davis, 1989).

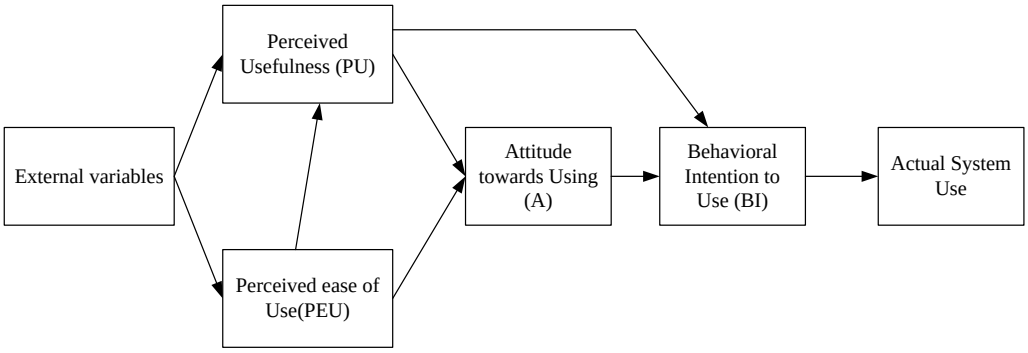


Figure 2.2: First modified version of TAM (Davis, Bagozzi and Warshaw, 1989, p. 985)

There are several reasons why the TAM is so widely used. The main strength of the TAM is its parsimony: intentions to use a technology influence usage behaviour, and perceived usefulness and perceived ease of use determine intentions to use (Bagozzi, 2007). The TAM overlaps with the theory of reasoned action (TRA) and the theory of planned behaviour (TPB).

The variables attitude and behavioural intention to use replace the effects of attitude and subjective norms in the TRA model. The difference between the TRA model and the TPB is that the TPB includes perceived behavioural control. So in TAM attitude and behavioural intention replace the effect of perceived behavioural control (Bagozzi, 2007). Since this study is only focusing on TAM as a basis, the TRA and TPB are not discussed into detail. However, several authors do state that the TAM has significantly outperformed the TRA and the TPB in terms of explained variances across many studies (e.g. Davis et al., 1989; Venkatesh, Morris, Davis, & Davis, 2003). In addition, Godoe and Johansen (2012) mention that the TAM has received considerable support over the years. The TAM has been validated over a wide range of systems, and perceived usefulness and perceived ease of use have proven to be reliable and valid cognitive dimensions (Burton-Jones & Hubona, 2006; King & He, 2006; Legris et al., 2003; MacFarland & Hamilton, 2006).

In short, the reason for choosing TAM as a part of this research is because TAM has been tested empirically and supported through validations, applications, and replications (Venkatesh, 2000; Schaup et al., 2010; Lee, 2010; Yusoff et al., 2010). However, there are also several shortcomings in the TAM. Because the TAM is so parsimonious, this could also be a shortcoming since it is unreasonable to expect that one model would explain decisions and behaviour fully across a wide range of technologies, adoption situations, and differences in decision making and decision makers (Bagozzi, 2007). The extensive study done by Venkatesh et al. (2003) attempted to find a unified view regarding the TAM and resulted in a unified TAM with 41 independent variables and 8 dependent variables which is not desirable to use due to its complexity (Bagozzi, 2007). In table 2.1, a literature overview is shown for relevant TAM articles. Furthermore, there are several contexts in which the TAM is applied and where the model has proved to be useful. Examples of TAM applications in a physician context are computerised physician order entry, telemedicine, electronic medical records, internet-based applications, handheld computers, electronic mental health resources, and medical error reporting systems. What can be noted is that most contexts are existing non-physical products whereas this study is more focused on predicting acceptance of a physical product. This is discussed more in depth in the next chapter.

Table 2.1: Technology Acceptance literature overview

Authors	Research Model(s)	Independent variables or mediators	Dependent variable(s)
Davis (1989)	TAM	External variables, Perceived ease of use, Perceived usefulness, Attitude, Behavioural intention	Actual usage
Hu et al. (1999)	TAM	Perceived usefulness, Perceived ease of use, Attitude	Intention to use
Chau & Hu (2001)	TAM, TPB	Compatibility, Perceived usefulness, Perceived ease of use, Attitude, Subjective norms, Perceived behavioural control	Behavioural intention
Egea & Gonzales (2011)	TAM	Trust, Perceived risk, Information integrity, Perceived usefulness, Perceived ease of use, Attitude	Intention to use
Chismar & Wiley-Patton (2002)	TAM	Subjective norms, image, Job relevance, Output quality, Result demonstrability, Experience, voluntariness, Perceived usefulness, Perceived ease of use, intention to use	Usage behaviour
Venkatesh & Bala (2008)	TAM	Individual differences, System characteristics, Social influence, Facilitating conditions, Perceived usefulness, Perceived ease of use, Behavioural intention	Use behaviour
Yi et al. (2006)	TAM	Personal innovativeness in IT, Result demonstrability, Image, Subjective norm. Perceived behavioural control, Perceived usefulness, Perceived ease of use,	Behavioural intention
Venkatesh & Bala (2008)	TAM	Performance expectancy, Effort expectancy, Social influence, Facilitating conditions *Mediators*: Age, Gender, Experience, Voluntariness of use	Behavioural intention, Use behaviour
Rogers (1995)	Diffusion	Relative advantage, Compatibility, Complexity, Trialability, Observability	Diffusion rate

2.2.2 The Technology Acceptance Model application

Based upon an extensive meta-analysis by Schepers and Wetzels (2007), who analysed 63 studies in which the TAM is applied into different settings ranging from the use of search engines to computer use, it can be concluded that the TAM is widely applied across the world in the field of (new) technologies and that most studies analysed in the sample used quantitative methods. In addition, from the analysis it can also be concluded that most studies who apply the TAM use it for (computer) technologies such as online shopping, internet banking, and electronic supermarkets.

This study focuses on physicians and patients. Because of the professional training physicians receive, they may differ from users of technologies in other industries (Yarbrough & Smith, 2007). Empirical evidence in the field of technology acceptance in the physician population is scarce. However, published studies do shed some light on potential barriers to technology acceptance (Yarbrough & Smith, 2007). A research done by Yarbrough and Smith (2007) included an analysis of all articles in the field of technology acceptance among physicians from 1996 to 2006. 18 empirical studies covering seven different types of technology provide the starting point for a real understanding of factors contributing to physician technology acceptance (including computerised physician order entry, telemedicine, electronic medical record, internet-based applications, handheld computers, electronic mental health resources, and medical error reporting system). Yarbrough and Smith (2007) found that the TAM constructs generally hold in a physician-specific context, but the perceived ease of usage component of the model does not prove to be consistently related to either attitudes or perceived usefulness. Several barriers to physician technology acceptance have emerged in the existing literature such as interruption of traditional practice patterns, lack of evidence regarding the benefits of IT, organizational issues, and issues specifically related to a certain system or product (i.e., system-specific). Yarbrough and Smith (2007) state that often doctors are hesitant to adopt technologies that require an interruption of their traditional practice patterns during implementation. Also the requirement of additional time is one of the major barriers to physicians' technology acceptance present in the literature. Furthermore, Yarbrough and Smith (2007) argued that one limitation of the TAM is its inability to

consider the influence of external variables and barriers to technology acceptance. They concluded that the major barriers to physicians' acceptance of hospital information systems can be classified into three groups, namely: personal (human) characteristics, organisational characteristics, and information system (technology) characteristics. To conclude, in the literature to date no studies are known which address the acceptance of the AP amongst physicians and the factors influencing this process.

Also regarding diabetes patients, few studies have been conducted which assess diabetes patients' technology acceptance (e.g., van Bon et al., 2010; van Bon et al., 2011). Therefore, technology acceptance among patients in general, instead of diabetes patients, will be also discussed. In the first part of this section it was motivated that the TAM holds in a physician specific context. Wilson and Lankton (2004) studied patients' acceptance of provider delivered e-health. The authors mention that the TAM is an appropriate tool to use in a patients specific context, also because it holds in a physician specific context in for example, telemedicine (e.g., Hu et al., 1999). Also Wilson and Lankton (2004) extensively tested several models in a patient context. The TAM proved to be robust in the context of e-health and among a subject of medical patients. Also, it is important to highlight the relevance of studying user acceptance among diabetes patients and how this is done in the past with other diabetes treatment methods. Liberman et al. (2011) indicate that the evaluation of patient reported outcomes (such as the impact of the technology and satisfaction with the technology) is important in, for example, clinical trials of CGM. Because literature is scarce, also CGM studies are examined to understand the need to research technology acceptance regarding the AP. Liberman et al. (2011) emphasise the significance of coping skills, retrospective data review and involvement in the effective management of CGM. Also in the AP context, this data can help to improve patient selection and guidance in the use of this new technology. So, compared to the AP, data yielded from technology acceptance and readiness can also help to understand diabetes' patients coping skills with regards to the AP. Coping skills with technology are also tested in this study and fall under the constructs of technology readiness, complexity, and perceived usefulness. As mentioned earlier in this paragraph, with regards to the AP, a few studies have been conducted regarding future acceptance of the artificial pancreas which were part of a dissertation report (van Bon et al., 2010; van Bon et al., 2011). In these studies, the TAM was consistently used as a base for conducting interviews and questionnaires. In short, the TAM is to some extent useful for predicting acceptance amongst physicians and diabetes patients but should be enhanced in order to better predict technology acceptance by taking a more generalised approach by using the TRI as a predictor of TAM. In chapter 2.4 it is explained that the TRI has proven to be useful in predictive settings. Also the effects of the TRI on intention to use through the mediator perceived usefulness are examined. So this study extends the TAM by adding the TRI dimensions as external variables and test for direct and indirect influences of people's general beliefs on intention to use. In the next chapter, the technology readiness dimensions are introduced.

2.3 Technology Readiness theory

2.3.1 Technology Readiness Index

Another stream of research posits an individual's personality at the centre of his or her acceptance of technology (Walczuch, Lemmink, & Streukens, 2007). An example of such a model is the technology readiness index (TRI) (Parasuraman, 2000). Technology Readiness (TR) refers to "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman, 2000, p. 308). At the measurement level, the TRI was developed to measure people's general beliefs about technology. More specifically, TRI reflects a set of beliefs about technology but is not an indicator of a person's competence in using it (Walczuch et al., 2007). The TRI is a combination of positive and negative technology-related beliefs. These beliefs are assumed to vary among individuals (Parasuraman, 2000). Collectively, these coexisting beliefs determine a person's predisposition to interact with new technology (Parasuraman & Colby, 2001). Furthermore, findings show that these beliefs can be categorised into four dimensions: *optimism, innovativeness, discomfort, and insecurity* (Parasuraman, 2000). These are shown in table 2.2.

Table 2.2: Overview Technology Readiness constructs

Optimism	**Innovativeness**
Optimism is defined as "a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives" (Parasuraman & Colby, 2001, p. 34). It generally captures positive feelings about technology.	Innovativeness is defined as "a tendency to be a technology pioneer and thought leader" (Parasuraman & Colby, 2001, p. 36). This TR dimension generally measures to what degree individuals perceive themselves as being at the forefront of technology adoption.
Discomfort	**Insecurity**
Discomfort is defined as "a perceived lack of control over technology and a feeling of being overwhelmed by it" (Parasuraman & Colby, 2001, p. 41). This dimension generally measures the fear and concerns people experience when confronted with technology.	Insecurity is defined as a "distrust of technology and scepticism about its ability to work properly" (Parasuraman & Colby, 2001, p. 44). The insecurity dimension focuses on concerns people may have in face of technology-based transactions.

A visual distribution of all four factors is shown in figure 2.3. The dimensions optimism and innovativeness are drivers, or motivators, of technology readiness. If a person scores high on these dimensions it will increase overall technology readiness. Discomfort and insecurity are indicators of a low technology readiness (Parasuraman, 2000). Results in the literature show that the four dimensions are independent of each other, i.e., each of them makes a unique contribution to an individual's technology readiness (Parasuraman & Colby, 2001). The original TRI consists of a 36-item scale which measures all four dimensions and these dimensions proved to be valid and reliable constructs in many settings.

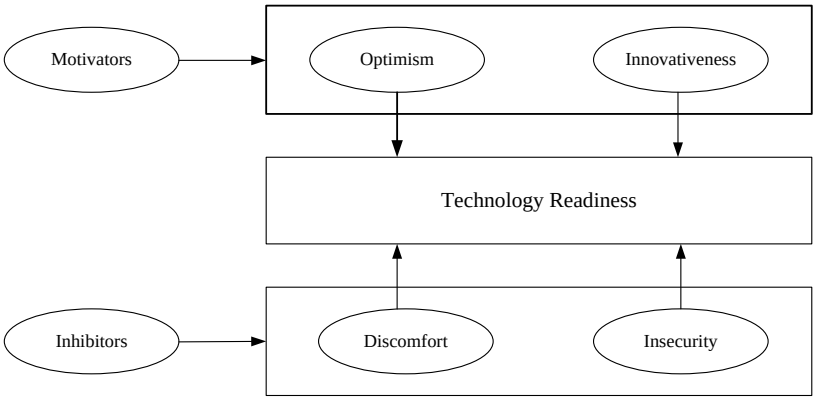


Figure 2.3: Motivators and Inhibitors of Technology Readiness (Parasuraman, 2000)

Many technological innovations, such as the AP, are radical or new to customers, and cause apprehension in those who lack sufficient experience with the technology (Garcia & Calantone, 2002). So far, the TR instrument has been used to compare consumers in different countries (Parasumaran, 2000; Tsikriktsis, 2004), to understand the TR of service employees (Taylor et al., 2002), and to explain the relationships between perceived ease of use, usefulness and behavioural intentions (Yi et al., 2003). This paper delves more into the technology readiness and technology acceptance of the two stakeholders' diabetes type 1 patients and physicians and also to validate the two concepts in this specific context. Furthermore, this study aims to examine understanding and knowledge of the AP among diabetes type 1 patients and physicians and to contribute to the process of developing a sound dissemination strategy for the AP for the aforementioned stakeholders.

2.4 Technology Acceptance and Technology Readiness as a combined concept

The Technology Readiness Index (TRI) is a relatively new measurement method compared to the TAM model. Since the year 2000, some researchers attempted to use the technology readiness concept to measure effects on technology acceptance (e.g., Walczuch et al., 2007; Lin et al., 2007; Lam et al., 2008; Godoe & Johansen, 2012). Other studies combined the TRI with the predecessor of TAM, the TPB (e.g., Chen & Li, 2010). According to Porter and Donthu (2006), two research paradigms have emerged to explain technology adoption and acceptance. The first is focused on measuring a specific system or technology, where the TAM is most widely used and the second paradigm, the TRI, focuses on personality dimensions to explain use and acceptance of new technologies (Porter & Donthu, 2006). Lin et al. (2005) were the first authors to present an integration of the two models TAM and TRI. Lin et al. (2007) state that "it is intuitively accepted that TAM and TR are interrelated, although the measurement of usefulness and ease of use in TAM is specific for a particular system (i.e., system specific) while TR is for general technology beliefs (i.e., individual specific)" (p. 644). Furthermore, research on technology acceptance suggests that individual differences, including personality traits, generalised beliefs, and affects about technology, as well as demographics, may affect the acceptance (Lam et al., 2008; Im, Bayus, & Mason, 2003; Meuter et al., 2005; Parasuraman, 2000). For example, when a person has an enduring insecure feeling about technology this may influence a person's acceptance of a variety of technology-based products and services (Lam et al., 2008). Also, when a person is faced with a choice that he or she has to make, consumers in general first engage in internal search, examining memory for available information (Bettman, 1979). Consequently, Lin et al. (2007) state that in addition to heterogeneous system characteristics, people's general beliefs

about technology derived from prior experience may be employed to anchor perceptions of usefulness and ease of use. This experience based evaluation may apply more to novice consumers (i.e., a less experienced consumer). A diabetes patient can be categorised as an experienced user in diabetes products so this could apply less to this user group. However, regarding the yet unavailable AP, users will still be faced with an initial choice to make regarding the adoption of a new technology.

In the literature, there appears to be implicit theoretical and practical bases to assume that when people evaluate technology adoption intentions, perceived usefulness and perceived ease of use (cognitive appraisals) are retrieved and processed (Lin et al., 2007). In addition, consumer studies have indicated that previous product experience and knowledge influences consumer cue utilisation and message processing in product evaluation (Rao & Monroe, 1988; Peracchio & Tybout, 1996). Furthermore, people with more product knowledge may search for more information before problem solving because of their high awareness of existing attributes and may identify relevant information more accurately (Brucks, 1985; Alba & Hutchinson, 1987). Also, Lin et al. (2007) mention that more product knowledge reflects more extensive, complex, experienced, expert, and familiar knowledge, and thus effortful processing of issue-related information and evaluative inferences concerning product features by high-knowledge consumers could be expected (Alba & Hutchinson, 1987; Peracchio & Tybout, 1996). To conclude, experience gained through previous use of technology is empirically confirmed to increase user perceptions of its ease of use and usefulness (Gefen, 2003; Karahanna, Straub, & Chervany, 1999), and users' (online) behavioural intentions (Yoh, Damhorst, Sapp, & Laczniak, 2003).

Furthermore, there are several other studies known which integrated the TRI and the TAM concept, which are now discussed. Walczuch et al. (2007) measured the relation between TRIs personality traits dimensions, optimism, innovativeness, discomfort, and insecurity and the cognitive dimensions of the TAM. According to Parasuraman (2000), a person with optimism and innovativeness and little discomfort and insecurity is more likely to use a new technology. However, Walczuch et al. (2007) mention that little effort has been made to combine personality-based and cognitive antecedents to technology use in one model. Therefore, Walczuch et al. (2007) hypothesised the effect of a general attitude of a person towards technology on his or her perceived ease of use and perceived usefulness of a given software system (the context in this study was the financial services industry). Results in the study of Walczuch et al. (2007) indicated that respondents' personality makes a difference in the adoption process of IT and this may help to explain how its adoption may be influenced by the personality of the user as well as the characteristics of the technology. In short, personality characteristics have a significant effect on technology adoption. Employees' optimism had the strongest impact on perceived usefulness of the information technology. An interesting finding was that a person's innovativeness negatively impacts perceived usefulness which resulted in a rejection of the hypothesis. Walczuch et al. (2007) mention that it is possible that innovative people are more critical towards technology since they are aware of the newest developments and possibilities and expect all technology to fulfil highest demands. However, this motivation is not likely to hold in this specific context of diabetes and healthcare and thus there is much more evidence to suggest a positive influence of innovative characteristics on perceived usefulness.

Another context in which the TRI and the TAM are combined is the consumer adoption of e-service systems. Lin et al. (2007) combined the TRI and the TAM because the TAM alone applied in marketing settings may not sufficiently explain consumers' technology adoption behaviours. Therefore, Lin et al. (2007) state that it is necessary to provide a model which incorporates individuals' differences variables towards identifying and qualifying the psychological processes of the perceptions of a technology's value. Therefore, TRI was used to take individual differences into account. As found by Walczuch et al. (2007), Lin et al. (2007) also mention that evidence from the fieldwork shows that TR is incapable of explaining why high-TR consumers do not always adopt new technologies, such as cellular phones with open operating systems or in-car global positioning systems. From the technology readiness aspect, Lin et al. (2007) tried to combine the four dimensions with the two focal constructs used in TAM, i.e., perceived usefulness and perceived ease of use within the context of consumer adoption of e-services systems. Furthermore, Lam et al., (2008) researched the roles of traits, generalised beliefs, and affects in technology acceptance where the TR constructs represent the generalised beliefs and affects about technology-based products (Parasuraman, 2000). Also, Lam et al. (2008) argue that for example Lin et al. (2005; 2007) examined the relationships between TR and technology acceptance by using the four dimensions as reflective indicators of a higher-order construct or adding up the scores on the four constructs to firm a composite measure of TR. However, Lam et al. (2008) state that this might be an oversimplification and has limited value from the standpoint of both behavioural prediction and explanation, because the four TR constructs clearly have different meanings and relate to different psychological processes underlying technology acceptance.

Similar to Lam et al. (2008), this study will also treat the four TR constructs as separate entities and the effect of each construct will be measured on technology acceptance. Another study which used this approach is the recent study by Godoe and Johansen (2012) who investigated the relationship between the personality dimensions of TRI and the system specific dimensions of the TAM. Godoe and Johansen (2012) also criticised the simplification of the TR constructs by Lin et al. (2005; 2007) and stated that the study of Walczuch et al. (2007) created a more specific model by linking all separate dimensions directly to the TAM. Godoe and Johansen (2012) state that an inclusion of the dependent variable "actual use" has not been tested yet and furthermore they state that by including actual use, a more comprehensive picture can be displayed. Godoe and Johansen (2012) mention that the direct effects of the TRI dimensions on actual use have previously been accounted for by Parasuraman & Colby (2001). However, the direct effects are not included in the model of Godoe and Johansen (2012) because of two reasons. Firstly, inclusion of external variables mediated through perceived usefulness and perceived ease of use is in accordance with the original TAM of Davis (1989). Secondly, Godoe and Johansen (2012) aimed to provide a clear and at the same time simple representation of relationships among different variables in the model. To conclude, there is handful of researchers who combined the TRI dimensions with the TAM of which an overview is depicted in table 2.3, however, the model of this study varies from the models discussed in this literature review. This is discussed in chapter 3.

Table 2.3: Technology Readiness and Technology Acceptance literature overview

Authors	Research Model(s)	Independent variables	Dependent variable(s)
Lin et al. (2007)	TRI, TAM	Technology Readiness, Perceived usefulness, Perceived ease of use	Use intention
Walczuch et al. (2007)	TRI, TAM	Optimism, Innovativeness, Insecurity, Discomfort	Perceived usefulness, Perceived ease of use
Godoe & Johansen (2012)	TRI, TAM	Optimism, Innovativeness, Insecurity, Discomfort, Perceived usefulness, Perceived ease of use	Actual use
Lu et al. (2012)	TRI	Optimism, Innovativeness, Insecurity, Discomfort, C2C platform functionality, C2C platform trust	C2C Satisfaction
Chen & Li (2010)	TPB, TRI	Technology Readiness, Attitude, Perceived Behavioural Control, Subject norms	Continuance intention

2.5 Conclusion regarding diffusion, technology readiness and technology acceptance

The innovation diffusion literature often defines adoption behaviour as an individuals' adoption time, or the elapsed time between market introduction of an innovative product and the individual's first-time acquisition of the product (Danaher, Hardie, & Putsis, 2001; Rogers, 2003; Lam et al., 2008). Burton-Jones and Straub (2006) conclude that technology usage is a very complex phenomenon and they recommend focusing on measures that can be expected to relate closely to the other constructs within the same network or domain. The adoption literature suggested a few factors which are necessary to predict a product's successful introduction, namely, relative advantage, gradual implementation, complexity, compatibility, and trialability (Rogers, 2003). Relative advantage, complexity, and compatibility proved to have the best fit within this study's context. However, relative advantage is argued to overlap with perceived usefulness which is also a separate factor in this study (Moore & Benbasat, 1991). Therefore, the constructs complexity and compatibility will be used for this study in relation to the perceived usefulness of the AP system among diabetes type 1 patients. More specifically, it is argued that complexity and compatibility are expected to correlate with TAM constructs and therefore are suitable to be used in this study. In short, to assess the adoption of an innovation such as the AP, a more fine-grained and predicting analysis is needed.

From the literature review it can be concluded that the Technology Acceptance model is widely used in different contexts. However, it is often used for evaluating existing products and systems but not often applied to predict behaviour. It also has not yet been extensively applied in diabetes management and in predicting future acceptance. Because the Artificial Pancreas is an innovation yet to be introduced it is more difficult to predict its future acceptance than with existing products. Therefore, the literature review made clear that before predicting acceptance of a product it is proven that measuring general beliefs of technology as an antecedent of TAM can help predict perceived usefulness and future acceptance. Since the emergence of the TR concept, many studies have been conducted in different settings (e.g., Sophonthummapharn & Tesar, 2007; Victorino et al., 2009; Walczuch et al., 2007) and in different countries (e.g., Elliott et al., 2008; Matthing et al., 2006; Taylor et al., 2005), exploring the power of TRI in revealing different types of technology readiness in people or its applicability to different contexts and settings. Results in the TR domain are highly varied (Liljander et al., 2006; Lin & Hsieh 2006; Yen, 2005). Based on the literature review, no study has been done examining types of technology readiness among diabetes type 1 patients or diabetes specialists (i.e., physicians) in the Netherlands, Germany, or Austria. Therefore, this study will take a different approach by measuring people's general beliefs before assessing their technology adoption behaviour measured in TAM. Also Godoe & Johansen (2012) mention that the combination of both the TRI and TAM expands prior models due to its focus on both individual and system, or product, specific characteristics. Furthermore, Lam et al.

(2008) state that knowledge about the effect of the TR constructs can be helpful to marketers in identifying potential adopters and heavy/light users of their technology based offering. The generalised effect of the four TR constructs implies that once marketers have established the profiles of potential adopters on these constructs, they can use this information to predict the acceptance of various types of technology-based offerings (Lam et al., 2008). Such knowledge can also help marketers in formulating and fine-tuning their product-positioning and communication strategies to match the TR profiles of potential customers in different stages of the product life cycle (Lam et al., 2008). The conceptual background is discussed in the next chapter.

3. Conceptual background and hypotheses

The measurement of perceived usefulness in TAM is specific for a particular system (system-specific), whereas TRI is for general technology beliefs (individual-specific). Lin et al. (2005) state that it is intuitive that the TAM and TRI are interrelated. When consumers are faced with a choice to make, in general they first engage in internal search, examining memory for available information (Bettman, 1979). Furthermore, Lin et al. (2005) state that most people have at some time used technologies before assessing a particular system, so in addition to objective system characteristics, people's general beliefs about technology, which are derived from prior similar experience, may be employed to anchor perceptions of perceived usefulness. This is more likely when people do not have specific experience on the particular system since novice consumers are more likely to process choice alternatives using abstract, general criteria instead of more specific criteria (Venkatesh & Davis, 1996; Bettman & Sujan, 1987). Therefore, there are implicit theoretical and practical bases to assume that when people evaluate technology adoption intentions (i.e., intention, instead of actual behaviour, is measured due to the unavailability of the product), technology readiness cognitive information is retrieved and processed before the retrieval and processing of specific cognitive appraisal such as constructs in the TAM (e.g., perceived usefulness). Furthermore, Raja, Johns, and Ntalianis (2004) state that personality often serves as an antecedent of perception that helps to determine behavioural intentions. This study aims to research if TR dimensions relate to diabetes patients and specialists' perceived usefulness and eventually intention to use/ prescribe the AP.

In this paper, an extension of the TAM is proposed which is derived from Davis' original framework (Davis, 1989) and Parasuramans' TRI (Parasuraman, 2000). Unlike most technology acceptance literature (e.g., Brown & Venkatesh, 2005), this study does not measure an individual's actual usage of a product but the intention to use it with patients or the intention to prescribe it for physicians and uses their general beliefs as an antecedent. One of the reasons for this approach is the unavailability of the AP product. Because this paper is focusing on two stakeholder groups, diabetes type 1 patients and physicians, the two groups will be treated separately and also different surveys will be administered to each group. Although some studies have combined the TR dimensions with the TAM constructs, most studies measure usage behaviour and use perceived ease of use as a determinant for perceived usefulness. This study uses the TR dimensions and adds complexity and compatibility and removes the perceived ease of use construct. Because this study focuses on two stakeholder groups it is also necessary to develop two models, namely one for every group. A difference between the two models is that the intention to use is measured with the patients and the intention to prescribe the product is

measured with the physician group. In the next section, the research models and constructs for each group will be discussed.

3.1 Diabetes Patients and Physicians hypothesis generation

As discussed in the previous chapters, it is always important to assess the end-user' acceptance but it is also relevant to assess the physicians' acceptance of a particular system or product and especially in the European diabetes market context the role of the physician is important (Yarbrough & Smith, 2007; Renard, 2010). Since this paper is assessing a product not yet available on the market, it is dealing with future acceptance of the product which is more complicated than assessing the acceptance of an already available product. Therefore, this study will first identify stakeholders' general beliefs towards technology by using adapted constructs of the TRI (Parasuraman, 2000). These TR dimensions are linked to the mediating construct perceived usefulness, which ultimately leads to the dependent variable, the intention to use the AP. Therefore, the mediating effect of perceived usefulness is also assessed in the empirical part to understand if perceived usefulness is a mediator between the TRI and intention to use. As discussed, because the AP is not available yet, the model included intention to use instead of actual use, which is often used by Technology Acceptance (TA) based models. The relationship between perceived usefulness and intention to use is studied in this model. This model varies from all other models studied in the literature review, since other TA based models included the variable perceived ease of use and tested its effect on perceived usefulness. As discussed before, one of the reasons this variable was left out of the model is due to the unavailability of the product. The four dimensions of TR are used as external variables to test whether general beliefs of the physicians have an influence of the perceived usefulness of the AP. The conceptual models for the physicians and diabetes patients with the hypothesised paths are depicted in figures 3.1 and 3.2 respectively.

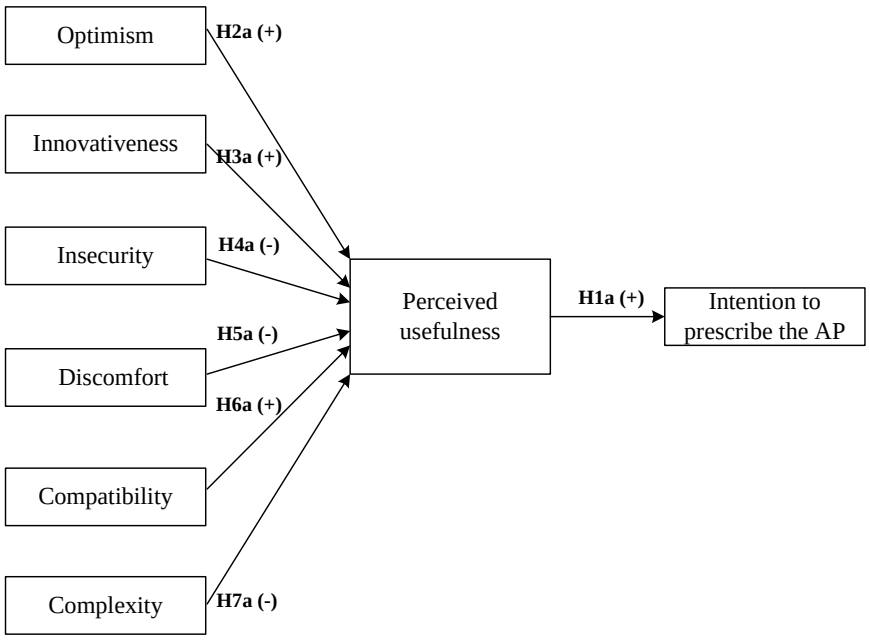


Figure 3.1: Conceptual model physicians with the hypothesised paths

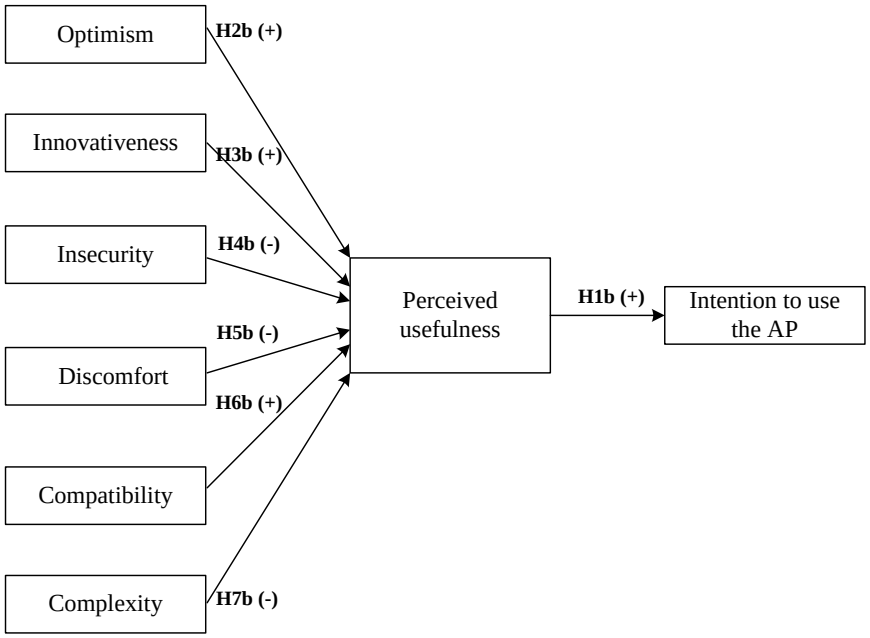


Figure 3.2: Conceptual model diabetes patients with the hypothesised paths

The variables optimism and innovativeness reflect a high technology readiness state and the variables insecurity and discomfort reflect a low readiness state. These model combinations have not yet been applied in the field of TR and TAM on the physician group and patients group and this study aims to find evidence that general beliefs, and also which general beliefs, have an influence on perceived usefulness and if perceived usefulness is a mediator between the general beliefs and intention to use. In the next section, the hypotheses in the models will be discussed.

3.1.1. The effect of Perceived usefulness on intention to use

According to Davis (1989) the main contributor to actual use of a new technology is its perceived usefulness. Therefore, people primarily adopt new technology based upon their functions, rather than based on how easy it is to perform the functions. Users of the product are willing to adopt a difficult system if it captures a critical function (Godoe & Johansen, 2012). In this study's predictive setting, perceived ease of use is left out of the model due to the unavailability of the product. Although Davis' original model used actual use, it can to some extent be compared to intention to use and also the literature review pointed out that several other studies also used the intention to use construct. Therefore, this study hypothesised:

***H1a**. The perceived usefulness among physicians will have a positive effect on behavioural intention to prescribe an artificial pancreas*
***H1b.** The perceived usefulness among diabetes patients will have a positive effect on behavioural intention to use an artificial pancreas*

3.1.2. The effect of optimism on perceptions of technology acceptance

Optimism is defined as "a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives" (Parasuraman & Colby, 2001, p. 34). It generally captures positive feelings about technology. Carver, Scheier, and Segerstrom (2010) state that higher levels of optimism have been related prospectively to better subjective well-being in times

of adversity or difficulty (i.e., controlling for previous well-being). In addition, optimism has been linked to higher levels of engagement coping and lower levels of avoidance, or disengagement coping. Furthermore, there is evidence that optimism is associated with taking proactive steps to protect one's health, whereas pessimism is associated with health-damaging behaviours (Carver et al., 2010). Similarly, Walczuch et al. (2007) state that optimists use more active coping strategies than pessimists and these strategies are more effective in achieving positive outcomes. Also, Taylor, Kemeny, Aspinwall, Schneider, Rodriguez, and Herbert (1992) mention that optimism is inversely related to emotional distress, worry and concern about bad experiences as well as perceived risk, and perceived control. Optimists are less likely to focus on negative events and thus confront technology more openly. They are more likely to accept their situation and less likely to be escapists (Walczuch et al., 2007). Therefore, optimists are more willing to use new technologies (Scheier & Carver, 1987). In short, based on the identified TR traits, a technologically optimistic person is more likely to assume a more positive outlook about his or her chances of success. An optimistic person is more likely to trust a new technology because, by nature, this person worries less about possible negative outcomes in an unknown situation (Lu et al., 2012; Walczuch et al. 2007). To conclude, in relation to this study's context, optimist people are more likely to adopt new technologies such as the AP. Thus, this study hypothesised:

H2a. *Optimism among physicians will have a positive effect on perceived usefulness*
H2b. *Optimism among diabetes patients will have a positive effect on perceived usefulness*

3.1.3. The effect of innovativeness on perceptions of technology acceptance

Consumer innovativeness has generally been conceptualized as a personality trait as well as a cognitive style (e.g., Goldsmith & Hofacker, 1991; Midgley & Dowling, 1993). Parasuraman and Colby (2001) define innovativeness as "a tendency to be a technology pioneer and thought leader" (p. 36). Or more simply stated a persons' tendency to try out new things (Hirschman, 1980; Shih & Venkatesh, 2004). Similarly to Parasuraman and Colby (2001) several other researchers also argue that innovativeness is best conceptualised as a generalised predisposition to try new things or technology (e.g., Im, Bayus, & Mason, 2003; Steenkamp, Hofstede, & Wedel, 1999; Tellis, Yin, & Bell, 2009). These researchers suggest that innovative consumers are generally more accepting of risk, more eager to try new things, and more likely to share their discoveries with others (Im, Bayus, & Mason, 2003). So innovativeness generally measures to what degree individuals perceive themselves as being at the forefront of technology adoption. The relation between innovativeness and consumer behaviour is a widely studied phenomenon in several domains such as the interactive marketing domain. For example, Thogersen, Haugaard, and Olsen (2010) found that innovativeness was a significant predictor in the early adoption of a new pro-environment innovation. There is a difference between global innovativeness and domain-specific (e.g., clothing) innovativeness. Previous research provides evidence that domain-specific innovativeness has higher predictive power than global innovativeness when applied to any specific innovation adoption decision (Goldsmith & Hofacker, 1991; Im, Bayus & Mason, 2003). Technology-based products (such as the AP) constitute a domain, since they share the common characteristics that define technology, namely, application of engineering knowledge and automatic operations (Lam et al., 2008). Therefore, this study's context can be defined as the technology domain. Lam et al. (2008) state that a positive relationship between innovativeness specific to the technology domain (i.e., the innovativeness dimension of TR) and technology acceptance is likely to exist. However, there is also contradicting evidence to the aforementioned

arguments. Walczuch et al. (2007) found that a person's innovativeness negatively impacts perceived usefulness which resulted in a rejection of the hypothesis. Walczuch et al. (2007) mention that it is possible that innovative people are more critical towards technology since they are aware of the newest developments and possibilities and expect all technology to fulfil highest demands. However, as discussed, most literature clearly suggests evidence for a positive relation here and above all, the explanation of Walczuch et al. (2007) is too general to be conclusive in this specific context of diabetes and healthcare. Therefore, the next hypotheses are:

H3a. *Innovativeness among physicians will have a positive effect on perceived usefulness*
H3b. *Innovativeness among diabetes patients will have a positive effect on perceived usefulness*

3.1.4. The effect of insecurity on perceptions of technology acceptance

Unlike optimism and innovativeness, which are drivers of TR, insecurity and discomfort are inhibitors of TR (Son & Han, 2011). Insecurity in this context stands for the distrust of technology for security and privacy reasons (Parasuraman, 2000). Meuter et al. (2005) suggest that technology anxiety causes people to entail negative comments on new technologies; attempts to reduce the amount of time spent using new technology, and even make them avoid new technology. Insecurity focuses on specific aspects of technology based transactions, rather than a lack of control over new technology in general (Son & Han, 2011). Consumers with a sense of insecurity are in general sceptical about new technologies and feel uncomfortable with them. Consequently, the consumers become suspicious of new functions and reduce trials to accept and use them (Son & Han, 2011). In the context of the AP, this paper predicts that higher levels of insecurity decrease the perceived usefulness and intention to use/ prescribe the AP. Therefore, the next hypotheses are:

H4a. *Insecurity among physicians will have a negative effect on perceived usefulness*
H4b. *Insecurity among diabetes patients will have a negative effect on perceived usefulness*

3.1.5. The effect of discomfort on perceptions of technology acceptance

Discomfort is defined as "a perceived lack of control over technology and a feeling of being overwhelmed by it" (Parasuraman & Colby, 2001, p. 41). This dimension generally measures the fear and concerns people experience when confronted with technology. Mukherjee and Hover (2001) state that discomfort represents the extent to which people have general fears of technology-based products and services, believing that the products and services lead to learning costs and comprehension difficulty. Consumers who score high in discomfort perceive new technology as more complex and often causing reactions ranging from aggravation to disappointment (Mick & Fournier, 1998). Therefore, customers with a high level of discomfort use technology-based products and services less frequently than originally intended. However, Son and Han (2011) mention that basic functions are usually less complex and do not require as much knowledge as innovative functions, which would make the customers with high levels of discomfort focus on basic functions. Therefore, this study suggests the following hypotheses:

H5a. *Discomfort among physicians will have a negative effect on perceived usefulness*
H5b. *Discomfort among diabetes patients will have a negative effect on perceived usefulness*

3.1.6. The effect of compatibility and complexity on perceptions of technology acceptance

In chapter 2 it is discussed that based upon Rogers' (2003) factors that influence an innovations' successful introduction only two factors are presumed to be eligible for testing in this context, namely, complexity and compatibility. In short, it is expected that a high perceived complexity rate of the AP will negatively impact perceived usefulness of the AP because if an individual finds an innovation complex than it is assumed that the person will be less likely to perceive the product as useful. And on the other hand, when a new innovation is not compatible with a person's lifestyle or routine, the person will be reluctant to perceive the AP as useful. Therefore, a high compatibility rate will positively influence perceived usefulness. Thus the last hypotheses are:

H6a. *Compatibility of the AP among physicians will have a positive effect on perceived usefulness*
H6b. *Compatibility of the AP among diabetes patients will have a positive effect on perceived usefulness*

H7a. *Complexity of the AP among physicians will have a negative effect on perceived usefulness*
H7b. *Complexity of the AP among diabetes patients will have a negative effect on perceived usefulness*

4. Methodology

4.1 Research strategy and context

The purpose of this study is to show that the technology readiness dimensions influence technology acceptance among diabetes patients and physicians. In this context the mediator is the perceived usefulness of the AP and the dependent variable is a person's behavioural intention to use the AP. An extensive literature review was conducted in coordination with a group of Bachelor students at the University of Twente and this yielded in the outcome that most comparable studies in the field of Technology Readiness and Technology Acceptance administered surveys for their analysis. Therefore, the literature research focused on gathering the most relevant and good (i.e., in terms of validity and reliability) questionnaires in the fields of technology acceptance and technology readiness to compare the constructs and make decisions on possible adaptations and suitability of the items in the AP context. All constructs for the variables were combined into one central Google docs file and constructs were rated regarding their reliability indicators and context suitability. Finally, a list was constructed with all relevant variables with a Cronbach's alpha exceeding 0.7 and redundant items for the study were left out of the construct. Multiple meetings were held between University staff and students to discuss the best possible structure. Most constructs had around four to seven items. Furthermore, all reversed scored items were excluded by rephrasing the items from negative to positive or vice versa. This is discussed further in the next section. The construct of the variables in both the TR model and the TAM were combined into one survey which was ready to be formed into the research instrument for this study. The context of this study is the healthcare sector. More specifically, (innovative) diabetes management. Furthermore, the Artificial Pancreas can be classified as an innovative product yet to be introduced into the market. This study aims to discover patients' and physicians' technology readiness in general and technology acceptance of the AP among patients and physicians. In the patients' respondent group, the intention to use the AP is measured and among physicians their intention to prescribe the AP is measured.

4.2 Participants' samples

In this study, surveys were administered among Dutch and German respondents mainly residing in the Netherlands, Belgium, Germany, and Austria. A quantitative research method was conducted for this study, based upon online questionnaires. No paper-pencil questionnaires were used since the patients group could be accessed through the Inreda Diabetics database via their email addresses and the physicians were accessed through an extensive desk research for the Netherlands area as well as Germany and Austria by internet and making phone calls to hospitals to obtain email addresses. Physicians were categorised on the speciality "endocrinology" and therefore, only physicians with this specialty were eligible for filling in the survey. In the Netherlands, email addresses were mostly retrieved by using Zorgkaart Nederland (n.d.), in Germany DiabSite (n.d.) was used, and in Austria Arztverzeichnis (n.d.) was used. It proved easier to retrieve email addresses in Germany and Austria due to the high rate of private clinics in these countries. In the Netherlands, most endocrinologists work in hospitals so therefore the general phone number had to be called to be referred to the internal healthcare department. Furthermore, other people involved in the development of the Artificial Pancreas were also contacted. For example, van Bon (2011), who wrote a dissertation on future acceptance of the AP, also collaborated as well as her colleagues. This intensive sampling method proved to be very effective since this yielded in a total of 123 Dutch diabetes specialists' email addresses. German and Austrian physicians were easier to retrieve and therefore a total of 436 (i.e., 241 German diabetes specialists and 195 Austrian internists specialising in diabetes) email addresses of German and Austrian physicians were retrieved. The patients sample was retrieved through the Inreda Diabetics database. Since 2013, Inreda Diabetics started to gain widespread media attention throughout the Netherlands. After a number of television show appearances of director Robin Koops and his team and by winning the prestigious Rabobank "Herman Wijffels" innovation price, many diabetes patients volunteered at Inreda Diabetics to participate in future studies. A list of patients was sorted out by students of the University which resulted in a sample of 595 diabetes type 1 patients who can be invited to participate in this study. Because these patients were retrieved through the network, this sample could be argued as being biased in answering some of the constructs used in this study. This is discussed further in the limitation section.

4.3 Instrument development

In this study a survey was administered to test respondents' opinion on technology in general and its relation towards accepting the AP. 7-point likert scales were used ranging from highly unlikely or "strongly disagree" to highly likely or "Strongly agree". A 5- or 7-point scale is also used in most studies in the literature review. As mentioned in the previous section, only existing scales were used whereas for the technology readiness constructs optimism, innovativeness, discomfort, and insecurity the scales were adapted from the main articles in the field of technology readiness (e.g., Godoe & Johansen, 2012; Walczuch et al., 2007; Parasuraman, 2000). The field of technology acceptance is more extensive and therefore many sources were used (e.g., Hu et al., 1999; Davis, 1989; Venkatesh & Davis, 2000; Moore & Benbasat, 1991). Several steps in the development of the instrument, such as, item requirements, item selection, instrument testing, item adaptations, and questionnaire construction are discussed in the next sections.

4.3.1 Item requirements

Measurement instruments that are collections of items combined into a composite score and intended to reveal levels of theoretical variables not readily observable by direct means are often referred to as scales (DeVellis, 2012). In the literature, there are many books describing scale development (e.g., DeVellis, 2012; Dijkstra & Smit, 1999). Examples of item requirements are to never use denying words or ambiguous ranking words, and to not use motivations for an answer (Dijkstra & Smit, 1999). In short, scale development is complicated, tedious and time consuming. Since this study is dealing with patients and physicians the standards for the survey are high and thus only validated and reviewed scales are used.

4.3.2 Item selection and instrument testing

For this study, existing items were placed in a common pool and subjected to two rounds of sorting by researchers and students to establish which items belong in which scale. Items were checked regarding their applicability, adaptability and suitableness. Analysis indicated several bad items not applicable in this research context. Also several items showed weaknesses in some of the constructs' original definitions. These were subsequently redefined. All constructs used were previously tested showing a very high reliability and validity was also further checked using factor analyses. The result is a parsimonious 38 item instrument comprising eight scales which provided a useful tool for the study of technology readiness and technology acceptance of innovations. In table 4.1 all original constructs used in this study are shown and their reduced length is also shown in comparison to their original length. Furthermore, all reversed scored items were left out of the survey and were rephrased to avoid confusion among respondents. This exclusion of reversed scored items also made it possible to calculate mean scores for the TRI index which are necessary to determine TR states among patients and physicians.

Table 4.1: Overview constructs used in the study

Scale	Original length	Reduced length	Source
Optimism	10	6	Godoe & Johansen(2012); Parasuraman (2000)
Innovativeness	7	5	Lin & Hsieh (2005); Parasuraman (2000)
Insecurity	10	7	Parasuraman (2000)
Discomfort	6	5	Lam et al. (2008); Parasuraman (2000)
Complexity	4	4	Venkatesh et al. (2003); Thompson et al. (1991)
Compatibility	3	3	Venkatesh et al. (2003); Moore and Benbasat (1991)
Perceived usefulness	6	6	Venkatesh et al. (2003); Venkatesh & Davis (2000)
Intention to use	2	2	Venkatesh & Davis (2000)
Total	**48**	**38**	

4.3.3 Item adaptations to the context of the Artificial Pancreas' Acceptance

The items were not only reduced, but also some items were adapted to the context of the artificial pancreas. Since all original scales often apply to an information system or technology, scales had to be adapted to the context of the AP. An overview of the original and adapted Technology Readiness constructs is shown in appendix I. Since the TRI is measuring a persons' general believe or attitude towards a system or technology the same constructs were used with both respondent groups of physicians and patients. In addition, since the TRI is measuring technology in general, few adaptations were necessary. However, some items had to be rephrased in order to exclude the reversed scores in the construct of insecurity items. Since the questionnaires were distributed among Dutch speaking patients and physicians and German speaking physicians, they were all translated to Dutch and German from English. All items in English, Dutch, and German with their universal codes can be found in Appendices A and B. All items were coded the same in order to ensure a smooth integration of the survey afterwards. This is discussed further in the next

section. Since the model of patients included more variables and different adjustments than the physicians, the surveys for both respondent groups were not identical (apart from the TRI constructs) in length and content. Appendix J gives an overview of item adaptations made for both patients and physicians.

4.3.4 Questionnaire construction

It has to be noted that the questionnaire used contained more scales since other studies were also involved in the project. All scales used in the complete questionnaire can be found in appendices A and B. All items were coded since there were four questionnaires which had to be combined after exporting all the data. However, for this study, the German patients were not included and therefore three questionnaires in total were distributed. The German physicians' results had to be combined with the Dutch physicians' results. In order to ensure a smooth integration, the questions in the constructs were coded the same. For example, compatibility item 1 was coded COM_01. And discomfort item 1 was coded ONG_1, where ONG stands for the Dutch word of discomfort, "Ongemak". These codes are given before every item in appendices A and B. Once the survey was ready to be implemented, the programme of "IGS Limesurvey" was used to distribute and monitor the survey. This programme is widely used in research at the University of Twente as well as by Inreda Diabetics' researchers in prior studies.

4.4 Pre-test questionnaire

The questionnaire was revised by a group of five University bachelor students, one Master student, one doctor, and one PhD student. Also, the survey constructs and items were revised by a representative of Inreda Diabetic. Furthermore, after implementation into the survey programme, the questionnaire for the patients was tested by two diabetes patients and the questionnaire for the physicians was tested by one GP assistant. After the testing rounds, some answer options and items were adapted. These include:

- In the first draft, the dependent variable for physicians was the same as the patients, namely, intention to use the AP. However, it was noted that physicians do not use the AP themselves but instead they prescribe it to their patients. The dependent variable was therefore changed to "intention to prescribe the AP".
- The variable "costs" was left out due to an overlap with Perceived Usefulness.
- In the physician questionnaire, respondents were asked in what type of hospital they were working. However, it was noted by German reviewers that the structure in the Netherlands and Germany cannot be considered the same. Therefore, other answer options were included for the German questionnaire. E.g., opposed to the Netherlands, in Germany many physicians work in private clinics whereas in the Netherlands physicians often work in hospitals.
- Several constructs used in the survey proved to be not applicable to every respondent. Since answering was mandatory in each question group, this could lead to invalid answers. Therefore, in some constructs the option "8" (i.e., not applicable) was added to the answer options.

4.5 Control variables

In the patients group, additional characteristics that could have an influence on perceived usefulness and eventually intention to use are the age of the participants, their diabetes treatment method and their sex. Therefore, this study controls for variation of treatment method by including two dummy variables for insulin pens and a combination of insulin pump with CGM. Furthermore, it controls for respondents' sex and age. For example, regarding sex, Ajzen and Fishbein (1969) researched that sex could have an influence on behavioural choices and they analysed differences in attitudes and normative beliefs towards single, dichotomous, and multiple behavioural choices. In the physician group, additional characteristics that could have an influence on perceived usefulness and eventually intention to use are the awareness of the AP, their sex, and their number of years' experience as a physician. Therefore, these variables are controlled. For example, Rogers (2010) mentions that the awareness of a new technology or innovation is often used by scientists to explain the beginning of the acceptance of an innovation.

Regarding the control variables that have more than two categories, it is necessary to create dummy variables (Field, 2009). Both the patients' treatment method and the physicians' number of years' experience have more than two variables and therefore new dummy variables were created and assigned either the value of 0 or 1. For diabetes treatments the reference, or baseline, group was set on patients who use an insulin pump. According to Field (2009) it is interesting to compare groups to the baseline group, which often has the most users. Most patients indicated to use an insulin pump so two dummy variables were created, one for use of an insulin pen, and another one for the use of an insulin pump in combination with a continuous glucose monitor. Furthermore, regarding experience as a physician, most physicians indicated to be active more than 15 years in their profession. Therefore, this group is set as the reference group and three control variables were created for 0-5 years' experience, 6-10 years' experience and 11-15 years of experience. The other control variables consisted of two categories. Sex (1 = female, 2 = male), awareness (1 = yes, 2 = no) and age was a continuous variable. This is important when interpreting the data.

4.6 Data collection

Once the survey was ready and tested, the survey was administered into the Limesurvey programme and subsequently sent out to all respondents. All invitations to the 595 Dutch diabetes patients and 559 Dutch, German and Austrian physicians were sent through the Limesurvey programme. Respondents were first persuaded through a short invitation text indicating the relevance of the study. These invitation texts can be found in appendices F, G, and H. After the respondent decided to participate in the study they were redirected to another page where they were presented with a more elaborate introductory text including visually appealing pictures to make it more understandable and persuasive. The introductory texts can be found in appendices C, D, E. The Limesurvey programme can be used to monitor how much response is given after the invitations are sent. For this study, during the period of three weeks after the initial invitation, reminders were sent in order to obtain the highest possible response rate.

4.7 Data analysis

For this study, the statistical analyses which needed to be conducted after the gathering of the data will be done using SPSS, analysis software which is widely used in several research settings. The Limesurvey programme was also chosen because it has the option to easily transport data from the

programme to SPSS. Therefore, the researcher does not have to code, or implement, all answers manually. Because in all three questionnaires the same codes were used, a very smooth and fast combination of data is possible. A structural approach will be used analysing the data. The first step is to carefully test all the items' validity using principal component analyses. In the second step it is necessary to test the reliability of the constructs based upon the factor analysis. Third, hierarchical multiple regression analyses are performed to test the hypotheses. Also a mediation analysis is done to test for possible mediating effects.

5. Results

5.1 Descriptive statistics, validity, reliability, regression, and mediation analyses

Because this study is dealing with two respondent groups the results of both the patients and the physicians will be discussed separately in this chapter. First it is important to identify all who participated in this study using descriptive statistics in the SPSS programme. Questions that fell under the demographical variable included sex, age, participation in a clinical trial, profession, number of years of diabetes, and country of residence. These items were included in all surveys to contribute in identifying the participants. As discussed in the methodology, in the physician group, the variables awareness, sex, and years of experience are controlled and in the patients' group the variables diabetes treatment method, sex, and age. Furthermore, even though existing scales and items were used for both questionnaires, it is still necessary to perform validity and reliability analysis to ensure the sample is adequate for analysis and to see if the reliability is still high after adaption to the artificial pancreas' context. Therefore, factor analyses are performed for both respondent groups and after item reduction the reliability analyses are run. After careful testing and item reductions, items are combined into their original constructs and multiple regression analyses are performed to test all hypotheses outcomes. First of all, the physician group is treated. What is important to note before discussing the results is that due to a sample size of 66 physicians in the Netherlands, Germany, and Austria this study conservatively removes the two variables complexity and compatibility from further analysis. The "rule of thumb" is to have at least 10 participants per variable to be able to perform sound analyses (Field, 2009). Regarding the variable intention to use it has to be noted that within the physician group intention to prescribe is measured but for the analyses these terms are used as interchangeable.

5.2 Results physicians

5.2.1 Descriptive statistics physicians

In the German and Austrian physician group there were in total 33 responses of which 25 were fully completed surveys. In the Dutch survey there was a total response of 60 physicians but only 41 physicians completed the survey. It has to be noted that emails were only sent to Dutch physicians but in the survey respondents were asked in which country they were residing and thus a physician working in the Netherlands could very well live in Belgium and a physician working in Germany could also live in Austria. This study only used the completed questionnaires because the incomplete survey only contained the first question or variables and thus they were excluded from the sample. Therefore, a total sample of 66 physicians is available for research to test the influence of the four TRI dimensions on the two TAM dimensions.

Table 5.1: Physicians Distribution of Sex (N = 66)

	Frequency	**Percentage**
Male	35	53.0%
Female	31	47.0%
Total	**66**	**100%**

The physician group consisted of 35 male physicians (*n* = 35*)* and 31 female physicians (*n* = 31) and thus a sample of 66 completely filled in the surveys (*N* = 66). So this sample has a fairly equal distribution of sex. Also, as shown in table 5.3, 50% (*n* = 33 of the respondent group indicated to have been active in its current profession for more than 15 years and 33.4% (*n* = 22) indicated to have been active between 6 and 15 years indicating an experienced group of diabetes specialists who participated in this study.

Table 5.2: Physician Distribution of Age (N = 66, Missing = 1)

	Age in years
Minimum age	28
Maximum age	64
Standard deviation	10.3
Mean	47

Table 5.3: Physicians, Number of years active in profession (N = 66)

	Frequency	**Percentage**
0 - 5 years	11	16.7%
6 - 10 years	11	16.7%
11 - 15 years	11	16.7%
More than 15 years	33	50%
Total	**66**	**100%**

As depicted in table 5.2 the mean age of the sample was 47 years old. Furthermore, physicians in four countries were surveyed, namely, the Netherlands (*n* = 40), Germany (*n* = 15), Austria (*n* = 10), and Belgium (*n* = 1) as depicted in table 5.4. As discussed in the methods a total of 437 surveys were sent to German and Austrian physicians and 124 to Dutch and Belgium physicians. In total 25 of the 437 (i.e., 242 German and 195 Austrian physicians) completed the survey which yields in a response rate of (25 / (242+195)) x 100% = 5.72%. The Dutch and Belgium group consisted of a sample of 124 physicians. The response rate of this group was (41/ (124)) x 100% = 33.06%. Therefore, a total response rate of the whole physician sample is (66/ (124+242+195)) x 100% = 11.76%. An explanation of this large difference between response rates between countries can almost certainly be attributed to a number of reasons. Firstly, the German and Austrian respondent groups' email addresses were both retrieved through the internet with almost no cold acquisitions by phone. On the other hand, in the Netherlands most physicians work in a hospital and email addresses had to be retrieved using cold acquisition by phone. This more personal approach proved to be much more effective. Secondly, the AP has already been in the media (i.e., television shows and newspapers) several times in the Netherlands and therefore the awareness was higher. This study also measured awareness rates among respondents as shown in table 5.4. In the sample, 36 of the 40 (90%) Dutch respondent indicated to have heard or read something

about the AP before filling in the questionnaire. Of the 15 German physicians only 5 (33.3%) indicated to have heard or read something about the AP before filling in the questionnaire. Interestingly all 10 Austrian physicians in the sample indicated to have heard or read something about the AP before filling in the survey. Therefore, a total of 77.3% of all respondents who filled in the survey indicated to have heard or read about the AP before filling in the survey and only 22.7% indicated that they never heard or read about the AP before. In table 5.5 the difference between awareness and means of intention to prescribe and perceived usefulness of the AP are shown. With a mean difference of .410 physicians who are aware of the AP also are more likely to prescribe the product. On the other hand, there was not much difference between awareness and means of perceived usefulness.

Table 5.4: Physicians' Awareness of the AP and distribution of country of residence

	Awareness of the AP before filling in the survey			
	Yes	**No**	**Country total**	**Percentage**
Netherlands	36 (54.5%)	4 (6%)	40	60.6%
Belgium	0 (0.0%)	1 (1.5%)	1	1.5%
Germany	5 (7.7%)	10 (15.1%)	15	22.7%
Austria	10 (15.1%)	0 (0.0%)	10	15.1%
Total	**51 (77.3%)**	**15 (22.7%)**	**66**	**100%**

Table 5.5: Difference between awareness of physicians and intention to prescribe and perceived usefulness (N = 66)

Awareness of the AP		**Intention to prescribe**	**Perceived usefulness**
Yes	Mean	5.510	4.631
	S.d.	1.134	1.141
No	Mean	5.100	4.520
	S.d.	.930	.970
Total	Mean	5.417	4.606
	S.d.	1.097	1.099

Lastly, this research also sets a base for further research and included variables which could be useful to add to the managerial implications in this research and ultimately contribute to draft a sound dissemination strategy for Inreda Diabetic's AP. Therefore, this study included the variable "communication channels" through which physicians are usually notified regarding new medical innovations such as the AP. In table 5.6, the results give a good indication on which communication channels Inreda Diabetic should focus. 86.4% (n = 57) of the physicians indicated to receive awareness of a new (medical) innovation through conferences. Also 84.8% (n = 56) indicated to read (medical) journals and get alerted through this channel. The third most popular channel to hear or read about medical innovation is through the colleague network, namely, 72.7% (n = 48). Other channels include newsletters (n = 32, 48.5%), websites/ social media (n = 27, 40.9%), company representatives such as medical supplier' sales men (n = 22, 33.3%) fairs (n = 17, 25.8%), and blogs (n = 2, 3.0%). In a physician context, blogs have proven to be a very ineffective channel to write about the AP. Respondents also used the option "other" if the used channel was not present in the answering options. Other, less frequently used communication

channels are congresses and (professional) medical trainings. In the next section, and appendix K the most effective communication channels are added to the physicians' technology readiness profiles and in chapter six these are discussed further in the managerial implications.

Table 5.6: Physicians' Communication channels (N = 66, multiple answers per respondent)

	Frequency	
Communication channel	**Yes**	**No**
Journals	**56 (84.8%)**	10 (15.2%)
Fairs	17 (25.8%)	49 (74.2%)
Conferences	**57 (86.4%)**	9 (13.6%)
Representatives	22 (33.3%)	44 (66.7%)
Colleagues	**48 (72.7%)**	18 (27.3%)
Websites/Social Media	27 (40.9%)	39 (59.1%)
Blogs	2 (3%)	64 (97%)
News letters	**32 (48.5%)**	34 (51.5%)

5.2.2 Physician persona

Since the main aim of this study is to measure the effects of the technology readiness dimensions on technology acceptance of an AP it is also interesting to sketch technology readiness profiles of the stakeholders in this paper. As became evident in the literature review, Lam et al. (2008) state that the generalised effect of the four TR constructs implies that once marketers have established the profiles of potential adopters on these constructs, they can use this information to predict the acceptance of various types of technology-based offerings. Furthermore, such knowledge can also help marketers in formulating and fine-tuning their product-positioning and communication strategies to match the TR profiles of potential customers in different stages of the product life cycle (Lam et al., 2008). Technology readiness profiles can be determined on the basis of the samples' mean score on all four technology readiness dimensions. As discussed in the literature review, the two TR dimensions optimism and innovativeness are drivers of TR and therefore a high score on these constructs indicates a high level of TR. Since this study used a 7-point Likert scale a mean score of one would indicate a very low technology readiness state and a seven would indicate a very high technology readiness state whereas a score of three and a half would be the average. This approach is possible, since all reversed scored items were rephrased and therefore excluded in this study.

To describe the physician group and their technology readiness state, a persona will be described. In the field of human-centred design, Maguire (2001) describes personas as means of representing users' needs to the design team by creating caricatures to represent the most important user groups. A persona is always a fictive representation of the user group. In this case, the physicians are not the user group but are determined an important stakeholder in the adoption process of the AP. From a managerial perspective this could be useful in the context of the AP. For example, before drafting a dissemination plan, it could be useful to get an understanding of the technology readiness state of important stakeholders and through which medium to communicate with them. All the means and correlations can be found in table 5.10 but for convenience purposes they are also displayed in table 5.7. The persona description for physicians can be found in Appendix K.

Table 5.7: Physicians' means technology readiness dimensions (*N* = 66)

	Optimism	Innovativeness	Insecurity	Discomfort
Mean	5.270	4.697	3.459	3.227
Std. Deviation	0.961	1.0933	1.1836	0.8931

Therefore, based upon these study's results, physicians in the Netherlands, Germany, and Austria are considered to have a moderate to higher technology readiness state because both drivers of TR are well above average and the two inhibitors of TR are around average. In the managerial implications it is discussed on how this information could add value to a positioning or communication strategy. Next, the validitity and reliability of the questionnaire is discussed.

5.2.3 Validity physicians

A principal component analysis (PCA) was conducted for the physicians' model which in total comprised of 31 items. Field (2009) suggests that in practice, orthogonal rotations are not realistic to use in data involving humans. Therefore, this study used the principal component analysis with oblique rotation, i.e., direct oblimin rotation, and tested this on all TR and TAM items with regards to the physicians' sample.

Before the factor analysis is discussed it is important to test for assumptions of the factor analysis. This can be done using *Bartlett's test.* If Bartlett's test is significant then it means that the correlations between variables are (overall) significantly different from zero so this is good news (Field, 2009). The Bartlett's test of sphericity was significant ($\chi 2$ (909) = 276 df, $p < .001$) indicating that correlations between items were sufficiently large for PCA. Furthermore, Kaiser-Meyer-Olkin measure of sampling adequacy was .759 which is well above the commonly recommended value of 0.5. Kaiser (1974) recommends a level above 0.5 as sufficient and a value between 0.7 and 0.8 as good. Therefore, a value of .759 reflects a sample size which is adequate for a factor analysis and furthermore indicates that the identified factors are unique and reliable. It is common that researchers take a loading of an absolute value of more than 0.4 to be important (Field, 2009). Therefore, to be conservative, in the factor analysis, all factors below 0.3 are suppressed. However, as discussed, Stevens (2002) also mentions that the significance of the factor loading will also depend on the sample size. This study has a sample of 66 physicians. Stevens (2002) recommends that for a sample size of 50 a loading of .722 can be considered significant and for a sample of 100 the loading should be greater than .512.

An initial analysis was run to obtain eigenvalues for each component in the data. 8 components had eigenvalues over Kaiser's criterion of 1. Variables were excluded step-wise, i.e., factor loadings were excluded according to their loadings where the lowest factor loadings are excluded first. In total, 7 rounds of analyses were performed with in total 7 items excluded. In appendix I, there is an overview of exactly which items were excluded. These are also discussed in the next paragraphs. Also in the last round only 6 components remained with eigenvalues larger than 1 (instead of 8 components) which is the same number as the variables that are in the physician model. The six components together explained 70.94% of the variance. In short, the total number of 31 items used for the factor analysis is reduced to a total of 24 items which are used for further analysis.

Table 5.8 shows the results from the factor analysis for both the TRI dimensions and the TAM variables. Because several items clustered on the same components this suggests that component 1 represents perceived usefulness, component 2 represents optimism, component 3 innovativeness, component 4 insecurity, and components 5 and 6 represent intention to use and discomfort respectively. As discussed, seven low loading items were excluded step by step which resulted in a factor analysis of all items being above .553. As can be deducted from table 5.8 most items loaded onto one factor and all five items of optimism loaded on one factor with all values exceeding .575. One out of five items was excluded from innovativeness (INN_1) and only three out of seven loaded onto discomfort and therefore the remaining four were excluded (ONG_04, ONG_05, ONG_06, and ONG_07). Furthermore, four out of five items loaded on insecurity and one was excluded (ONZ_03) and five out of six loaded on perceived usefulness and also here one was excluded (VN_06). In appendix I all excluded items can be found. Other reasons for excluding the variables are now discussed.

Several reasons for excluding the items are now discussed. VN_06 was "I expect that using the artificial pancreas would make it easier to do my job" so this item with a low factor loading proved to be the only which did not group together with the other items in perceived usefulness. It could be that the question is too ambiguous since the AP will not be directly used by physicians so it is not plausible that an AP would make the job of a physician easier. Also, INN_01 had a very low factor loading of <.3 and was the statement "Other people come to you for advice on new technologies". Also compared to other items that belong to innovativeness, this item can be excluded in the sense that one does not automatically think of innovativeness when looking at the questions compared to the other items. ONG_04, "If you buy a high-tech product or service, you prefer to have the basic model over one with a lot of extra features", ONG_05, "There should be caution in replacing important people-tasks with technology because new technology can breakdown or get disconnected", ONG_06, "Many new technologies have health or safety risks that are not technology work for you", and ONG_07, "Technology always seems to fail at the worst possible time". In this construct 4 out of 7 did not load significantly and most had extreme low factor loading of <.1. It appeared that these four items did not belong to any construct in the model and the extreme low factor loadings suggests these items could be a problem when used for further analysis. It can also be noted that these items are not automatically linked to discomfort. For example, ONG_07, "Technology always seems to fail at the worst possible time" is not likely to describe a feeling in general, but more a few annoying experiences. In addition, in the patients group, this construct also showed problems with low factor loadings. It could be that it is difficult to determine that these excluded items, which are adapted to this context, are clearly measuring discomfort. This is also discussed further in the limitation section. Lastly, ONZ_03, "It can be risky to switch to a revolutionary new technology too quickly", was excluded due to a very low factor loading. One could argue that the word "risky" can be interpreted in many ways and is therefore ambiguous. In general, the items also had low factor loadings due to the sample size. In the patients sample there are 398 respondents which resulted in much higher factor loadings and only two exclusions because of low factor loadings. So the sample size could very well have played a role in the lower factor loadings.

Table 5.8: Physicians Factor analysis

TR Dimensions	PU	OPT	INN	INS	ITU	DIS
Optimism						
1. Technology gives people more control over their daily lives	,331	**,575**				
2. Products and services that use the newest technologies are much more convenient to use		**,908**				
3. You prefer to use the most advanced technology available		**,827**				
4. Technology makes you more efficient in your occupation		**,647**				
5. Technology gives you more freedom of Mobility		**,793**				
6. You feel confident that machines will follow through with what you instructed them to do		**,751**				
Innovativeness						
7. In general, you are among the first in your circle of friends to acquire new technology when it appears			**-,723**			
8. You can usually figure out new high-tech products and services without help from others			**-,796**			
9. You keep up with the latest technological developments in your areas of interest			**-,744**			
10. You find you have fewer problems than other people in making technology work for you			**-,823**			
Discomfort						
11. Technical support lines are not helpful because they do not explain things in terms you understand						**-,721**
12. Sometimes, you think that technology systems are not designed for use by ordinary people						**-,928**
13. There is no such thing as a manual for a high-tech product service that is written in plain language					-,322	**-,703**
Insecurity						
14. Critics lead people to believe that revolutionary new technologies are less safe than they usually are				**-,759**	,341	
15. A machine or computer is going to be less reliable in doing a task than a person				**-,713**		
16. If you buy products that are too high-tech, you may get stuck without replacement parts or service.				**-,553**		
17. Technological innovations always seem to hurt a lot of people by making their skills obsolete.				**-,710**		
Perceived usefulness						
18. I expect that using the artificial pancreas improves my performance in daily life	**,805**					
19. I expect that using the artificial pancreas in my daily life increases my productivity	**,754**					
20. I expect that using the artificial pancreas enhances my effectiveness in daily life	**,839**					
21. I expect that using the artificial pancreas will be useful in my daily life	**,694**					
22. I expect that using the artificial pancreas would enable me to accomplish tasks more quickly	**,661**				-,319	
Intention to use						
23. Assuming I have access to an artificial pancreas, I intend to prescribe it					**-,821**	
24. Assuming I have access to the system, I predict that I would use it	,327				**-,818**	

Note. Factor loadings that are grouped together are in boldface, factor loadings <.30 are suppressed, OPT = Optimism, INN = Innovativeness, DIS = Discomfort, INS = Insecurity adapted from Godoe & Johansen (2012), Parasuraman (2000), Walczuch et al. (2007), Lin et al. (2007)

5.2.4 Reliability analysis physicians

After the PCA several items had low factor loadings. Therefore, only the 24 items which were not excluded are used in the reliability analysis. As shown in table 5.9, all four TRI dimensions optimism, innovativeness, discomfort, and insecurity had high reliabilities with all Cronbach's α = ≥0.72 and ≤0.89. However, a PCA proved to be necessary because for example discomfort yielded in a Cronbach's α = 0.64 before item reduction. In Parasuraman (2000) the original TRI index reliabilities ranged from 0.74 to 0.81 so analysis shows that also with this physician sample in the AP context the reliabilities are high. The two TAM components perceived usefulness and intention to use both show very high reliabilities with 0.88 and 0.93 respectively.

Table 5.9: Physicians' Reliability Analysis of TRI dimensions and TAM dimensions

TRI Dimensions	Reliability (α)	Items (N)
Optimism	0.89	6
Innovativeness	0.81	4
Discomfort	0.76	3
Insecurity	0.72	4
TAM dimensions		
Perceived usefulness	0.88	5
Intention to use	0.93	2

5.3. Empirical results physicians

5.3.1 Correlations between the variables in the physician model

In table 5.10 a correlation table is seen between all variables in the physicians model including the control variables which are awareness of the AP, sex, and three categories of years of experience as a physician as dummy variables. It seems that there is a significant correlation between perceived usefulness and optimism (r = .431, p <.01), innovativeness (r = .278, p < 0.05), and insecurity (r = -.369, p <.01). Discomfort showed a negative direction as it was hypothesised but there was no significant correlation with perceived usefulness. Also what can be derived from the table is that all correlations seem to be in the right direction. As hypothesised, optimism and innovativeness suppose to have a positive influence on perceived usefulness. In table 5.10 it can be seen that directions are positive for these variables. On the other hand, the variables discomfort and insecurity are hypothesised as having a negative direction. So most correlations seem to be in the same direction as hypothesised. In the next chapter, statistical influences are tested through multiple hierarchical regressions.

Table 5.10: Means, standard deviations, and correlations of the variables (N = 66)

	Mean	SD	PU	ITU	AW	SEX	D1	D2	D3	OPT	INN	DIS	INS
PU	4.606	1.099	1										
Intention to use	5.417	1.097	.526**	1									
Awareness	1.23	0.422	-.043	-.158	1								
Sex	1.53	0.503	-.039	-.016	-.069	1							
Dummy exp1	0.167	0.376	-.002	-.096	.243*	.014	1						
Dummy exp2	0.167	0.376	-.055	.016	-.049	-.149	-.200	1					
Dummy exp3	0.167	0.376	.012	-.134	-.049	-.231	-.200	-.200	1				
Optimism	5.270	0.961	.431**	.237	-.135	-.062	.020	.094	-.127	1			
Innovativeness	4.697	1.093	.278*	.222	-.198	-.157	-.175	.069	.050	-.359**	1		
Discomfort	3.460	1.184	-.232	-.059	.055	-.058	.021	-.060	-.267*	-.008	-.234	1	
Insecurity	3.227	0.893	-.369**	-.275*	.004	-.041	.218	-.034	-.046	-.285*	-.167	.387**	1

Note. * p < .05, ** p < .01, OPT = Optimism, INN = Innovativeness, DIS = Discomfort, INS = Insecurity, PU = Perceived Usefulness, ITU = Intention to Use, AW = Awareness, D1 = 0-5 years experience, D2 = 6-10 years experience, D3 = 11-15 years experience.

5.3.2 Multiple hierarchical regression physicians

Firstly, three regression analyses are performed. It is tested whether the TRI dimensions optimism, innovativeness, discomfort, and insecurity had an influence on perceived usefulness with awareness, sex and years of experience as a physician as control variables in the first step. Also the same control variables and perceived usefulness are tested with intention to use as the dependent variable. Lastly, the influence of the variables optimism, innovativeness, discomfort, insecurity, with age, sex and experience as control variables are tested on intention to use. The last regression is necessary to later test the mediating effect of perceived usefulness for the physicians. This mediation analysis is done in the last chapter.

5.3.2.1 Hypothesis testing for variables predicting perceived usefulness

Several assumptions must be true according to Berry (1993) as stated in Field (2009) before regression can be performed. Thus, before conducting hierarchical multiple regressions, the relevant assumptions of this statistical analysis are tested. First of all, with a sample size of 66 the sample size is adequate taking Field's (2009) rule of 10 per variable into account. The assumption of singularity was also met as the independent variables (optimism, innovativeness, discomfort, and insecurity) were not a combination of other independent variables. Collinearity statistics (i.e., the tolerance and variance inflation factor) were all within accepted limits with values between 0.9 and 1.1 which is all very close to 1. Menard (1995), in Field (2009), mentions that only values below 0.2 are reason for concern. Field (2009) also mentions a possibility of a bias of multicollinearity when values in the correlation matrix exceed the value of 0.9. In table 5.10 it can be seen that no value exceeds 0.9 with the highest correlation size being .526 so a potential bias of multicollinearity can be excluded. Also Mahalanobis and Cook's distance scores showed no multivariate outliers. Durban-Watson showed a value of 2.099 which is very close to 2 which is good (Field, 2009). Lastly, residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied (Field, 2009). The histogram showed almost a perfect normal distribution.

With regards to the physicians, this research aims to reveal whether the predictors' innovativeness, optimism, discomfort, and insecurity influence the perceived usefulness of the AP. Furthermore, as discussed, the variables awareness of the AP, sex, and years of experience are controlled. The correlation matrix in table 5.10 shows that the variables of the TRI, optimism, innovativeness and insecurity correlate with perceived usefulness. The highest correlation is between perceived usefulness and intention to use (r = .526, p = < .01), and optimism (r = .431, p = < .01).

To test the hypotheses, a two stage hierarchical multiple regression is performed of the four predictors optimism, innovativeness, discomfort, and insecurity on perceived usefulness (dependent variable) and the control variables. At stage 1, awareness, experience and sex were entered to control for these variables and to see if more variance is explained by these variables. The regression statistics are shown in table 5.11. As seen in table 5.11, the R^2 for the control variables was 0.8%, so 0.8% is explained by the control variables. The model as a whole predicts 29.5% of the variability in perceived usefulness. So this amount includes all the variables including the control variables. The R^2 change is 28.7% so the predictors optimism, innovativeness, discomfort, and insecurity explained an additional 28.7% of the variance in the

outcome. The ANOVA values showed $F = 2.609$ with $p < .05$. So this proves that this model is a statistically significant predictor of perceived usefulness.

Table 5.11: Physicians' results summary of Hierarchical multiple regression for variables predicting perceived usefulness (model 2 in mediation analysis)

	1			2		
	b	s.e.	*p*	*b*	s.e.	*p*
0 - 5 years experience	-,023	.409	.478	.142	.376	.356
6 - 10 years experience	-,208	.407	.306	-.329	.359	.182
11 - 15 years experience	-,056	.413	.447	-.066	.382	.432
Awareness	-.128	.346	.356	.028	.309	.464
Sex	-.126	.297	.337	-.136	.268	.308
Optimism				.375**	.150	.008
Innovativeness				.124	.131	.176
Discomfort				-.116	.125	.178
Insecurity				-.277*	.165	.050
R^2	.008			.295		

Note: N = 66; **p < .05, **p < .01, ***p< .001 (one sided test)*

Almost the entire 29.5% explained variance can be attributed to the four TRI dimensions and little is explained by the control variables as can be seen in table 5.11. To conclude, these results are now compared to this study's hypotheses for the physicians group. First of all, *Hypothesis 2a* is accepted. In hypothesis 2a it was hypothesised that optimism would positively affect perceived usefulness among physicians. A significant positive effect was found of optimism on perceived usefulness with $b = .375$ and $p < .01$ (one-tailed) and is therefore accepted. Optimism also showed the strongest relationship with perceived usefulness out of all the technology readiness dimensions. Furthermore, *hypothesis 3a* is rejected. A positive effect of innovativeness on perceived usefulness was hypothesised in hypothesis 3a and is rejected. However, there was a positive slope of $b = .124$ so it is possible that with a higher sample it would be accepted. Furthermore, in *hypothesis 4a* insecurity was assumed to have a negative influence on perceived usefulness. With $b = -.277$ and $p < .05$ (one-tailed) a significant negative influence of insecurity on perceived usefulness is found. Lastly, *hypothesis 5a* is rejected and it stated that discomfort was assumed to have a negative influence on perceived usefulness.

5.3.2.2 Hypothesis testing with intention to use as dependent variable

In this analysis, the influence of perceived usefulness is tested on intention to use with the same control variables. Firstly the assumptions for regression are analysed. The collinearity statistics tolerance (0.992) and the variance inflation factor (1.008) were all within accepted limits around the value of 1. Also Mahalanobis and Cook's distance scores showed no multivariate outliers. Durban-Watson showed a value of 1.883 and is thus no reason for concern (Field, 2009). Lastly, also here, residual and scatter plots indicated the assumptions of reasonable normality, linearity and homoscedasticity (Field, 2009).

One of the questions this research aims to reveal is whether the mediator perceived usefulness of an AP by physicians has an influence on the intention to prescribe an AP. Also here, experience, awareness, and sex are controlled. The correlation matrix in table 5.10 shows that there is a high

correlation between perceived usefulness and intention to use which is positive for this study outcome. With $r = .526$, $p = <.01$ it is a high correlation compared to other variables. Furthermore, only insecurity showed a significant negative correlation with intention to use.

To test the hypotheses, also here a two stage hierarchical multiple regression is performed with the perceived usefulness as a predictor of intention to use (dependent variable) and the control variables. At stage 1, experience, awareness and sex were entered as control variables. The regression statistics are shown in table 5.12. The R^2 for the control variables was .060, so 6% is explained by the control variables. The model as a whole predicts 32.8% of the variability in intention to use. The ANOVA values showed $F = 4.800$ with $p < .001$ (one-tailed). So this model is a statistically significant predictor of intention to use.

Table 5.12: Physicians' results summary of Hierarchical multiple regression for variables predicting intention to use

	1			2		
	b	s.e.	*p*	*b*	s.e.	*p*
0 - 5 years experience	-.325	.397	.209	-.313	.339	.180
6 - 10 years experience	-.189	.395	.317	-.081	.338	.406
11 - 15 years experience	-.568	.402	.081	-.540	.343	.061
Awareness	-.387	.336	.128	-.320	.287	.135
Sex	-.174	.289	.275	-,108	.247	.331
Perceived usefulness				.519***	.107	.000
R^2	.060			.328		

Note: N = 66; *$p < .05$, **$p < .01$, ***$p < .001$ (one sided test)*

For the control variables there were no significant relationships with intention to use. However, 6% of the variance explained in intention to use can be attributed to the control variables. Regarding the hypothesis, with a $b = .519$ and $p < .001$ (one-tailed) there is a very significant influence of perceived usefulness of an AP on the intention to use the AP which is also the same as the hypothesis. In *hypothesis 1a* it was hypothesised that the perceived usefulness of the AP would positively affect its behavioural intention to prescribe the AP by physicians. As can be seen in table 5.12, there is strong evidence to suggest that perceived usefulness positively influences intention to prescribe an AP and the hypothesis is therefore accepted.

5.3.2.3 The influence of the TRI on intention to use

So now the influences of the TRI are tested on both perceived usefulness and intention to use and the hypotheses outcomes were all discussed. It is also relevant to test for a possible mediation between the TRI and intention to use through the mediator perceived usefulness. Therefore, another hierarchical regression analysis is performed between the same control variables, and the TRI dimensions with intention to use as a dependent variable.

The assumption of singularity was met as the independent variables (optimism, innovativeness, discomfort, and insecurity) were not a combination of other independent variables. Also Mahalanobis and Cook's distance scores showed no multivariate outliers. Durban-Watson showed a value of 1.655. Lastly, residual and scatter plots indicated the assumptions of reasonable normality, linearity and homoscedasticity were all satisfied (Field, 2009). Within this last regression analysis in the physician group, the predictors innovativeness, optimism, discomfort,

and insecurity are tested against intention to use the AP. Furthermore, also the variables, years of experience as a physician, sex, and awareness are controlled.

Another two stage hierarchical multiple regression is performed of the control variables and the predictors optimism, innovativeness, discomfort, and insecurity but this time on intention to use (dependent variable). At stage 1, the three experience dummy variables, awareness, and sex were entered to control for these variables. The regression statistics are shown in table 5.13. The R^2 for the control variables was 6%, so 6% is explained by the control variables. The model as a whole predicts 16.9% of the variability in intention to use. The R^2 change is 10.8% so the predictors optimism, innovativeness, discomfort and insecurity explained an additional 10.8% of the variance in the outcome. However, the ANOVA values showed a value of $F = 1.265$ with $p = 0.276$ which is insignificant. In short, possibly due to a smaller sample size, this model is not a statistically significant predictor of intention to use but it is basically needed for further analysis and not to test hypotheses.

In table 5.13 it can be seen that only insecurity with $b = -0.310$ and $p = < 0.05$ (one-tailed) is a statistically significant predictor of intention to use and can be used to test a possible mediation through perceived usefulness.

Table 5.13: Physicians' results summary of Hierarchical multiple regression for variables predicting intention to use (model 1 in mediation analysis)

	1			2		
	b	s.e.	*p*	*b*	s.e.	*p*
0 - 5 years experience	-.325	.397	.209	-.093	.408	.410
6 - 10 years experience	-.189	.395	.317	-.223	.390	.285
11 - 15 years experience	-.568	.402	.081	-.556	.415	.093
Awareness	-.387	.336	.128	-.338	.335	.159
Sex	-.174	.289	.275	-,251	.291	.196
Optimism				.072	.163	.331
Innovativeness				.169	.142	.121
Discomfort				.035	.135	.399
Insecurity				-.310*	.179	.045
R^2	.060			.169		

Note: N = 66; **p < .05, **p < .01, ***p< .001 (one sided test)*

5.3.2.4 Mediation effect of perceived usefulness physicians

The mediation analysis of Baron and Kenny (1986) is used to test a possible mediation between optimism, innovativeness, discomfort, insecurity and intention to use through the mediator perceived usefulness. The mediation analysis assumes that one variable (the predictor) affects a second variable (the mediator) and the second variable affects a third variable (the outcome). In the physicians' conceptual model which is tested, the mediator perceived usefulness could mediate the relationship between the predictors optimism, innovativeness, discomfort, insecurity and the outcome intention to use. The mediation analysis of Baron and Kenny (1986) consists of four steps. For each one of the steps, significant relationships are examined using linear regression models and their relationships are visualised in figures 5.1 and 5.2.

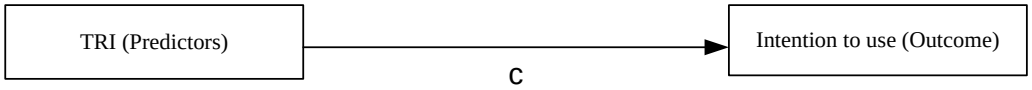


Figure 5.1: Simple relationship (from Field, 2013, p. 408)

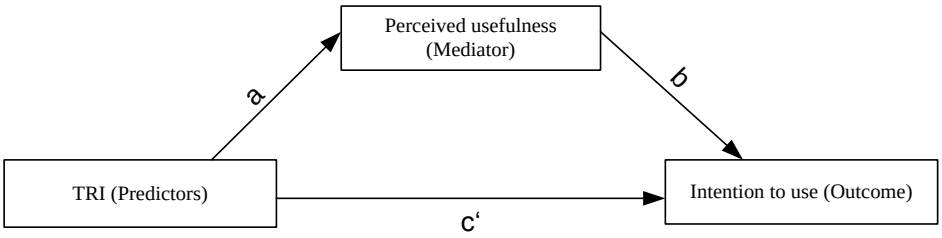


Figure 5.2: Mediated relationship (from Field, 2013, p. 408)

In short, a direct link must be established between the independent variable and dependent variable to ensure there is a relationship to be mediated. Second, a direct relationship must be established between the independent variable and the mediator variable. Third, the mediator must be significantly related to the dependent variable. Last, the relationship between the independent and dependent variable must be significantly reduced when the mediator is added.

Model 1 (Table 5.13) is a regression analysis that predicts the outcome (intention to use) from the predictor variables (TRI) which is the relation *c* in figure 5.1. Model 2 (Table 5.11) is a regression analysis that predicts the mediator (perceived usefulness) from the predictor variables (TRI) and can be seen as the relation *a* in figure 5.2. The last model, model 3, according to Field (2013) is a regression analysis predicting the outcome (intention to use) from both the predictor variables and the mediator (perceived usefulness). The regression coefficient for the predictor can be seen as relation *c'* in figure 5.2 and the regression coefficient for the mediator perceived usefulness is the value *b* in figure 5.2. Model 3 can be seen in table 5.14 where the control variables and insecurity are controlled in the first two steps. Only insecurity proved to have a significant direct effect on intention to use and therefore meets the condition of mediation and is used as the independent variable. This is discussed in the next paragraphs.

Table 5.14: Physicians' results summary with perceived usefulness as mediator between the independent variable insecurity and the outcome intention to use (model 3 in mediation analysis)

	1			2			3		
	b	s.e.	*p*	*b*	s.e.	*p*	*b*	s.e.	*p*
0 - 5 years experience	-.325	.397	.209	-.138	.393	.364	-.255	.349	.234
6 - 10 years experience	-.189	.395	.317	-.191	.383	.310	-.089	.339	.398
11 - 15 years experience	-.568	.402	.081	-.581	.389	.071	-.545	.344	.060
Awareness	-.387	.336	.128	-.428	.326	.098	-.337	.289	.124
Sex	-.174	.289	.275	-.205	.280	.233	-.123	.248	.312
Insecurity				-.343*	.153	.015	-.108	.147	.233
Perceived usefulness							.486***	.116	.000
R^2	.060			.134			.334		

Note: N = 66; **p < .05, **p < .01, ***p< .001 (one sided test)*

The regression results in table 5.13 (model 1), 5.11 (model 2) and 5.14 (model 3) are used to assess the four conditions of mediation.

In the first step, a hierarchical two step regression analysis was conducted to test the direct effect of the TRI and compatibility and complexity and ignoring the mediator perceived usefulness. Table 5.13 (model 1) shows that only insecurity has a significant effect intention to use (b = -.310, p = < .05). The other predictors optimism, discomfort, and discomfort have no significant direct effect on intention to use. So the first condition of mediation is satisfied for insecurity as the predictor.

In the second step, another hierarchical two step was conducted to test whether the four predictors are influencing perceived usefulness. In model 2 (table 5.11) it is seen that insecurity shows a significant negative relationship with perceived usefulness (b = -.277, p = < .05). The second criterion for mediation is also satisfied.

The third step measures whether the mediator perceived usefulness is positively influencing intention to use when controlling for the independent variable insecurity. The results in table 5.14 show the outcomes of the three step hierarchical regression analysis when controlling for the control variables and insecurity. So perceived usefulness has a clear positive effect on intention to use (b = .486, p = < .001) when the whole model all together is tested.

The fourth, and last step, tests whether the predictor variable insecurity predicts the outcome less strongly in model 3 than in model 1 (Field, 2013). As shown in table 5.14 (model 3) insecurity has now a b = -.108, p = .223 so this is insignificant in model 3 and significant in model 1. So the slope has been reduced to from b = -.310, p = < .05 to b = -.108, p = .223. Therefore, based upon this comparison it can be concluded that complete mediation occurred between insecurity and intention to use through perceived usefulness. However, the Sobel test has been a traditional method of testing the significance of mediation effects (Preacher & Hayes, 2004). Therefore, the Sobel test is used because it is most widely employed. In table 5.15, based upon the Sobel test, the relationship between insecurity and intention to use is not significantly reduced to claim a complete mediation effect (z = -1.558, p = .060).

These findings suggest that the relationship between insecurity and intention to use is reduced but not significantly enough to conclude a complete mediation effect through perceived usefulness.

Table 5.15: Summary Sobel Z-test with perceived usefulness as mediator between insecurity and intention to use

Dependent variable	Independent variable	Sobel Z-value	s.e.	*P*
Intention to use	Insecurity	-1.558	.165	.060

Note: N = 66; **p < .05, **p < .01, ***p< .001 (one sided test)*

5.4 Results patients

5.4.1 Descriptive statistics patients

The patients group consisted of a sample of 536 responses of which 413 filled in the survey completely. In this study, similar to the physician group, only complete responses are used. The target group for diabetes patients in this study were patients who suffered from type 1 diabetes. Therefore, all other types of diabetes were excluded from the sample. In this sample, 398 out of 413 respondents suffered from type 1 diabetes and will be used in the sample. Therefore, the usable sample of type 1 diabetes patients is 398 and this sample is used for the rest on the analyses.

Table 5.16: Patients diabetes type (*N* = 413)

	Frequency	**Percentage**
Type 1 diabetes	398	96.4%
Type 2 diabetes	14	3.4%
Other	1	0.2%
Total	**413**	**100%**

Respondents were also asked in which country they resided. The survey was in Dutch and therefore both Dutch and Belgium respondents could have filled in the survey. The country distribution is shown in table 5.17. Because the question asked to respondents was the country of residence instead of nationality, the 13 Belgium and/ or German respondents could also have been Dutch. Since the largest part of the sample consists of 382 Dutch residing persons and a small part consists of respondents who reside in either Belgium or Germany cross-country analysis is not feasible and therefore the final sample consists of 398 respondents who mainly reside in the Netherlands and all speak Dutch.

Table 5.17: Patients' distribution of country of residence (*N* = 398)

	Frequency	**Percentage**
Netherlands	382	96.0%
Belgium	10	2.5%
Germany	3	0.8%
Other	3	0.8%
Total	**398**	**100%**

As depicted in table 5.18, the final group consisted of a total of 177 males and 221 female patients. So with a distribution of 44.5% males and 55.5% females the sample has a very good distribution of sex. The mean age of the sample was 39 years old with the age ranging between 3 years and 85 years old. Also, on average, patients are diagnosed with type 1 diabetes at the age of 21. It has to be noted that also children participated in the survey and these questionnaires were filled in by a parent on behalf of the child.

Table 5.18: Patients' distribution of Sex (*N* = 398)

	Frequency	**Percentage**
Male	177	44.5%
Female	221	55.5%
Total	**398**	**100%**

Table 5.19: Patients' distribution of Age (*N* = 396, Missing = 2)

	Age in years
Minimum age	3
Maximum age	85
Standard deviation	15.9
Mean	39

To calculate the response rate, the total number of complete responses of 413 is used against a total number of invitations sent namely 596 which leads to the calculation (413/596)*100% = 69.3%. Therefore, the response rate is 69.3% which is extremely high in general and also compared to the physicians' response rate. This is also discussed further in the limitations section. This high response can be attributed to a number of reasons, but there are two main reasons which mainly explain the high response rate. Firstly, almost the entire sample of 596 email-addresses was retrieved from Inreda Diabetics' database. This database was compiled by University Bachelor students which were also active in this project. The list of email addresses was sorted and filtered out of a very large sample of diabetes patients or other interested individuals who indicated to be willing to participate in studies related to the development of the AP. This was possible due to the widespread media attention that Inreda Diabetic received over the past few years. Secondly, and closely related to the first reason, is that more than 90% of the sample resides in the Netherlands and the AP has received a lot of media attention and also won awards and therefore the awareness of the product could have played a role in the high response rate. So one could conclude this group had a high potential of being biased towards this study's results. However, since four out of six independent variables comprised the technology readiness variables this bias has less effect than in other variables closely related to the artificial pancreas. Because the technology readiness constructs measure an individual's general belief towards technology and therefore a respondent cannot be biased towards his own general beliefs of technology. However, the other variables used in the patients sample, complexity, compatibility, perceived usefulness, and intention are closely related to the APs' context and therefore a potential bias could exist here because the questions asked were specifically based upon a system, or in other words, they were questioning statements with regard to the AP. Furthermore, 95.7% of the sample indicated to have heard or read something about the AP before filling in the survey so obviously this is due to the fact that the largest part of the sample came from the database of Inreda Diabetic. These issues are discussed further in the limitations section. Furthermore, patients were asked about their current treatment type whereas most patients currently use an insulin pump (*n* = 183, 46.9%) and also an insulin pen is often used (*n* = 154, 39.5%). 13.6% (*n* = 53) of the sample uses a combination of an insulin pump with a continuous glucose monitor. Also it became evident that only 1% (*n* = 4) of the sample participated in a clinical trial regarding the AP. This can be attributed to the fact that the clinical trials at Inreda Diabetic commenced at the same time this survey was held.

Table 5.20: Patients' current method of diabetes treatment (*N* = 390 (98%), missing = 8 (2%))

	Frequency	**Valid Percentage**
Insulin pen	154	39.5%
Insulin pump	183	46.9%
Insulin pump and CGM	53	13.6%
Total	**390**	**100%**

Table 5.21: Patients' participation in a clinical trial (*N* = 398)

	Frequency	**Valid Percentage**
Yes	4	1%
No	394	99%
Total	**398**	**100%**

Patients were also asked which communication channels are often sought after when retrieving information about new (medical) innovations such as the AP. These channels can be an important source to look at from a managerial perspective before implementing a dissemination strategy. These results yielded in very interesting outcomes from a managerial perspective. Table 5.22 gives an overview of the communication channels most often used by patients. The analysis showed that 60.3% (*n* = 240) of the patients use journals and magazines to receive updates about new medical information. Furthermore, 30.4% (*n* = 121) indicated to use Social Media platforms to receive news regarding medical innovations. Also television broadcasts (54.3%, *n* = 216) and a diabetes association (64.6%, *n* = 257) proved to be very effective channels for communication with the diabetes patients. In contrast with the physician group, fairs proved to be a very ineffective channel for communication with only 2.3% (*n* = 9). Also, other diabetes patients are not often consulted for new medical innovations. YouTube and Blogs also proved to be ineffective channels both with only 9.5% (*n* = 38) of the patients using them.

Lastly, the relationship between the patient and their physicians and nurses is important. Results indicate that patients are more often informed about medical innovation by their diabetes nurses (41.7%, *n* = 166) than by their physicians (29.1%, *n* = 116). All aforementioned results set multiple bases for further analysis and are discussed further in chapter six. Firstly, given the fact that television broadcasts, diabetes associations, journals, magazines, and Social Media are the most used channels these are the channels which should be used in further (communication) research and in diabetes management. On the other hand, fairs, YouTube and Blogs proved to be much less effective channels. In addition, the comparison between the physician and diabetes nurse yielded in the outcome that diabetes nurses share more information regarding medical innovations with their patients than physicians do. This could already be an indication that for further research it would be interesting to include the diabetes nurse as a respondent group.

Table 5.22: Patients Communication channels (*N* = 398, multiple answers per respondent)

	Frequency	
Communication channel	**Yes**	**No**
Journals/ Magazines	**240 (60.3%)**	158 (39.7%)
Fairs	9 (2.3%)	389 (97.7%)
Other diabetes patients	56 (14.1%)	342 (85.9%)
Through the patients' physician	**116 (29.1%)**	282 (70.9%)
Through the patients' diabetes nurse	**166 (41.7%)**	232 (58.3%)
Social Media	**121 (30.4%)**	277 (69.6%)
YouTube	38 (9.5%)	360 (90.5%)
Blogs	38 (9.5%)	360 (90.5%)
Television broadcasts	**216 (54.3%)**	182 (45.7%)
Diabetes association (e.g., the diabetes foundation)	**257 (64.6%)**	141 (35.4%)

5.4.2 Diabetes patient persona

Also a persona is described for the patients group. From a managerial perspective this could be useful as the sample of 398 can be summarised into a representative caricature. Also here it is important to look at the average scores on each technology readiness dimension. The motivation of this approach is explained in chapter 5.2.2. The mean scores are depicted in the correlation matrix in table 5.26. For convenience purposes, the means for only the technology readiness dimensions are also displayed in table 5.23. In appendix K, the persona is described based upon the communication channels analysis and the technology readiness index.

Table 5.23: Patients' means technology readiness dimensions (*N* = 398)

	Optimism	Innovativeness	Insecurity	Discomfort
Mean	5.907	4.994	3.014	3.124
Std. Deviation	0.836	1.223	0.997	1.063

As can be deducted from table 5.23, similar to physicians, patients also show a very high rate of optimism towards new technologies and also they are quite innovative regarding new technologies. This is interesting in this context, since a high rate of innovativeness also indicates that a person is purchasing a new product earlier than for example other people around this person. Furthermore, diabetes patients are not very insecure towards (new) technologies and also their discomfort level towards technology is not high. Therefore, the technology readiness state is high which is positive for adopting new technologies (Parasuraman, 2000). Also here, in the managerial implications it is discussed how this information could add value to a positioning or communication strategy.

5.4.3 Validity patients

A principal component analysis (PCA) was also conducted for the patients' model which in total comprised of 38 items. Similar to the physicians, this study used the principal component analysis with oblique rotation, i.e., direct oblimin rotation, and tested this on all TR dimensions, complexity, compatibility and the TAM items with regards to the patients' sample. Similar to the physicians group, all factors below .30 are suppressed. As noted before, Stevens (2002) mentions that the significance of the factor loading will also depend on the sample size. The sample of the patients is much higher than the physicians, namely 398. Stevens (2002) recommends that for a sample size of 300 the loading should be greater than .298. Therefore, to be conservative, all factors below 0.298 are suppressed. It is important to start by testing the assumptions of the factor analysis. This can be done using *Bartlett's test of sphericity.* The Bartlett's test of sphericity was significant ($\chi 2$ (7292) = 528 df, $p < .001$) indicating that correlations between items were sufficiently large for PCA. Furthermore, Kaiser-Meyer-Olkin measure of sampling adequacy was .894 which is well above the commonly recommended value of 0.5. Hutcheson and Sofroniou (1999) mention that values between 0.8 and 0.9 are great and values above 0.9 are superb. So the sample is definitely adequate for factor analysis.

The initial factor analysis showed 7 components where items grouped together while there are 8 variables tested. It became evident that compatibility and intention to use loaded both onto the same factor whereas intention to use showed much higher factor loadings. However, when the questions are analysed it is not logical to combine both constructs with each other as they clearly measure other things. Furthermore, two factor loadings showed values less than .298 which were, together with the compatibility items, excluded step wise where the lowest loadings are excluded first. Compatibility will still be used in the reliability analysis and also in the regression analysis due to an expected correlation with perceived usefulness. In short, the total number of 38 items used for the factor analysis is reduced to a total of 33 items which are used for further analysis. So two items showed a value lower than .298. These items belong in the original discomfort construct. The item ONG_05 was the statement: "There should be caution in replacing important people tasks with technology because new technology can breakdown or get disconnected" appeared to have a low factor loading of <.298. And ONG_07, "Technology always seems to fail at the worst possible time" also loaded very low. A reason for these low factor loadings could be that the questions are too ambiguous for the respondent to be associated with discomfort. For example, "new technology could break down" could be interpreted as not really measuring a real feeling but more an annoyance and similarly, "technology seems to fail at the worst possible time" could also lead people to think of one or two incidents but not a general feeling, or discomfort towards technology. There seems to be a problem with these items in the discomfort construct as they were also excluded in the physicians' sample. In appendix I it is also shown in a scheme exactly which items are excluded by the factor analysis for both patients and physicians. The seven components together explained 66.24% of the variance. Table 5.24 shows the results from the factor analysis for both the TRI dimensions and the variables intention to use, perceived usefulness, complexity, and compatibility. No factors were excluded from the analysis except the compatibility construct which loaded on the same component as intention to use and two items in the discomfort construct that did not load significantly (i.e., $\leq .298$).

Table 5.24: Patients Factor analysis

TR Dimensions	PU	DIS	INN	OPT	INS	CX	ITU
Optimism							
1. Technology gives people more control over their daily lives				**-,769**			
2. Products and services that use the newest technologies are much more convenient to use				**-,754**			
3. You prefer to use the most advanced technology available				**-,675**			
4. Technology makes you more efficient in your occupation				**-,641**			
5. Technology gives you more freedom of Mobility				**-,800**			
6. You feel confident that machines will follow through with what you instructed them to do				**-,694**			
Innovativeness							
7.Other people come to you for advice on new technologies			**,655**				
8. In general, you are among the first in your circle of friends to acquire new technology when it appears			**,768**				
9. You can usually figure out new high-tech products and services without help from others			**,826**				
10. You keep up with the latest technological developments in your areas of interest			**,806**				
11. You find you have fewer problems than other people in making technology work for you			**,872**				
Discomfort							
12. Technical support lines are not helpful because they do not explain things in terms you understand		**,806**					
13. Sometimes, you think that technology systems are not designed for use by ordinary people		**,827**					
14. There is no such thing as a manual for a high-tech product service that is written in plain language		**,795**					
15. If you buy a high-tech product or service, you prefer to have the basic model over one with a lot of extra features		**,575**					
16. Many new technologies have health or safety risks that are not discovered until after people have used them		**,326**			,446		
Insecurity (INS)							
17. Critics lead people to believe that revolutionary new technologies are less safe than they usually are					**,461**		
18. A machine or computer is going to be less reliable in doing a task than a person					**,458**	-,321	
19. It can be risky to switch to a revolutionary new technology too quickly.					**,759**		
20. If you buy products that are too high-tech, you may get stuck without replacement parts or service.					**,758**		
21. Technological innovations always seem to hurt a lot of people by making their skills obsolete.					**,476**		
Perceived Usefulness (PU)							
22. I expect that using the artificial pancreas improves my performance in daily life	**,832**						
23. I expect that using the artificial pancreas in my daily life increases my productivity.	**,853**						
24. I expect that using the artificial pancreas enhances my effectiveness in daily life.	**,865**						
25. I expect that the artificial pancreas will be useful in my daily life.	**,502**						
26. I expect that using the artificial pancreas would enable me to accomplish tasks more quickly.	**,804**						
27. I expect that using the artificial pancreas would make it easier for me to accomplish my daily activities.	**,680**						
Complexity (CX)							
28. I expect that using the artificial pancreas will take too much time from my normal duties.						**-,808**	
29. I expect that working with the artificial pancreas is so complicated, it is difficult to understand what is going on.						**-,819**	
30. I expect that using the artificial pancreas involves too much time doing mechanical operations.						**-,749**	

31. I expect that it takes too long to learn how to use an artificial pancreas to make it worth the effort.	**-,811**
Intention to Use (ITU)	
32. Assuming I have access to an artificial pancreas, I intend to use it.	**,823**
33. Assuming I have access to the artificial pancreas, I predict that I would use it	**,880**

Note. Factor loadings that are grouped together are in boldface, factor loadings <.298 are suppressed, OPT = Optimism, INN = Innovativeness, DIS = Discomfort, DIS = Discomfort, INS = Insecurity adapted from Godoe & Johansen (2012), Parasuraman (2000), Walczuch et al. (2007), Lin et al. (2007)

5.4.4 Reliability analysis patients

After the PCA two items from discomfort were excluded and the three compatibility items and the two intention to use items loaded onto the same factor but the compatibility items showed much lower loadings and were therefore excluded but are still used for the regression analysis as discussed. Also compatibility is used in the reliability analysis. As shown in table 5.25, all four TRI dimensions optimism, innovativeness, discomfort, and insecurity had high reliabilities ranging from Cronbach's $\alpha = \geq 0.78$ to ≤ 0.88. In Parasuraman (2000) the original TRI index reliabilities ranged from 0.74 to 0.81 so also with this patients' sample in the AP context the reliability is high and also complexity showed a very high reliability of Cronbach's $\alpha = 0.86$ in this context whereas in Moore and Benbasat (1991) the complexity had a reliability of Cronbach's $\alpha = 0.52$ and in Venkatesh et al. (2003) and Thompson et al. (1991) the Cronbach's $\alpha = 0.73$. Although compatibility was excluded from the factor analysis, it is used in the reliability analysis and yielded in a high Cronbach's $\alpha = 0.88$. The two TAM components perceived usefulness and intention to use both show very high reliabilities with 0.90 and 0.86 respectively. Compared to Venkatesh and Davis (2000), where Cronbach's α was 0.82, this is also quite high.

Table 5.25: Patients' Reliability Analysis of TRI dimensions, TAM dimensions, and complexity

TRI Dimensions	Reliability (α)	Items (N)
Optimism	0.85	6
Innovativeness	0.88	5
Discomfort	0.78	5
Insecurity	0.78	5
TAM dimensions and complexity		
Perceived usefulness	0.90	6
Intention to use	0.86	2
Compatibility	0.88	3
Complexity	0.86	4

5.5. Empirical results patients

5.5.1 Correlations between the variables in the patients model

First of all, in this chapter several multiple regressions will be performed with perceived usefulness as the mediating variable and intention to use as the dependent variable and optimism, innovativeness, discomfort, insecurity, complexity and compatibility as the independent variables. Furthermore, diabetes treatment method, age and sex are used as control variables.

In table 5.26 a correlation table is seen between all independent and dependent variables in the model including the control variables. There was a significant correlation between all independent and dependent variables in the model with all *p*s < .01. For example, perceived usefulness was significantly correlated with intention to use ($r = .510$, $p < .01$). Also what needs to be checked are the directions of the slopes and if they match the theory. As hypothesised, optimism, innovativeness, perceived usefulness and compatibility supposed to have a positive influence. In

table 5.26 it can be seen that all directions are positive for these variables. On the other hand, the variables discomfort, insecurity, and complexity are hypothesised as having a negative influence on for example perceived usefulness or intention to use. From the table it can be derived that these statistics also show the right directions, i.e., all negative correlations. So this correlation table possibly indicates some positive hypotheses outcomes for the patients group. In the next chapter, multiple regressions are performed.

Table 5.26: Means, standard deviations, and correlations of the variables (*N* = 398)

	Mean	SD	PU	ITU	AGE	SEX	IP	IPC	OPT	INN	DIS	INS	COM	CX
PU	6.058	0.831	1											
Intention to use	6.494	0.833	.510**	1										
Age	39.24	15.94	.099*	.000	1									
Sex	1.44	0.498	- .034	.022	.130**	1								
Dummy IP	0.387	0.488	.044	-.075	.169**	.171**	1							
Dummy IPC	0.133	0.341	.036	.047	.036	-.068	-.311**	1						
Optimism	5.907	0.836	.468**	.325**	.162**	.152**	.089	.073	1					
Innovativeness	4.994	1.223	.248**	.253**	.029	.311**	.025	-.112*	.460**	1				
Discomfort	3.166	1.106	-.120*	-.201**	.222**	-.108*	.086	-.082	-.177**	-.232**	1			
Insecurity	3.014	0.996	-.203**	-.269**	-.067	-.184**	-.026	-.078	-.349**	-.326**	.571**	1		
Compatibility	6.211	0.841	.650**	.579**	.131**	-.012	-.007	.072	.514**	.229**	-.212**	-.331**	1	
Complexity	2.141	1.039	-.333**	-.323**	.005	-.181**	.060	-.068	-.332**	-.215**	.511**	.526**	-.436**	1

Note: * p < .05, ** p < .01, OPT = Optimism, INN = Innovativeness, DIS = Discomfort, INS = Insecurity, COM = Compatibility, CX = Complexity, PU = Perceived Usefulness, ITU = Intention to Use, IP = Insulin pen, IPC = Insulin pump and CGM

5.5.2 Multiple hierarchical regression patients

Three regression analyses are performed. Firstly, it is tested whether the TRI dimensions optimism, innovativeness, discomfort, insecurity and complexity and compatibility had an influence on perceived usefulness with age, sex and treatment methods as control variables in the first step. Also the same control variables and perceived usefulness are tested with intention to use as a dependent variable. Lastly, the influence of the variables optimism, innovativeness, discomfort, insecurity, complexity and compatibility with age, sex and the two aforementioned treatment methods as control variables are tested on intention to use. The last regression is necessary to test the mediating effect of perceived usefulness which is done in the last chapter and will go through a number of steps to assess if there is a mediating effect of perceived usefulness.

5.5.2.1 Hypothesis testing for variables predicting Perceived usefulness

Before multiple regression can be performed, several assumptions must be true according to Berry (1993), as stated in Field (2009). Thus, before conducting a hierarchical multiple regression, the relevant assumptions of this statistical analysis are tested. First of all, with a sample size of 398 the sample size is more than adequate taking Field's (2009) rule of 10 per variable into account. The assumption of singularity was also met as the independent variables (optimism, innovativeness, discomfort, insecurity, compatibility, and complexity) were not a combination of other independent variables. The collinearity statistics (i.e., tolerance and variance inflation factor) were all within accepted limits around the value of 1. Menard (1995), in Field (2009), mentions that only values below .20 are reason for concern. Field (2009) also mentions a possibility of a bias of multicollinearity when values in the correlation matrix exceed the value of .90. In table 5.26 it can be seen that no value exceeds .90 with the highest correlation size being .650 so a potential bias of multicollinearity can be excluded. Also Mahalanobis and Cook's

distance scores showed no multivariate outliers. Durban-Watson showed a value of 1.876 which is very close to 2 which is a good assumption for regression (Field, 2009). Lastly, residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied (Field, 2009).

With regards to the patients, this research aims to reveal whether the predictors innovativeness, optimism, discomfort, insecurity, complexity, and compatibility influence the perceived usefulness of the AP. Furthermore, as discussed, the variables diabetes treatment method (insulin pen and insulin pump with CGM), age, and sex are controlled. The correlation matrix in table 5.26 shows that many variables correlate with each other with many values of $p < .01$. The highest correlation is between perceived usefulness and compatibility ($r = .650$, $p = < .01$), intention to use and compatibility ($r = .510$, $p = < .01$) and perceived usefulness and optimism ($r = .468$, $p = < .01$).

To test the hypotheses, a two stage hierarchical multiple regression is performed of the six aforementioned predictors and the control variables on perceived usefulness. At stage 1, age, treatment methods and sex were entered to control for these variables. The regression statistics are shown in table 5.27. The R^2 for the control variables was 1.5%, so 1.5% is explained by the control variables. The model as a whole predicts 46.5% of the variability in perceived usefulness. So this amount includes all the variables including the control variables. The R^2 change is 45%, so the predictors optimism, innovativeness, discomfort, insecurity, complexity, and compatibility explained an additional 45% of the variance in the outcome. The ANOVA values showed $F = 33.46$ with $p < .001$. In short, this model is a statistically significant predictor of perceived usefulness.

Table 5.27: Patients' results summary of hierarchical multiple regression for variables predicting perceived usefulness (model 2 in mediation analysis)

	1			2		
	b	s.e.	*p*	*b*	s.e.	*p*
Insulin Pen	.092	.093	.160	.088	.069	0.103
Insulin Pen and CGM	.116	.129	.186	-.032	.097	0.371
Age	.005*	.003	.034	.000	.002	0.414
Sex	-.082	.086	.168	-.151*	.069	0.015
Optimism				.166***	.048	0.001
Innovativeness				.064*	.031	0.018
Discomfort				.006	.037	0.435
Insecurity				.077*	.042	0.033
Compatibility				.520***	.047	0.000
Complexity				-.081*	.039	0.020
R^2	.015			.465		

Note: N = 398; **p < .05, **p < .01, ***p< .001 (one sided test)*

The control variables add only about 1.5% to the model while the other variables explain almost half of the variance in the model (45.0%). To conclude, these results are now compared to this study's hypotheses for the patients group. *Hypothesis 2b* is accepted. In hypothesis 2b it was

hypothesised that optimism would positively affect perceived usefulness. A significant positive effect was found of optimism on perceived usefulness with $b = .166$ and $p < .001$ (one-tailed) and is therefore accepted. Similar to the physician group, optimism also showed the strongest relationship with perceived usefulness out of all the technology readiness dimensions. *Hypothesis 3b* is accepted. A positive effect of innovativeness on perceived usefulness was hypothesised in hypothesis 3b and is also accepted with $b = .064$ and $p < .05$ (one-tailed). Furthermore, in *hypothesis 4b* insecurity was assumed to have a negative influence on perceived usefulness. It appears that not only the slope is going upward ($b = .077$) but there is also a significant influence on perceived usefulness with $p < .05$ (one-tailed), so it is rejected. So this would mean that insecure patients would be more likely to perceive the AP as useful. This will be discussed further in the conclusions. In the physicians group insecurity did have a significant negative effect on perceived usefulness. *Hypothesis 5b* is rejected and it assumed that discomfort should have a negative influence on perceived usefulness. With $b = .006$ there is a very small, but increasing line evident. However, no significant p-value was found to prove this to be statistically significant. *Hypothesis 6b* is accepted. Here compatibility was hypothesised to have a positive influence on perceived usefulness. With the highest coefficient of $b = .520$ and $p < .001$ (one-tailed) there is strong statistical evidence to claim that compatibility positively influences perceived usefulness. Lastly, *hypothesis 7b* was also accepted with $b = -.081$ and $p < .05$ (one-tailed). So complexity of the product negatively affects perceived usefulness among diabetes patients.

5.5.2.2 Hypothesis testing with intention to use as dependent variable

Also here, the relevant assumptions of this statistical analysis are tested. The collinearity statistics tolerance (.985) and the variance inflation factor (1.015) were all within accepted limits around the value of 1. Also Mahalanobis and Cook's distance scores showed no multivariate outliers. Durban-Watson showed a value of 1.946 which is very close to 2 which is good (Field, 2009). Lastly, also here, residual and scatter plots indicated the assumptions of reasonable normality, linearity and homoscedasticity (Field, 2009).

This research aims to reveal whether the mediator perceived usefulness has an influence on the intention to use an AP. Also here, the diabetes treatment methods, age, and sex are controlled. The correlation matrix in table 5.26 shows that most importantly, there is a high correlation between perceived usefulness and intention to use which is positive for this study outcome. In fact, with $r = .510$, $p = <.01$ it is a very high correlation. None of the control variables had a significant correlation with intention to use.

To test the hypotheses, a two stage hierarchical multiple regression is performed of the perceived usefulness as a predictor of intention to use (dependent variable) and the control variables. At stage 1, age, treatment methods and sex were entered as control variables. The regression statistics are shown in table 5.28. The R^2 for the control variables was .007 so as little as .7% is explained by the control variables. The model as a whole predicts 27.5% of the variability in intention to use which can almost entirely be attributed to the predictor perceived usefulness. The ANOVA values showed $F = 29.54$ with $p < .001$ indicting that this model is a statistically significant predictor of intention to use.

Table 5.28: Patients' results summary of hierarchical multiple regression for variables predicting intention to use

	1			2		
	b	s.e.	*p*	*b*	s.e.	*p*
Insulin Pen	-,114	.093	.109	-,163*	.080	.021
Insulin Pen and CGM	.069	.130	.299	.008	.850	.470
Age	.000	.003	.464	-.002	.002	.158
Sex	.069	.086	.213	.112	.074	.065
Perceived usefulness				.522***	.043	.000
R^2	.007			.275		

Note: N = 398; **p < .05, **p < .01, ***p< .001 (one sided test)*

For the control variables, only insulin pens proved to have a slightly negative influence on intention to use with p = .05 (one-tailed). It makes a statistical significant contribution with a negative direction with b = -.163 and p = .021 (one-tailed). So with a b = .522 and p < .001 (one-tailed) there is a very significant influence of perceived usefulness of an AP on the intention to use the AP.

To conclude, also here these results are now compared to the first hypothesis for the patients group. In *hypothesis 1b* it was hypothesised that the perceived usefulness of the AP would positively affect its behavioural intention to use. As can be seen in table 5.28, with a b =.522 and p <.001 (one-tailed) there is strong evidence to suggest that perceived usefulness positively influences intention to use an AP and hypothesis 1b is therefore accepted.

5.5.2.3 The influence of the TRI, complexity and compatibility on intention to use

In the previous two chapter the influences of the TRI, complexity, and compatibility are tested for both perceived usefulness and intention to use and the hypotheses outcomes were all discussed. It is also a part of this paper to test for a possible mediation between the TRI, compatibility, complexity and intention to use through the mediator perceived usefulness. Therefore, another regression analysis is performed between the same control variables, the TRI dimensions and compatibility and complexity and intention to use as a dependent variable.

The assumption of singularity was met as the independent variables (optimism, innovativeness, discomfort, insecurity, compatibility, complexity) were not a combination of other independent variables. Similar to previous analysis, multicollinearity is not a threat and also Mahalanobis and Cook's distance scores showed no multivariate outliers. Durban-Watson showed a value of 1.968. Lastly, residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied (Field, 2009). Within this analysis, the predictors innovativeness, optimism, discomfort, insecurity, complexity, and compatibility are tested against intention to use the AP. Furthermore, also the variables diabetes treatment methods, age, and sex are controlled. The correlation matrix in table 5.26 shows that many variables correlate with each other with many values of p < .01. In fact, all the independent predictors from TRI and complexity and compatibility correlate with intention to use in the right direction. The highest correlation is between intention to use and compatibility (r =.579, p = <.01) and complexity (r = -.323, p = <.01), and optimism (r = .325, p = <.01).

To test the hypotheses, another two stage hierarchical multiple regression is performed of the six aforementioned predictors but this time on intention to use (dependent variable) and the control variables. At stage 1, age, the treatment methods insulin pen and insulin pump with CGM and sex were entered to control for these variables. The regression statistics are shown in table 5.29. The R^2 for the control variables was 0.7%, so 0.7% is explained by the control variables which is quite low. The model as a whole predicts 36.9% of the variability in intention to use. The R^2 change is 36.2% so the predictors optimism, innovativeness, discomfort, insecurity, complexity, and compatibility explained an additional 36.2% of the variance in the outcome. The model is statistically significant with an F-value change of $F = 36.799$ and $p = <.001$. The ANOVA values showed $F = 22.510$ with $p <.001$. So this model is a statistically significant predictor of intention to use.

The next step is to evaluate all independent variables. In table 5.29 it can be seen that only innovativeness with $b = .084$ and $p = < .01$ (one-tailed) and compatibility with $b = .529$ and $p = <$ .001 (one-tailed) are statistically significant predictors of intention to use. So in this model only innovativeness and compatibility proved to have significant effect but most variables are showing the right direction. In the next paragraph, the mediating effect of perceived usefulness is examined.

Table 5.29: Patients' results summary of Hierarchical multiple regression for variables predicting intention to use (model 1 in mediation analysis)

	1			2		
	b	s.e.	*p*	*b*	s.e.	*p*
Insulin Pen	-.114	.093	0.110	-.108	.075	0.076
Insulin Pen and CGM	.069	.130	0.299	-.073	.106	0.245
Age	.000	.003	0.464	-.003	.002	0.084
Sex	.069	.086	0.213	-.002	.075	0.487
Optimism				-.011	.053	0.419
Innovativeness				.084**	.033	0.006
Discomfort				-.006	.040	0.442
Insecurity				-.040	.045	0.192
Complexity				-.029	.043	0.249
Compatibility				.529***	.051	0.000
R^2	.007			.369		

Note: N = 398; **p < .05, **p < .01, ***p< .001 (one sided test)*

5.3.5.1 Mediation effect of perceived usefulness patients

The mediation analysis of Baron and Kenny (1986) is used to test a possible mediation between optimism, innovativeness, discomfort, insecurity, compatibility and complexity and intention to use through the mediator perceived usefulness. In short, the mediation analysis assumes that one variable (the predictor) affects a second variable (the mediator) and the second variable affects a third variable (the outcome). In the patients' conceptual model, the mediator perceived usefulness mediates the relationship between the predictors optimism, innovativeness, discomfort, insecurity, compatibility and complexity and the outcome intention to use. The mediation analysis of Baron and Kenny (1986) consists of four steps. For each one of the steps, significant relationships are

examined using linear regression models and their relationships are visualised in figures 5.3 and 5.4.

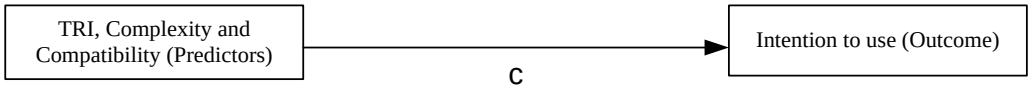


Figure 5.3: Simple relationship (from Field, 2013, p. 408)

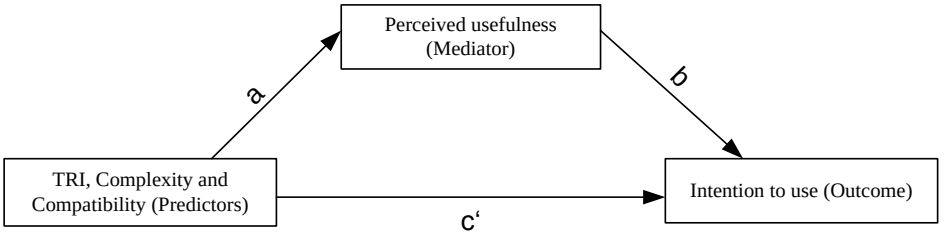


Figure 5.4: Mediated relationship (from Field, 2013, p. 408)

Model 1 (Table 5.29) is a regression analysis that predicts the outcome (intention to use) from the predictor variables (TRI, complexity, and compatibility) which is the relation *c* in figure 5.3. Model 2 (Table 5.27) is a regression analysis that predicts the mediator (perceived usefulness) from the predictor variables (TRI, compatibility, and complexity) and can be seen as the relation *a* in figure 5.4. According to Field (2013) the last model, model 3 (Table 5.30), is a regression analysis predicting the outcome (intention to use) from both the predictor variables and the mediator (perceived usefulness). The regression coefficient for the predictor can be seen as relation *c'* in figure 5.4 and the regression coefficient for the mediator perceived usefulness is the value *b* in figure 5.4. This last model can be seen in table 5.30. The four conditions of mediation according to Baron & Kenny (1986) are discussed in the next paragraph.

Table 5.30: Patients' results summary with perceived usefulness as mediator between the independent variables innovativeness and compatibility and the outcome intention to use (model 3 in mediation analysis)

	1			2			3		
	b	s.e.	*p*	*b*	s.e.	*p*	*b*	s.e.	*p*
Insulin Pen	-.114	.093	.109	-.113	.080	.065	-.134*	.073	.034
Insulin Pen and CGM	.069	.130	.299	-.065	.111	.268	-.059	.103	.278
Age	.000	.003	.464	-.003	.002	.056	-.004*	.002	.044
Sex	.069	.086	.213	.020	.074	.395	-.048	.072	.251
Innovativeness				.091**	.030	.002	.070**	.030	.010
Compatibility				.554***	.042	.000	.420***	.052	.000
Perceived usefulness							.221***	.053	.000
R^2	.007			.355			.381		

Note: N = 398; **p < .05, **p < .01, ***p< .001 (one sided test)*

The regression results in table 5.29 (model 1), 5.27 (model 2) and 5.30 (model 3) are thus used to assess the four conditions of mediation.

In the first step, a hierarchical two step regression analysis was conducted to test the direct effect of the TRI and compatibility and complexity and ignoring the mediator perceived usefulness. Table 5.29 (model 1) shows that innovativeness has a significant effect on intention to use (b = .084, p = < .01). Also compatibility showed a direct significant effect on intention to use (b = .529, p = < .001). The other predictors optimism, discomfort, insecurity and complexity have no significant direct effect on intention to use. So the first condition of mediation is satisfied for innovativeness and compatibility.

In the second step, another hierarchical two step was conducted to test whether the six predictors are influencing perceived usefulness. In table 5.27 it is seen that innovativeness shows a positive relationship with perceived usefulness (b = .064, p = < .05). Furthermore, compatibility showed a very strong positive influence on perceived usefulness (b = .520, p = < .001). The second condition for mediation is also satisfied.

The third step measures whether the mediator perceived usefulness is positively influencing intention to use when controlling for the independent variables. The results in table 5.30 show the outcomes of the three step hierarchical regression analysis when controlling for the control variables and the independent variables. So perceived usefulness also has a clear positive effect on intention to use (b = .221, p = < .001) when the whole model all together is tested.

The fourth, and last step, tests whether the predictor variables innovativeness and compatibility predict the outcomes less strongly in model 3 than in model 1 (Field, 2013). As shown in table 5.29 (model 1) innovativeness has b = .084, p = .006 and in table 5.30 (model 3) innovativeness has a b = .070, p = .010 so there is in fact a bit less stronger prediction in model 3 for innovativeness so a partial mediation has occurred. So the slope has been reduced to b = .070. Furthermore, there is a strong statistical relationship between compatibility in both models with p < .001 but in model 1 the b = .529, p < .001 and in model 3 the b = .420, p < .001 so it shows a slightly less increasing slope but still it is significant so there is only a partial mediation according to Miles and Shevlin (2001) because the effect is still significant. The amount of mediation is calculated by finding the differences in the slopes that were found in steps 1 and 4 (Miles & Shevlin, 2001). For innovativeness this is .084 - .070 = .014 and for compatibility this calculation is .529 - .420 = .109.

To test if the reduction is significant the Sobel test is used. The Sobel test has been a traditional method of testing the significance of mediation effects (Preacher & Hayes, 2004). Therefore, the Sobel test is used because it is most widely employed. In table 5.31 the results of the Sobel test are shown with both Sobel tests significant. Perceived usefulness partially mediates between innovativeness and intention to use (z = 2.036, p < .021) and also perceived usefulness partially mediates between compatibility and intention to use with z = 3.705, p < .001. These findings suggest that if users perceive the AP as useful, perceived usefulness will partially effect intention to use. This implies that perceived usefulness is a partial mediator between innovativeness and compatibility and intention to use.

Table 5.31: Summary Sobel Z-test with perceived usefulness as mediator

Dependent variable	Independent variable	Sobel Z-value	s.e.	*p*
Intention to use	Innovativeness	2.036*	.030	.021
	Compatibility	3.705***	.052	.000

Note: N = 398; **p < .05, **p < .01, ***p< .001 (one sided test)*

6. Conclusions

6.1 Discussion and comparison to relevant theory

This study has investigated the effects of an individuals' general beliefs as proposed in TRI on perceived usefulness and eventually intention to use or prescribe (i.e., the main elements of TAM) an artificial pancreas among physicians and diabetes patients. Furthermore, the effects of complexity of, and compatibility with, the product were tested on perceived usefulness in the patients' group. To recapitulate, the central research question was:

"*To what extent do stakeholders' general beliefs of technology have an influence on perceived usefulness and eventually intention to use an Artificial Pancreas among type 1 diabetes patients and physicians in the Netherlands, Germany, and Austria?"*

In order to test this, twelve hypotheses were tested with seven hypotheses focused on patients and five on physicians. An overview of both the patients and the physicians' model with the outcomes is seen in figures 6.1 and 6.2 respectively. Overall, in the patients group most hypotheses were supported. Also in the physicians group there were some significant effects on intention to use and perceived usefulness. In addition, mediation analyses were conducted for both the patients' model and the physicians' model to test the mediating effect of perceived usefulness. There was a significant partial mediation between innovative beliefs towards technology and compatibility of the product and intention to use through perceived usefulness of the artificial pancreas in the patients group. In the physician model the effect of insecurity on intention to use was mediated through perceived usefulness. However, for this last relation no significant evidence was found and thus a claim of mediation cannot be made here. The outcomes of this study are now discussed according to topic.

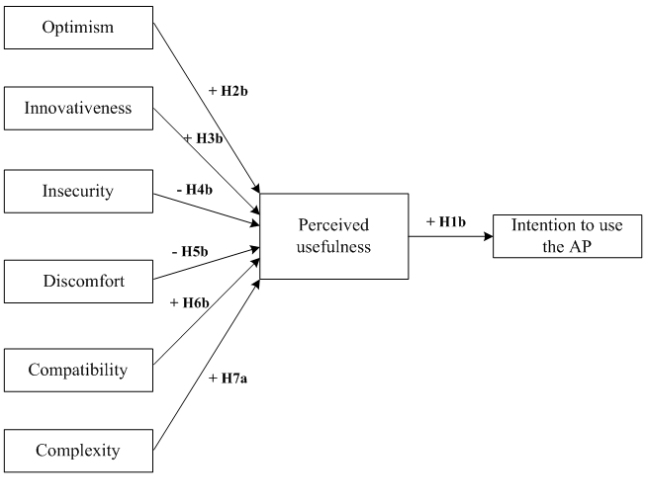


Figure 6.1: Research model patients

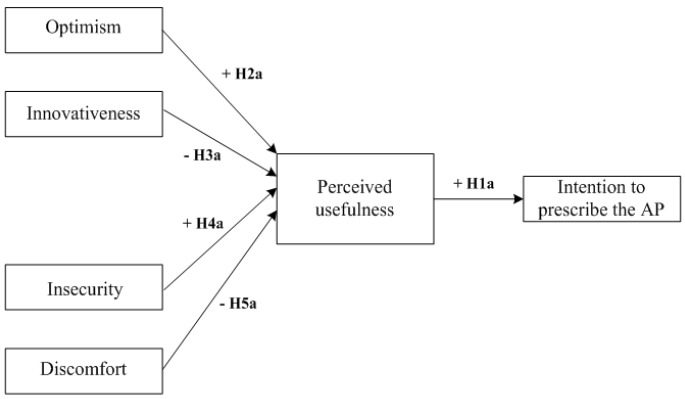


Figure 6.2: Research model physicians

6.1.1 Optimism

This study was able to show that physicians in the Netherlands (and Germany, and Austria) with an optimistic attitude towards technology are also more likely to perceive the artificial pancreas as useful. Also, diabetes patients in the Netherlands with an optimistic attitude towards technology showed a very significant relationship between optimism and perceived usefulness of the AP. Compared to relevant literature, optimism often has a significant effect on perceived usefulness of a specific system (e.g., Godoe & Johansen, 2012). Also Taylor et al. (1992) mentioned that optimism is inversely related to emotional distress, worry and concern about bad experiences as well as perceived risk, and perceived control. So optimists are more willing to use new technologies (Scheier & Carver, 1987). Also Walczuch et al. (2007) proved that employees' optimism, from all TRI dimensions, had the strongest impact on perceived usefulness of information technology. Similar to Walczuch et al. (2007), this study found evidence that optimism is the strongest predictor of perceived usefulness. However, no direct effect of optimism on intention to use was found, and thus also no mediation effect through perceived usefulness. Therefore, this study only provides evidence to claim that optimism is significantly related to perceived usefulness of the artificial pancreas among both patients and physicians. Therefore, the positive relation between optimism and the cognitive dimension of TAM, perceived usefulness can be interpreted as follows: "A physician, or diabetes patient, who is optimistic about technology in general, will find a medical innovation, such as the AP, more useful than a physician or diabetes patient who is less optimistic". So in short, this study's results confirm that in this context the results are similar to existing theory in TAM, TRI and psychology domains.

6.1.2 Innovativeness

Both optimism and innovativeness are drivers of technology readiness. The second driver of TR, innovativeness, proved to have an insignificant effect on perceived usefulness for the physician group. This was not hypothesised beforehand. However, a significant effect on perceived usefulness for diabetes patients was found. Therefore, we compare these results to existing literature to shed more light on this study's outcome. Im et al. (2003) suggest that innovative consumers are generally more accepting of risk, more eager to try new things, and more likely to share their discoveries with others. In the interactive marketing domain, the relation between innovativeness and consumer behaviour is widely studied and Thogerson et al. (2010) also found that innovativeness was a significant predictor in the early adoption phase of a new product environment. This study measures the pre-adoption phase and yielded in a different outcome. However, as mentioned in earlier chapters, the outcome is not completely different to all other research in the field. Walczuch et al. (2007) also hypothesised a positive relation between innovativeness and perceived usefulness but their findings also proved otherwise. Walczuch et al. (2007) mention a possible reason for this outcome as being the likelihood that innovative people are more critical towards technology since they are aware of the newest developments and possibilities and expect all technologies to fulfil the highest demands. However, with regards to physicians in this context, this is not likely to be a conclusive argument for the hypothesis being rejected. It can be noted that the unstandardised beta coefficient was in the predicted positive direction so a larger sample size could yield in a significant result. On the other hand, innovativeness among diabetes patients did prove to be a strong predictor of perceived usefulness. So this concurs with existing theory that innovative people are more likely to adopt new technology, or in this case, perceive new technology as useful. In the patients group there was also

a direct effect of innovativeness on intention to use and the relationship was also tested for a possible mediation through perceived usefulness. Results indicated a partial mediation between innovativeness and intention to use through perceived usefulness indicating that when a diabetes is innovative towards new technology it is, to a certain extent, also likely that this person will intend to use the artificial pancreas. In the next paragraph, the inhibitors of the TRI are discussed.

6.1.3 Insecurity

The first inhibitor of TR, insecurity, is now discussed. It was hypothesised that insecure physicians and diabetes patients (i.e., insecure towards adopting new technology) are more likely to perceive the AP as less useful. Insecurity in this context stands for the distrust of technology for security and privacy reasons (Parasuraman, 2000). Theory here suggested that in several contexts insecurity had a negative impact on perceived usefulness. In a general context, consumers with a sense of insecurity are in general sceptical about new technologies and feel uncomfortable with them and therefore the consumers become suspicious of new functions and reduce trials to accept and use them (Son & Han, 2011). However, compared to this study's results, insecurity proved to have a positive significant influence on perceived usefulness among diabetes patients. This would mean that insecurity among diabetes patients positively affects them in perceiving the artificial pancreas as useful. Even though the effect was minimal, the question that arises here is how insecurity can be positively related to perceived usefulness. This is in conflict with the theory discussed in the field of technology readiness and technology acceptance and should be further researched. The hypothesis is also rejected. On the other hand, this study found significant evidence that physicians who feel insecure will also be more likely to perceive the artificial pancreas as less useful which is in line with the theory discussed. So basically a physician who is insecure in general regarding technology will also be more reluctant to perceive the artificial pancreas as useful. So for the physician group this study provided enough evidence to claim that insecurity, or a high level of scepticism and suspiciousness towards adopting new technologies, has a negative effect on perceived usefulness of the AP. So this outcome also concurs with existing literature in other contexts (e.g., Meuter et al., 2005). In addition, insecurity was the only predictor which had a direct negative influence on intention to use in the physician group. However, although significantly reduced, no significant evidence of a mediation between insecurity and intention to use through perceived usefulness could be found.

6.1.4 Discomfort

Among both patients and physicians there was no evidence to claim that discomfort plays a significant role in the perceived usefulness of the AP. In short, discomfort is defined as "a perceived lack of control over technology and a feeling of being overwhelmed by it" (Parasuraman & Colby, 2001, p. 41). A possible explanation could be that the diabetes patients on the other hand proved to be very optimistic individuals and this optimism also had a strong significant effect on perceived usefulness within both groups. To compare the two dimensions, Mukherjee and Hover (2001) state that discomfort represents the extent to which people have general fears of technology-based products and services, believing that the products and services lead to learning costs and comprehension difficulty. On the other hand, optimism is defined by Parasuraman and Colby (2001) as "a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives" (p. 34). So comparing the two they can be considered as quite the opposite of each other indicating that diabetes type 1 patients in the Netherlands have in general absolutely no fear of technology-based products and services and in

fact are very optimistic and positive regarding technology. Also, for the physicians group, discomfort characteristics among physicians proved not to be of significant importance when physicians adopt or recommend new innovations. However, it also has to be noted here that many items in the discomfort construct yielded in invalid outcomes within the validity analysis among both groups and several items were excluded which could have influenced the construct validity. This is also discussed further in the limitation section.

6.1.5 Compatibility and complexity

As discussed, only for the patients group, two more variables were tested on perceived usefulness, namely, compatibility and complexity (Rogers, 2003). Compatibility of the AP with the diabetes patients' lifestyle proved to play a very important role in the perceived usefulness of the AP. There was a very strong predicting influence of compatibility on perceived usefulness as hypothesised. Also the complexity of the artificial pancreas proved to be significantly (negative effect) related with perceived usefulness so this hypothesis was also accepted. There was however a much stronger positive predictive influence of compatibility on perceived usefulness so diabetes patients attach more value to whether the product "fits" within their lifestyle or routine than to how complicated the product is. A possible explanation for this outcome is that all patients in the sample are already used to using "complicated" diabetes appliances such as a CGM or an insulin pump and therefore the complexity factor could have less effect on the perceived usefulness. In short, compatibility of the AP with daily routines proved to have a very significant effect on the perceived usefulness of the AP. In the managerial implications it is discussed how these outcomes can be used in communication and/or positioning strategies. Also compatibility was partially mediated through perceived usefulness. Compatibility was significantly related to both perceived usefulness and intention to use but there was a small amount of mediation evident.

6.1.6 Perceived usefulness and intention to use

Lastly, both models tested the effect of perceived usefulness of the artificial pancreas on the intention to use the AP for patients and intention to prescribe the AP for physicians. In both the physicians and the patients' group the perceived usefulness of the AP proved to have a very significant effect on intention to use or prescribe an AP. This implicates that physicians and patients who perceive the AP as a useful device are also likely to use or prescribe the AP. So in general this is a very positive outcome also because the intention to use/ prescribe the AP is the first hypothesis in this study which is accepted for both groups. Moreover, Davis (1989) mentions that the main contributor to actual use of a new technology is its perceived usefulness. Therefore, this study provides evidence that when patients and physicians perceive the AP as useful this has a positive effect on its, in this case, future adoption or recommendation.

6.1.7 Summary of the overall models

To recapitulate, this study provided enough evidence to prove that optimism among physicians and patients had a significant positive effect on perceived usefulness of the AP. Furthermore, there is significant evidence to indicate that innovativeness positively influences perceived usefulness among diabetes patients. Among physicians insecure feelings lead to a negative effect on perceived usefulness. Furthermore, both variables from Rogers' (2003) diffusion theory, complexity and compatibility showed significant results on perceived usefulness in the patients group. Also in both groups the perceived usefulness of the AP has a significant positive effect on the intention to use/ prescribe the AP. So with regard to the research question, there was indeed an

effect of general beliefs of technology on perceived usefulness. To investigate if generalised beliefs also eventually influenced intention to use, a mediation analysis was performed. In other words, the predictor variables were tested for mediating effects through perceived usefulness. Only in the patients' group there was substantial evidence of a partial mediation between innovativeness and compatibility on intention to use through perceived usefulness. So a claim can be made based upon this study that generalised beliefs towards technology predict perceived usefulness. But to a lesser extent it can be claimed that this eventually also influences intention to use. In the next chapter, the theoretical implications are set forth.

6.2 Theoretical implications

This study combined the technology readiness index (Parasuraman, 2000), complexity, compatibility (Rogers, 2003) and the cognitive dimension of TAM, perceived usefulness and intention to use. This study also contributes to the existing theory in some ways.

Firstly, this study makes a theoretical contribution by showing that technology readiness has an effect on perceived usefulness in a medical innovation context. Typically, the TAM literature showed that much TAM research has been done in information systems and information technology. Schepers and Wetzels' (2007) extensive literature review concluded that the TAM is widely applied in the technology field but most often for (computer) technologies such as online shopping, internet banking, and electronic supermarkets. So this study showed that the TAM variables perceived usefulness and intention to use also hold in a medical innovation context and furthermore, with a physical product while often in the field of TAM non-physical applications are tested.

Second, this paper adapted several TAM and diffusion constructs to this context and proved that this was very well possible. Since this is a relatively new research field, many studies are still testing whether it is possible to combine the two concepts (e.g., Godoe & Johansen, 2012). Godoe and Johansen (2012) concluded that a combination of the two models comprises a holistic view. This paper also contributes to existing theory in a sense that it provided further evidence that the two concepts can be combined. This study performed extensive validity and reliability analyses and showed that all the adapted constructs in the reliability analyses have high reliability factors (i.e., Cronbach's $\alpha = >0.7$). Also regarding diffusion variables. For example, compared to Moore and Benbasat (1991), these authors used the complexity construct with a Cronbach's α of only 0.52 and in the studies by Venkatesh et al. (2003) and Thompson et al. (1991) the Cronbach's $\alpha =$ 0.73. This study showed a Cronbach's $\alpha = 0.86$ for complexity. In short, within this research context some of the scales' reliabilities came out stronger than existing scales and therefore this paper contributes to their reliability and validity and also strengthens the TAM and TRI applicability. This study also assumes that the scales used in this study can now also be extended to other fields with other (tangible) technological products and not are not only applicable in information technology or information system technology.

Third, because this study is analysing the AP which is unavailable, the use of only the TAM could not be sufficient since only questions specifically related to the AP are asked in TAM and therefore an extension of the model with the TR constructs was proposed to help predict behaviour. In addition to a handful of other researchers since 2005 (e.g., Lin et al., 2005), this study combined the TRI with the TAM and was able to show that the TR constructs are useful in

this study's predictive setting, where the product is not available yet and also TRI and TAM proved to hold in a patient and physician setting. The marketing literature on TR often focuses on the relationship between TR and product adoption whereas this study focused more on intentions (Liljander et al., 2006; Walczuch et al., 2007). The TR constructs measure general beliefs towards technology which can be used in predicting adoption behaviour among, in this case, patients and physicians. This similar approach can also be used in other (predictive) settings.

Lastly, this study's empirical investigations support that among physicians and patients, optimism proved to be very significantly related to perceived usefulness. This is also consistent with the hypotheses made based upon existing literature in the TR field, but also in social sciences (e.g., Carver et al., 2010). Moreover, optimism proved to have the most significant effect on perceived usefulness. In addition, this study helps in further establishing the TR dimensions as generalised predictors of technology acceptance. Many other studies (e.g., Lin et al., 2007) tested the overall influence of TR on technology acceptance whereas this study offers more detailed insights by providing strong empirical support that separate TR constructs can be used for predicting technology acceptance. More specifically, most individual TR constructs have been found to significantly influence TAM variables. Also multiple regression analyses indicated enough independence among all variables in the model including the TRI. Therefore, in addition to existing studies which combined the two concepts, findings from this study suggest that these constructs can be used to predict acceptance of any specific technology-based product in medical innovation and potentially even beyond this field.

6.3 Managerial implications

In this section the managerial implications are discussed. Since this research mainly focused on the AP within the diabetes market as the context the managerial implications that are discussed are especially relevant for marketers engaged in developing dissemination strategies for new medical innovations. However, to a certain extent, the implications are also generally applicable to other (new) technology marketers. The implications of this study are important for marketers because several personality characteristics towards technology significantly influence perceived usefulness and intention to use a product in medical innovation. Therefore, managers can adapt strategies on how to stimulate use of a new product by diabetes patients and physicians based upon their personalities. This research has several managerial implications based upon academic research which are now discussed.

Firstly, according to Parasuraman (2000), an optimistic and innovative person is more likely to use a new technology. Findings from this study indicated that diabetes patients and physicians who are optimistic are more likely to perceive the AP as useful. Also, insecurity proved to be a significant negative predictor of intention to use among physicians. And innovative patients will be more likely to use an AP. Therefore, implications for marketing managers are that they need to carefully examine how to position and promote their offerings. For example, since optimism proved to be the most important predictor of perceived usefulness, promotion and marketing campaigns should also contain message designs which evoke these optimistic feelings. Also since innovative patients are more likely to use an AP, this group of people could be a first target group to focus on since most patients scored high on innovativeness (even though the group is potentially biased). So these issues are to be considered when drafting a communication strategy. Specifically, since evidence was found that both within the patient and physician group optimistic

feelings towards technology lead to perceived usefulness, managers could utilise an appropriate advertising slogan which evokes optimistic feelings among both groups.

Second, and related to the first implication, the findings of this study also have implications for communication strategies which are drafted by marketing managers in diabetes management, but also in other (new) technology based products. Because this is a new technology, the managers should consider extending the marketing communication strategies beyond the classical promotions focusing on product adoption and main features but instead also put a strong focus on the perceived benefits of additional advantages that come with the product. This leads to the next important finding of this study and its managerial implication. This study was able to prove that the compatibility of the product with diabetes patients' lifestyle and routine has a great positive effect on both perceived usefulness and intention to use. Complexity of the product proved to have a negative effect but with less effect. Therefore, this indicates that marketing managers in the diabetes market should focus on these facts in their positioning- and communication strategies. For example, an emphasis should be placed on explaining diabetes patients how this product is compatible with a persons' lifestyle or activities. For example, a marketing manager can mention a specific function such as its wireless capabilities, and motivate that therefore a person can also swim with the device.

Third, this study also assessed the communication channels to measure usage rates among patients and physicians. In other words, it identified relevant communication channels that the target groups use. Managers in diabetes management should be aware of the most effective communication channels to use for their dissemination strategy in order to reach as many patients as possible. Most diabetes patients prefer to receive information via their diabetes association or through journals and magazines. Furthermore, television broadcasts are also effective. Thus, when information is disseminated these are the channels to focus on to create awareness among diabetes patients. Interestingly enough patients indicated to receive more information about new technologies in diabetes management from their diabetes nurse than from their physician. Therefore, in this context, there should also be a clear line of communication focus towards diabetes nurses regarding new technologies. Social Media proved to be less interesting for diabetes patients to receive information, however, Social Media proved to be effective in many other fields and it is also a relatively cheap and easy to implement medium compared to for example television broadcasts. Also, this study made clear why physicians play an important role in diabetes management. Therefore, also the physicians are to be considered in the communication strategy but physicians need to be approached through different channels. Since almost all physicians in the sample indicated to receive information through (professional) journals and conferences these are the two major mediums to focus on when trying to communicate with physicians. Furthermore, managers could consider drafting a (bi-) monthly newsletter because this also proved to be a well utilised medium by physicians. Also here, Social Media was quite often used and is also advisable to be used by marketers in this context due to low costs and easy implementation.

Lastly, to summarise all these characteristics and believes towards technologies and preferred communication channels, this study created personas to represent each group of respondents which can be found in Appendix K. In line with the study by Lam et al. (2008), this study assumes that once marketers have established the TR profiles of potential adopters they can use

this information to predict the acceptance of various types of technology-based offerings. More importantly, this information can also help marketers in formulating and fine-tuning their product positioning and communication strategies to match the TR profiles of potential adopters. In addition, this paper also added the most effective communication mediums to these profiles in order for marketers to get a clear idea on which mediums to put their focus. So to recapitulate, a manager of new technology products should be aware of the technology readiness of his target group and adjust positioning- and communication strategies accordingly. Since several TR constructs in both the patient and physician group proved to have a significant effect on perceived usefulness and intention to use/ prescribe an AP, the managers can use these facts to their advantage.

6.4 Directions for further research

This study is one of the few researches that combined the TRI and the TAM in this specific context of medical innovation using quantitative methods in a predictive setting. However, there are several suggestions for further research.

First of all, in the patients group it would be interesting to replicate this study in other geographical settings. This questionnaire was only used for Dutch patients but could also be used in other European countries to be able to do a cross-country analysis and find out differences between countries and to improve the external validity. In a later stadium, this study could also be extended to a non-European country to see if there are differences with other cultures. The relationship between culture and acceptance could be a very interesting direction to research. With regards to Hofstede (2003), his work on cultural dimensions could play a role here. For example, one of the cultural dimensions, uncertainty avoidance, could mediate the relationship between insecurity and intention to use.

Second, this study included variables such as compatibility and complexity which dealt with issues such as coping skills and time-costs. However, especially nowadays, pricing factors also play a large role in the acceptance of any new medical innovation. Therefore, in a later stadium when the price is known, this factor should also be taken into consideration among patients and physicians. It is also important to research the role of the insurance companies and the own monetary amount that patients would have to contribute in order to adopt the device in different countries. Also the variable insecurity proved to have a slight positive effect on perceived usefulness among diabetes patients which is contradictive to existing literature in the field. Among physicians insecurity did prove to have a negative effect on perceived usefulness. Therefore, the question arises how insecurity among diabetes patients can positively influence perceived usefulness of a new product. Hence, this could be further researched among other stakeholders or other patients' samples.

Third, within this study, it would also have been interesting to map out differences between physicians in the Netherlands, Germany, and Austria and run the appropriate statistical tests. While it is shown in the validity analysis that the sample of $N = 66$ is adequate for analysis it would be much better to test this study with a much larger sample of physicians. Also the variables complexity and compatibility have not been tested due to a relative small sample size. Therefore, with a larger sample size it would also be interesting to include an adapted form of compatibility and complexity in the physicians' model. Moreover, most physicians resided in the Netherlands and therefore the sample proved to be too small and imbalanced to perform statistical

sound cross country analyses. Therefore, future research with a larger sample could yield in interesting results with potentially more significant relationships and interesting cross-country analysis results.

Fourth, this study identified another important stakeholder in the relationship with the diabetes patient, namely the diabetes nurse. This study showed that diabetes patients indicated to listen and receive much information via their nurse and therefore future research could also include diabetes nurses as a respondent group.

Fifth, due to the unavailability of the product in this context, many variables could not be tested, such as price and perceived ease of use. Therefore, after the introduction of the AP these variables could also be taken into consideration. Longitudinal studies can be conducted by measuring the same variables over a period of three years into three phases, namely, pre-adoption, adoption, and post-adoption phase. It would also be interesting to test satisfaction of patients and physicians after adoption and compare these results to older results. Also this study measured the mediating role of perceived usefulness. It is also interesting to test the mediating role of the other cognitive variable in TAM (i.e., perceived ease of use) between, for example, the TRI and intention to use.

Sixth, Lin et al. (2007) mention that evidence from the fieldwork shows that TR is incapable of explaining why high-TR consumers do not always adopt new technologies, such as cellular phones with open operating systems or in-car global positioning systems. According to this study's outcome, the patients and physicians both show high TR rates and therefore this should yield in high adoption rates as well according to Parasuraman (2000). Thus, after the introduction of the AP it could be interesting to explore the relation between TR and actual usage since this study indicated high TR levels in both diabetes patients and physicians.

Lastly, within the diabetes market there are many stakeholders such as physicians, diabetes patients, diabetes nurses, GPs, hospitals, health insurance companies, pharmacies, and medical device suppliers. This study focused only on physicians and diabetes patients, it is also interesting to research other stakeholders' technology acceptance and technology readiness.

6.5 Limitations

This research is not without limitations. There are several limitations to be mentioned with regard to this study.

First, this study assessed two stakeholder groups, whereas the patients group yielded in 398 usable responses and the physicians in 66 usable responses. The patients' respondents were all retrieved through the network of Inreda Diabetic and could therefore be argued to be biased towards several variables such as awareness of the AP. This also becomes evident in the 69.3% response rate whereas with a random sample a response rate between 20% and 30% is considered good. Also regarding awareness among physicians, similarly to patients, it became evident that in the physician group 77.3% indicated to have heard or read something about the AP before filling in the survey. Therefore, physicians could have been potentially biased towards some questions groups in the survey. Also, especially in the patients' group, a potential bias could exist towards some variables' outcomes such as intention to use and perceived usefulness since the largest part of the patients' group volunteered to participate in studies from Inreda Diabetic, probably because they have a high interest in the AP.

Second, the scales used in the survey were all based upon previously validated scales and items in English. In this study items were adapted to this research' context and translations were made to Dutch and German. Also several items were left out. Therefore, to be conservative, validity analyses and reliability analyses were run. It became evident that within the patients' model compatibility showed the same factor loading as intention to use and was therefore excluded from the factor analysis. It was still tested for reliability and was used for multiple regression analyses due to an expected effect on perceived usefulness and intention to use. Subsequently this study also found evidence for a significant relation between compatibility and perceived usefulness. Also a partial mediation between compatibility and intention to use was found through perceived usefulness. As discussed in chapter 5, even though it was not validated in this study, previous study's already validated this construct with Cronbach's alpha's of more than 0.7 (e.g., Venkatesh et al., 2003) and thus using compatibility for analyses should be no major point of concern.

Third, the outcome of the validity analyses of both the patients and the physicians showed certain problems with the discomfort variable and it had several low factor loading in both groups. The discomfort variable was the only variable which had more than two reductions after PCAs and therefore this variable was less suitable to be tested within this context. One possible reason for low factor loadings might be issues related to translation. As mentioned before, within this study all items were translated into Dutch and German which could have caused slightly different interpretations in some of the items due to free translations. However, some questions within the construct also seemed to be too ambiguous to be linked to discomfort. In both groups there was no relationship between discomfort and a dependent variable. In fact, in the patients group this was the only independent variable that showed to be not significantly related to perceived usefulness. Thus, the item reduction could have played a role here.

Fourth, all items were adapted to the context of the AP. For example, often "the system" was replaced by "the Artificial Pancreas". Even though this is done in many researches, in some items the validity could have been affected. Since the AP is not available yet, this study took measures to adapt the methodology towards this fact by adapting all scales and include intention to use instead of actual use. Furthermore, this study also added the TRI as antecedents to be better able to predict the technology acceptance. However, when a research is done without the availability of a product it can remain difficult to obtain the right results. Also for respondents it could often be confusing to answer questions without the availability of the physical product. Furthermore, largely due to the unavailability of the product, one out of three major components in TAM, perceived ease of use, had to be excluded.

Lastly, in terms of external validity, most of this study's results are limited to evidence from the Netherlands. Therefore, one should be careful generalising these study's results to countries outside the European union due to possible cultural differences.

7. Bibliography

Alba, J.W., & Hutchinson,W. (1987). Dimensions of consumer expertise. *Journal of Consumer Research, 13*, 411-454.

Al-Gahtani, S. (2001). The applicability of TAM outside North America: an empirical test in the United Kingdom. *Information Resource Management Journal, 14*(3), 37-46.

Arztverzeichnis (n.d.). Suchergebnis. Retrieved on May 23, 2014 from http://www.arztverzeichnis.at/suche/?nachname=&geschlecht=&plz=&ort=&county=0&mainfield=15&additivefield=0&spezial=4&x=74&y=23&diplom=0&funktion=0&spezialtherapie=0&stichwort=&cmd=sucheSubmit

Backer, T. E., Liberman, R. P., & Kuehnel, T. G. (1986). Dissemination and adoption of innovative psychosocial interventions. *Journal of Consulting and Clinical Psychology*, *54*, 111-118.

Bettman, J.R. (1979). *An Information Processing Theory of Consumer Choice.* Addison-Wesley, Reading, MA.

Bettman, J.R. & Sujan, M. (1987). Effects of Framing on Evaluations of Comparable and Non-Comparable Alternatives by Expert and Novice Consumers. *Journal of Consumer Research, 14*, 141-154.

Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182.

Berry, W. D. (1993). *Understanding regression assumptions*. Sage university paper series on quantitative applications in the social sciences, 07-092. Newbury Park, CA: Sage.

Bon, A.C. Van., Kohinor, J.E., Hoekstra, J.B.L., Basum, G. Von., & DeVries, J.H. (2010). Patients' perception and Future Acceptance of an Artificial Pancreas. *Journal of diabetes science and technology, 4*(3), 569-602.

Bon, A.C. Van, Brouwer, T.B., Hoekstra, J.B.L., VonBasum, G., & DeVries, J.H. (2011). Future acceptance of an Artificial Pancreas in Adults with Type 1 Diabetes. *Journal of diabetes technology and therapeutics, 13*(7), 731-736.

Bracht, N., Kingsbury, L., & Rissel, C. (1999). Community organization principles in health promotion: A five-stage model. In N. Bracht (Ed.), *Health promotion at the community level 2: New Advances.* Thousand Oaks, CA: SAGE.

Brewer, J. & Hunter, A. (1989). *Multimethod research: A synthesis of Styles.* Sage Library of Social Research, 175, Beverly Hills, CA: Sage.

Brown, B. S., & Flynn, P. M. (2002). The federal role in transferring knowledge to practice. *Journal of Substance Abuse Treatment, 22*, 245-257.

Brucks, M. (1985). The effects of product class knowledge on information search behaviour. *Journal of Consumer Research, 12,* 1-16.

Brunetti, P., Orsini Federici, M., & Massi Benedetti, M. (2003). The artificial pancreas. *Artificial cells, blood substitutes, and biotechnology, 31*(2), 127-138.

Burton-Jones, A., & Hubona, G. S. (2006). The mediation of external variables in the technology acceptance model. *Information & Management, 43,* 706-717.

Carver, C. S., Scheier, M. F., & Segerstrom, S. C. (2010). Optimism. *Clinical Psychology Review, 30,* 879-889.

Carroll, K. M., Farentinos, C., Ball, S. A., Crits-Christoph, P., Libby, B., Morgenstern, J., et al. (2002). MET meets the real world: Design issues and clinical strategies in the clinical trials network. *Journal of Substance Abuse Treatment, 23,* 73-80.

Chen, S-C., & Li, S-H. (2010). Consumer adoption of e-service: Integrating technology readiness with the theory of planned behaviour. *African Journal of Business Management, 16*(4), 3556-3563.

Chismar, W.G., & Wiley-Patton, S. (2002). Does the Extended Technology Acceptance Model Apply to Physicians. *System Sciences,* Proceedings of the 36th Annual Hawaii International Conference on System Sciences.

Chorpita, B. F., Yim, L. M., Donkervoet, J. C., Arensdorf, A., Amudsen, M. J., McGee, C., et al. (2002). Toward large-scaled implementation of empirically supported treatments for children: A review and observations by the Hawaii Empirical Basis to Services Task Force. *Clinical Psychology: Science and Practice, 9,* 165-190.

Cohen, D. A., Farley, T. A., Bedimo-Etame, J. R., Scribner, R., Ward, W., Kendall, C., et al. (1999). Implementation of condom social marketing in Louisiana, 1993 to 1996. *American Journal of Public Health, 89,* 204-208.

Chuttur M.Y. (2009). Overview of the Technology Acceptance Model: Origins, Developments and Future Directions. *Working Papers on Information Systems, 9*(37), 1-21.

Danaher, P. J., Hardie, B. G. S., & Putsis, W. P., Jr. (2001). Marketing-mix variables and the diffusion of successive generations of a technology innovation. *Journal of Marketing Research, 38,* 501-514.

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 3*(3), 319-340.

Davis, F., Bagozzi, R., & Warshaw, P. (1989). User acceptance of computer technology: A comparison of two. *Management Science, 35*(8), 982-1004.

DeVellis, R.F. (2012) *Scale Development: Theories and Applications (3rd ed.)* Thousand Oaks, CA: SAGE.

Diabsite (n.d.) Diabetologen DDG – Deutsche Diabetes-Gesellschaft. Retrieved on May 25, 2014 from http://www.diabsite.de/wegweiser/adressen/diabetologen/index.html

Dijkstra, W., & Smit, J. (1999). *Onderzoek met vragenlijsten: een praktische handleiding.* Amsterdam: VU uitgeverij.

Drake, R., Essock, S., Shaner, A., Cary, K., Minkoff, K., & Kola, L. (2001). Implementing dual diagnosis services for clients with severe mental illness. *Psychiatric Services, 52,* 469-476.

Elliott, K. M., Meng, J., & Hall, M.C. (2008). Technology Readiness and the Likelihood to Use Self-Service Technology: Chinese vs. American Consumers. *Marketing Management Journal, 18*(2), 20-31.

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). London, UK: SAGE.

Field, A. (2013). *Discovering statistics using SPSS* (4th ed.). London, UK: SAGE.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research.* Addison-Wesley, Reading, MA.

Garcia, R., Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review. *The Journal of Product Innovation Management, 19*(2), 110 - 132.

Gefen, D. (2003). TAM or just plain habit: A look at experienced online shoppers. *Journal of End User Computing, 15,* 1-13.

Gefen, D., & Straub, D.W. (1997). Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly, 21,* 389-400.

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly, 27,* 51-90.

Ghauri, P., & Grønhaug, K. (2010). *Research Methods in Business Studies (4th ed.).* Edinburgh, England: Pearson Education Limited.

Glanz, K., Rimer, B.K., & Viswanath, K. (2008). *Health behavior and health education. Theory, Research, and Practice.* San Fransisco, CA: Jossey-Bass.

Godoe, P., & Johansen, T.S. (2012). Understanding adoption of new Technologies: Technology Readiness and technology acceptance as an integrated concept. *Journal of European Psychology Students, 3,* 38-52.

Goldsmith, R. E., & Hofacker, C. F. (1991). Measuring consumer innovativeness. *Journal of the Academy of Marketing Science, 19,* 209-221.

Henggeler, S. W, Schoenwald, S. K, & Pickrel, S. G. (1995). Multisystemic therapy: Bridging the gap between university- and community-based treatments. *Journal of Consulting & Clinical Psychology, 63,* 709-717.

Henggeler, S. W., Melton, G. B., Brondino, M. J., Scherer, D. G., & Hanley, J. H. (1997). Multisystemic therapy with violent and chronic juvenile offenders and their families: The role of treatment fidelity in successful dissemination. *Journal of Consulting & Clinical Psychology, 65*, 821-833.

Henggeler, S. W., Lee, T., & Burns, J. A. (2002). What happens after the innovation is identified? *Clinical Psychology: Science & Practice, 9*, 191-194.

Hofstede, G. (2003). *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Hollon, S. D., Munoz, R. F., Barlow, D. H., Beardslee, W. R., Bell, C. C, Bernal, G., et al. (2002). Psychosocial intervention development for the prevention and treatment of depression: Promoting innovation and increasing access. *Biological Psychiatry, 52,* 610-630.

Hovorka, R. (2006). Continuous glucose monitoring and closed-loop systems. *Diabetic Medicine : A Journal of the British Diabetic Association, 23*, 1-12.

Hu, P.J., Chau, P.Y.K., Sheng, O.R.L., Tam, K.Y. (1999). Examining technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management of Information Systems, 16*, 91-112.

Hutcheson, G., & Sofroniou, N. (1999). *The multivariate social scientist.* London: Sage.

Im, S., Bayus, B. L., & Mason, C. H. (2003). An empirical study of innate consumer innovativeness, personal characteristics, and new product adoption behaviour. *Journal of the Academy of Marketing Science, 31*, 61-73.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*, 31-36.

Karahanna, E., Straub, D.W., & Chervany,N. L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post adoption beliefs. *MIS Quarterly, 23*, 183-213.

King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management, 43*, 740-755.

Kotler, G., & Zaltman, P. (1971). Social marketing theory: An approach to planned social change. *Journal of Marketing, 35*, 3-12.

Lam, S.Y., Chiang, J., & Parasuraman, A. (2008). The effects of the dimensions of technology readiness on technology acceptance: An empirical analysis. *Journal of Interactive Marketing, 22*(4), 19-39.

Langendam, M., Luijf. Y.M., Hooft, L., DeVries, J.H., Mudde, A.H., & Scholten, R.J.P.M. (2012). *Continuous glucose monitoring systems for type 1 diabetes mellitus (Review).* The Cochrane Collaboration. John Wiley & Sons, Ltd.

Lee, Y., Kozar, K. A., & Larsen, K.R.T. (2003). The technology acceptance model: past, present and future. *Commun. AIS, 12* (50), 752-780.

Lee, M.C. (2010). Explaining and predicting users' continuance intention toward e-learning: an extension of the expectation confirmation model. *Computer Education, 54*, 506-516.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information and Management, 40*, 191-204.

Liberman, A., Buckingham, B., & Philip, M. (2011). Diabetes technology and the human factor. *The international journal of clinical practice, 65*, 83-90.

Liljander, V., Gillberg, F., Gummerus, J., & van Riel, A. (2006). Technology Readiness and the Evaluation and Adoption of Self-Service Technologies. *Journal of Retailing & Consumer Services, 13*(3), 177-191.

Lin, J. S. & Hsieh, P.L. (2006). The Role of Technology Readiness in Customers' Perception and Adoption of Self-Service Technologies. *International Journal of Service Industry Management, 17*(5), 497-517.

Lin, C-H., Shih, H-Y., & Sher, P.J. (2007) Integrating Technology Readiness into Technology Acceptance: The TRAM model. *Psychology & Marketing, 24*(7), 641-657.

Lu, J., Yu, C., Liu, C., & Yao, J. E. (2003). Technology acceptance model for wireless Internet. *Internet Research: Electronic Networking Applications and Policy, 13*, 206-222.

Lu, J., Wang, L., Hayes, L.A. (2012). How do technology readiness, platform functionality and trust influence c2c user satisfaction? *Journal of Electronic Commerce Research, 13*(1), 50-69.

Maguire, M. (2001). Methods to support human-centred design. *International Journal of Human Computer Studies, 55*, 587-634.

Malhotra, Y. & Galletta, D. F. (1999). Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation. *Thirty Second Hawaii International Conference on System Sciences* (HICSS), Maui, Hawaii.

Martin, G., Herie, M., Turner, B., & Cunningham, J. (1998). A social marketing model for disseminating research-based treatments to addictions treatment providers. *Addiction, 93*, 1703-1715.

Matthing, J., Kristensson, P., Gustafsson, A., & Parasuraman, A. (2006). Developing Successful Technology-Based Services: the Issue of Identifying and Involving Innovative Users. *Journal of Services Marketing, 20*(5), 288-297

McFarland, D. J., & Hamilton, D. (2006). Adding contextual specificity to the technology acceptance model. *Computers in Human Behavior, 22*, 427-447.

McLellan, A. T. (2002). Technology transfer and the treatment of addiction: What can research offer practice? *Journal of Substance Abuse Treatment, 22*, 169-170.

Menard, S. (1995). *Applied logistic regression analysis*. Sage university paper series on quantitative applications in the social sciences. Thousand Oaks, CA: Sage.

Meuter, M. L., Bitner, M. J., Ostrom, A. L., & Brown, S. W. (2005). Choosing Among Alternative Service Delivery Modes: An Investigation of Customer Trial of Self-Service Technologies. *Journal of Marketing, 69*, 61-83.

Mick, D. G., & Fournier, S. (1998). Paradoxes of Technology: Consumer Cognizance, Emotions, and Coping Strategies. *Journal of Consumer Research, 25*, 123-147.

Midgley, F. D., & Dowling, G. R. (1993). A longitudinal study of product form innovation: The interaction between predispositions and social messages. *Journal of Consumer Research, 19*, 611-625.

Miles, J. & Shevlin, M. (2001). *Applying Regression and Correlation: A guide for Students and Researchers*, Thousand Oaks, CA: Sage.

Mukherjee, A., & Hoyer, W.D. (2001). The effect of novel attributes on product evaluation. *Journal of Consumer Research, 28*(3), 462-472.

National Institute of Mental Health. (2002). *State implementation of evidence based practices: Bridging science and service*. Retrieved May 2, 2014, from http://grants.nih.gov/ grants/guide/rfa-files/RFA-MH-03–007.html

Parasuraman, A. (2000). Technology readiness index (TRI): a multiple item scale to measure readiness to embrace new technologies. *Journal of Service Research, 2*(4), 307-320.

Parasuraman, A., & Colby, C.L. (2001). *Techno-Ready Marketing: How and Why Your Customers Adopt Technology*. Free Press, New York.

Pavlou, P. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce, 7*, 101-134.

Peracchio, L. A., & Tybout, A. M. (1996). The moderating role of prior knowledge in schema-based product evaluation. *Journal of Consumer Research, 23*, 177–192.

Phillips, S. D., Burns, B. J., Edgar, E. R., & Brocke, B. (2001). Moving assertive community treatment into standard practice. *Psychiatric Services., 52*, 771-779.

Preacher, K.J. & Hayes, A.F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behaviour Research Methods, Instruments, & Computers, 36*(4), 717-731.

Rao, A. R., & Monroe, K. B. (1988). The moderating effect of prior knowledge on cue utilization in product evaluations. *Journal of Consumer Research, 15*, 253-264.

Raja, U., Johns, G., & Ntalianis, F. (2004). The Impact of Personality on Psychological Contracts. *Academy of Management Journal, 47*(3), 350-367.

Renard, E. (2010). Insulin Pump Use in Europe. *Diabetes Technology & Therapeutics, 12*(1), 29-32.

Rogers, E.M. (1995). *The Diffusion of Innovations* (4th ed.). New York: The Free Press

Rogers, E.M. (2002). Diffusion of preventive innovations. *Addictive Behaviours, 27*, 989-993.

Rogers, E.M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Rogers, E.M. (2010). *Diffusion of innovations*: Simon and Schuster.

Schaup, L.C., Carter, L., McBride, M.E. (2010). E-file adoption: a study of U.S. taxpayers' intentions. *Computer Human Behaviour, 26*(4), 636-644.

Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management, 44*, 90-103.

Schmidt, F., & Taylor, T. (2002). Putting empirically supported treatments into practice: Lessons learned in a childrens' mental health centre. *Professional Psychology: Research and Practice, 33*, 483-489.

Shaw, J.E., Sicree, R.A., & Zimmet, P.Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes research and clinical practice, 87*, 4-14

Simpson, D. (2002). A conceptual framework for transferring research to practice. *Journal of Substance Abuse Treatment, 22*, 171-182.

Sobel, M. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological methodology, 13*, 290-312.

Son, M., & Han, K. (2011). Beyond the technology adoption: Technology readiness effects on post-adoption behaviour. *Journal of Business Research 64*, 1178-1182

Sophonthummapharn, K. & Tesar, G. (2007). "Technology Readiness and Propensity of Cell Phone Users to Subscribe to Commercial Messaging Services," *Marketing Management Journal, 17*(2), 81-95.

Steenkamp, J. E. M., ter Hofstede, F., & Wedel, M. (1999). A cross-national investigation into the individual and national cultural antecedents of consumer innovativeness. *Journal of Marketing, 63*, 55-69.

Stevens, J. P. (2002). *Applied multivariate statistics for the social sciences* (4th ed.). Hillsdale, NJ: Erlbaum.

Taylor, S. E., Kemeny, M. E., Aspinwall, L. G., Schneider, S. G., Rodriguez, R., & Herbert, M. (1992). Optimism, coping, psychological distress, and high-risk sexual behavior among men at risk for acquired immunodeficiency syndrome (AIDS). *Journal of Personality and Social Psychology, 63*, 460-473.

Taylor, S. A., Goodwin, S., & Celuch, K.G. (2005). An Exploratory Investigation into the Question of Direct Selling via the Internet in Industrial Equipment Markets. *Journal of Business-To-Business Marketing, 12*(2), 39-72.

Tellis, G. J., Yin, E., & Bell, S. (2009). Global consumer innovativeness: Cross-country differences and demographic commonalities. *Journal of International Marketing, 17*, 1-22.

Thogersen, J., Haugaard, P., & Olesen, A. (2010). Consumer responses to Eco labels. *European Journal of Marketing, 44*, 1787-1810.

Thompson, R. L., Higgins, C. A., & Howell, J. (1991). Personal Computing : Toward a Conceptual Model of Utilization. *MIS Quarterly, 15*, 124-143.

Tidd, J. & Bessant, J. (2013). *Managing Innovation: Integrating technological, market and organizational change* (5th ed.). Wiley

Tsikriktsis, N. (2004). A technology readiness-based taxonomy of costumers: A replication and extension. *Journal of Service Research, 7*, 42-52.

Veblen-Mortensen, S., Rissel, C., Perry, C., Forster, J., Wolfson, M., & Finnegan, J. (1999). Lessons learned from Project Northland: Community organization in rural communities. In N. Bracht (Ed), *Health promotion at the community level 2: New Advances.* Thousand Oaks: Sage Publications.

Venkatesh, V., & Davis, F.D. (1996). A model of the antecedents of perceived ease of use: development and test. *Decision Science, 27*(3), 451-481.

Venkatesh, V., Morris, M.G., Davis, G.B., & Davis, F.D. (2003). User acceptance of information technology: towards a unified view. *MIS Quarterly, 27*(3), 425-478.

Victorino, L., Karniouchina, E., & Verma, R. (2009). Exploring the Use of the Abbreviated Technology Readiness Index for Hotel Customer Segmentation. *Cornell Hospitality Quarterly, 50*(3), 342-359.

Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information & Management, 44*, 206-215.

Wang, Y. S., Wang, Y. M., Lin, H. H., & Tang, T. I. (2003). Determinants of user acceptance of Internet banking: An empirical study. *International Journal of Service Industry Management, 14*, 501-519.

Yap, L., Wu, Z., Liu, W., Ming, Z., & Liang, S. (2002). A rapid assessment and its implications for a needle social marketing intervention among injecting drug users in China. *International Journal of Drug Policy, 13*, 57-68.

Yarbrough, A.K. & Smith, T.B. (2007). Technology acceptance among physicians: a new take on TAM. *Medical Care Research and Review, 64(*6), 650-672.

Yen, S. J. (2005). An Attribute-Based Model of Quality Satisfaction for Internet Self-Service Technology. *Service Industries Journal, 25*(5), 641-659.

Yi, M. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies, 59*, 431-449.

Yi, M.Y., Jackson, J.D., Park, J.S., & Probst, J.C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & Management, 43*, 350-363

Yoh, E., Damhorst, M. L., Sapp, S., & Laczniak, R. (2003). Consumer adoption of the Internet: The case of apparel shopping. *Psychology & Marketing, 20*, 1095-1118.

Yusoff, Y. M., T. Ramayah, & Ibrahim, H. (2010). E-HRM: A proposed model based on technology acceptance model. *African Journal of Business Management Vol. 4*(13), 3039-3045.

Zorgkaart Nederland (n.d.). 170 internisten met als specialisme endocrinologie in Nederland bekend. Retrieved on May 23, 2014 from http://www.zorgkaartnederland.nl/internist/endocrinologie

8. Appendices

8.1 Appendix A: Survey Dutch Patients

Construct	Item code	Item in Dutch
EN: Buyer Readiness NL: Bereidheid tot aanschaf van de kunstmatige alvleesklier	BR_01	Ik heb wat gehoord of gelezen over de kunstmatige alvleesklier alvorens deze enquête in te vullen.
	BR_02	De kunstmatige alvleesklier is zichtbaar in mijn omgeving (denk hierbij bijvoorbeeld aan media, nieuwsartikelen etc.)
	BR_03	Ik heb actief gezocht naar informatie over de kunstmatige alvleesklier.
	BR_04	Ik wil meer weten of leren over de kunstmatige alvleesklier
	BR_05	Ik ben van plan de kunstmatige alvleesklier te vergelijken met andere behandelingen
EN: Optimism	OPT_01	Technologie geeft mensen meer controle over hun dagelijkse leven
NL: Optimisme	OPT_02	Producten en diensten die de nieuwst beschikbare technologie gebruiken zijn gemakkelijker om te gebruiken
	OPT_03	U heeft een voorkeur om de meest geavanceerde technologie die beschikbaar is te gebruiken
	OPT_04	Technologie maakt u efficienter in uw beroep
	OPT_05	Technologie geeft u meer bewegingsvrijheid
	OPT_06	U bent er van overtuigd dat apparaten doen wat u ze heeft geïnstrueerd
EN: Innovativeness	INN_01	Andere mensen komen bij u advies inwinnen over nieuwe technologieën
NL: Innovativiteit	INN_02	In het algemeen bent u de eerste in uw vriendenkring die nieuwe technologie aanschaft wanneer het beschikbaar is
	INN_03	Normaliter begrijpt u nieuwe high-tech producten en diensten zonder de hulp van anderen
	INN_04	U blijft op de hoogte van de laatste technologische ontwikkelingen in uw dagelijksleven
	INN_05	U heeft over het algemeen minder problemen dan andere mensen om u een technologie eigen te maken
EN: Discomfort	ONG_01	Technische instructies zijn niet behulpzaam omdat ze geen uitleg geven in voor u begrijpelijke taal
NL: Ongemak	ONG_02	Soms denkt u dat technische systemen niet ontworpen zijn voor gewone mensen
	ONG_03	Naar mijn mening, bestaat er niet zoiets als een handleiding voor een technisch product of service dat is geschreven in eenvoudig nederlands
	ONG_04	Wanneer u een technisch product of dienst koopt, heeft u liever het basis model dan een model met veel extra functies
EN: Insecurity	ONZ_01	Revolutionaire nieuwe technologie is vaak minder veilig dan critici me doen geloven.
NL: Onzekerheid	ONZ_02	Een machine of een computer zal een taak minder betrouwbaar uitvoeren dan een persoon

	ONZ_03	Het kan riskant zijn om te vroeg naar een nieuwe technologie om te schakelen
	ONZ_04	Als je producten koop die erg technisch zijn, kan het gebeuren dat je geen reserve onderdelen of service kan vinden
	ONZ_05	Nieuwe technologie lijkt mensen altijd te benadelen doordat deze hun vaardigheden overbodig maken
EN: Perceived Usefulness	VN_01	Ik verwacht dat het gebruik van de kunstmatige alvleesklier mijn prestaties in het dagelijks leven zal verbeteren
NL: Verwachte Nut	VN_02	Ik verwacht dat het gebruik van de kunstmatige alvleesklier mijn productiviteit in het dagelijks leven zal verbeteren
	VN_03	Ik verwacht dat het gebruik van de kunstmatige alvleesklier mijn effectiviteit in het dagelijks leven zal verbeteren
	VN_04	Ik verwacht dat het gebruik van de kunstmatige alvleesklier nuttig zal zijn in mijn dagelijks leven
	VN_05	Ik verwacht dat het gebruik van de kunstmatige alvleesklier in mijn dagelijks leven ervoor zal zorgen dat ik taken sneller af kan ronden
	VN_06	Ik verwacht dat het gebruik van de kunstmatige alvleesklier het makkelijker zou maken voor me om mijn dagelijkse bezigheden te voltooien
EN: Compatability	COM_01	Ik verwacht dat het gebruik van de kunstmatige alvleesklier mogelijk is in alle aspecten van mijn leven, zowel werk als vrije tijdsbesteding
NL: Compatibiliteit	COM_02	Ik denk dat het gebruik van de kunstmatige alvleesklier goed past bij de manier waarop ik graag leef en werk
	COM_03	Ik verwacht dat het gebruik van de kunstmatige alvleesklier goed past bij de manier waarop ik mijn dagelijkse taken uitvoer
EN: Complexity NL: Complexiteit	ING_01	Ik verwacht dat het gebruik van de kunstmatige alvleesklier te veel tijd wegneemt van mijn normale dagelijkse taken
	ING_02	Ik verwacht dat het gebruik van de kunstmatige alvleesklier zo ingewikkeld is dat het moeilijk is om te begrijpen wat er precies gaande is.
	ING_03	Ik verwacht dat het gebruik van de kunstmatige alvleesklier te veel tijd kost in de vorm van de uit te voeren handelingen
	ING_04	Ik verwacht dat het te lang zal duren om te leren hoe de kunstmatige alvleesklier te gebruiken om het de moeite waard te maken
EN: Subjective Norm	SN_01	Ik denk dat mensen die mijn gedrag beïnvloeden vinden dat ik de kunstmatige alvleesklier zou moeten gebruiken
NL: Subjectieve Norm	SN_02	Ik denk dat mensen die belangrijk voor mij zijn vinden dat ik de kunstmatige alvleesklier zou moeten gebruiken
EN: Social Influences	SI_01	Andere personen met diabetes vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
NL: Sociale Invloeden	SI_02	Normaal gesproken wil ik graag doen wat andere diabetespatienten vinden dat ik zou moeten doen
	SI_03	Mijn vrienden vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_04	Normaal gesproken wil ik graag doen wat mijn vrienden vinden dat ik moet doen
	SI_05	Mijn arts vindt waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken

	SI_06	Normaal gesproken wil ik graag doen wat mijn arts vindt dat ik moet doen
	SI_07	Mijn diabetes verpleegkundige vindt waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_08	Normaal gesproken wil ik graag doen wat mijn diabetes verpleegkundige vindt dat ik moet doen
	SI_09	Mijn familie vindt waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_10	Normaal gesproken wil ik graag doen wat mijn familie vindt dat ik moet doen
	SI_11	Mijn partner vindt waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_12	Normaal gesproken wil ik graag doen wat mijn partner vindt dat ik moet doen
	SI_13	Patientenverenigingen vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_14	Normaal gesproken wil ik graag doen wat de patientenvereniging vindt dat ik moet doen
	SI_15	Mijn kinderen vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_16	Normaal gesproken wil ik graag doen wat mijn kinderen vinden dat ik moet doen
	SI_17	Mijn collega's vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten gebruiken
	SI_18	Normaal gesproken wil ik graag doen wat mijn collega's vinden dat ik moet doen
EN: Diabetes Treatment Satisfaction	TH_01	Hoe tevreden bent u met uw huidige behandeling van diabetes?
NL: Diabetes behandelingstevredenheid	TH_02	Hoe vaak hebt u de afgelopen tijd het idee gehad dat uw bloedsuikers onaanvaardbaar hoog waren?
	TH_03	Hoe vaak hebt u de afgelopen tijd het idee gehad dat uw bloedsuikers onaanvaardbaar laag waren?
	TH_04	Hoe gemakkelijk vindt u op dit moment uw huidige behandeling?
	TH_05	Hoe flexibel vindt u op dit moment uw huidige behandeling?
	TH_06	Hoe tevreden bent u met uw kennis van diabetes?
	TH_07	Zou u uw huidige behandeling van diabetes aan iemand met hetzelfde type diabetes aanraden?
	TH_08	Hoe graag zou u met uw huidige vorm van behandeling verdergaan?
EN: Intention to Use	ITU_01	Er van uitgaande dat ik toegang zou hebben tot een kunstmatige alvleesklier, ben ik van plan om het te gebruiken
NL: Intentie tot gebruik	ITU_02	Er van uitgaande dat ik toegang zou hebben tot een kunstmatige alvleesklier, voorspel ik dat ik het zou gebruiken
EN: General Descriptives	AG_01	Wat is uw leeftijd?
NL: Demografische vragen	AG_02	Wat is uw geslacht?
	AG_03	Wat is uw hoogstgenoten opleiding?

AG_04	Wat voor type diabetes heeft u?
AG_05	Hoe oud was u toen u de diagnose diabetes kreeg?
AG_06	Welke methode gebruikt u op dit moment om diabetes te behandelen?
AG_07	Als u een insuline pomp heeft, hoeveel jaar heeft u deze al?
AG_08	Als u een CGM heeft, hoeveel jaar heeft u deze al?
AG_09	Heeft u deelgenomen aan een klinische test van de kunstmatige alvleesklier?

8.2 Appendix B: Surveys Dutch physicians and German physicians

Construct (Dutch, German, English)	Itemcode	Item in Dutch	Item in German
NL: Bereidheid tot aanschaf van de kunstmatige alvleesklier DE: Kaufbereitschaft EN: Buyer Readiness	BR_01	Ik heb wat gehoord of gelezen over de kunstmatige alvleesklier alvorens deze enquête in te vullen	Ich habe von der künstlichen Bauchspeicheldrüse gehört oder gelesen, bevor ich diesen Fragenbogen ausgefüllt habe.
	BR_02	De kunstmatige alvleesklier is zichtbaar in mijn beroepspraktijk	Die künstliche Bauchspeicheldrüse ist in meinem professionellen Umfeld präsent.
	BR_03	Ik heb actief gezocht naar informatie over de kunstmatige alvleesklier	Ich habe mich bemüht weitere Informationen über die künstliche Bauchspeicheldrüse zu erhalten, nachdem ich von ihr erfahren habe.
	BR_04	Ik wil meer weten of leren over de kunstmatige alvleesklier	Ich möchte mehr über die künstliche Bauchspeicheldrüse erfahren und lernen.
	BR_05	Ik ben van plan de kunstmatige alvleesklier te vergelijken met andere behandelingen	Ich gedenke die künstliche Bauchspeicheldrüse mit anderen Behandlungsmethoden zu vergleichen.
NL: Optimisme DE: Optimismus EN: Optimism	OPT_01	Technologie geeft mensen meer controle over hun dagelijkse leven	Technologie gibt Menschen mehr Kontrolle im Alltag.
	OPT_02	Producten en diensten die de nieuwst beschikbare technologie gebruiken zijn gemakkelijker om te gebruiken.	Produkte und Dienstleistungen, die auf der neuesten Technologie basieren, sind deutlich komfortabler zu nutzen.
	OPT_03	U heeft een voorkeur om de meest geavanceerde technologie die beschikbaar is te gebruiken.	Ich bevorzuge es modernste Technologien zu nutzen.
	OPT_04	Technologie maakt u efficiënter in uw beroep.	Technologien erlauben es mir, effizienter in meinem Beruf zu sein.
	OPT_05	Technologie geeft u meer bewegings vrijheid.	Technologien geben mir mehr Mobilität.
	OPT_06	U bent ervan overtuigd dat apparaten doen wat u ze heeft geïnstrueerd.	Ich bin zuversichtlich, dass Maschinen das befolgen was ich ihnen vorgebe.
NL: Innovativiteit DE: Innovativität EN: Innovativeness	INN_01	Andere mensen komen bij u advies inwinnen over nieuwe technologieën.	Mitmenschen fragen mich nach Ratschlägen zu neuen Technologien.
	INN_02	In het algemeen bent u de eerste in uw vriendenkring die nieuwe technologie aanschaft wanneer het beschikbaar is.	Generell bin ich einer der Ersten in meinem Bekanntenkreis der neue Technologien besitzt sobald sie verfügbar sind.
	INN_03	Normaliter begrijpt u nieuwe high-tech producten en diensten zonder de hulp van anderen.	Gewöhnlicherweise kann ich neue Hightech-Produkte und Dienstleistungen ohne die Hilfe von anderen verstehen.
	INN_04	U blijft op de hoogte van de laatste technologische ontwikkelingen in uw werkveld.	Ich bin über die neuesten technologischen Entwicklungen in Gebieten, die mich interessieren, auf dem Laufenden.
	INN_05	U heeft over het algemeen minder problemen dan andere mensen om u een	Ich habe weniger Probleme als andere Menschen mit technischen Geräten

		technologie eigen te maken.	umzugehen.
NL: Ongemak DE: Unannehmlichkeiten EN: Discomfort	ONG_01	Technische instructies zijn niet behulpzaam omdat ze geen uitleg geven in voor u begrijpelijke taal	Technik-Hotlines sind für mich nicht hilfreich, da sie Dinge nicht in leicht verständlicher Sprache erklären.
	ONG_02	Soms denkt u dat technische systemen niet ontworpen zijn voor gewone mensen.	Manchmal denke ich, dass technologische Systeme nicht für den Durchschnittsmenschen gemacht sind.
	ONG_03	Naar mijn mening, bestaat er niet zoiets als een handleiding voor een high-tech product of dienst dat is geschreven in eenvoudig Nederlands.	Es gibt keine Anleitung für Hightech-Produkte oder Dienstleistungen, die in deutlicher Sprache verfasst ist.
	ONG_04	Wanneer je een technisch product of dienst koopt, heb je liever het basis model dan een model met veel extra functies	Wenn ich ein Hightech-Produkt oder eine Dienstleistung kaufe, bevorzuge ich eher das Basismodell als eines mit viel Ausstattung.
	ONG_05	Voorzichtigheid is geboden wanneer belangrijke menselijke taken vervangen worden door nieuwe technologie.	Achtsamkeit ist von Nöten, da neue Technologien, die die manuelle Arbeit von Menschen ersetzen, defekt sein können.
	ONG_06	Veel nieuwe technologische ontwikkelingen hebben gezondheids- of veiligheidsproblemen die niet ontdekt worden tot na gebruik.	Viele neue Technologien haben Gesundheits- oder Sicherheitsrisiken, die nicht erforscht sind bevor sie genutzt werden.
	ONG_07	Technologie lijkt altijd te mislukken op het slechtst mogelijke moment.	Dem Anschein nach versagen Technologien immer im ungünstigsten Augenblick.
NL: Onzekerheid DE: Unsicherheit EN: Insecurity	ONZ_01	Revolutionaire nieuwe technologie is vaak minder veilig dan critici me doen geloven.	Kritiken lassen Menschen glauben, dass revolutionäre neue Technologien deutlich unsicherer sind als sie eigentlich sind.
	ONZ_02	Een machine of een computer zal een taak minder betrouwbaar uitvoeren dan een persoon.	Eine Maschine oder ein Computer ist deutlich unzuverlässiger in der Bewältigung einer Aufgabe als ein Mensch.
	ONZ_03	Het kan riskant zijn om te vroeg naar een nieuwe technologie om te schakelen.	Es kann riskant sein zu schnell zu einer revolutionären neuen Technologie zu wechseln.
	ONZ_04	Als je producten koopt die erg high-tech zijn, kan het gebeuren dat je geen reserve onderdelen of service kan vinden.	Wenn ich ein Hightech-Produkt erwerbe, laufe ich Gefahr keine Ersatzteile zu finden oder Service zu erhalten.
	ONZ_05	Nieuwe technologieën lijken altijd mensen te benadelen doordat deze hun vaardigheden overbodig maken	Technologische Innovationen schaden immer einer Menge Menschen, da sie deren Fähigkeiten hinfällig machen.
NL: Verwachte Nut DE: Wahrgenommener Nutzen EN: Perceived Usefulness	VN_01	Ik verwacht dat het gebruik van de kunstmatige alvleesklier de prestaties in mijn werk zal verbeteren	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse meine Leistungsfähigkeit im Beruf erhöht.
	VN_02	Ik verwacht dat het gebruik van de kunstmatige alvleesklier de productiviteit in mijn werk zal verbeteren	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse meine Produktivität im Beruf erhöht.

	VN_03	Ik verwacht dat het gebruik van de kunstmatige alvleesklier de effectiviteit in mijn werk zal verbeteren	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse meine Effektivität im Beruf erhöht.
	VN_04	Ik verwacht dat het gebruik van de kunstmatige alvleesklier nuttig zal zijn in mijn werk	Ich erwarte, dass die künstliche Bauchspeicheldrüse nützlich in meinem Job sein wird.
	VN_05	Ik verwacht dat het gebruik van de kunstmatige alvleesklier me zal helpen om bepaalde taken in mijn werk sneller te volbrengen	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse es mir ermöglicht, Aufgaben schneller zu erledigen.
	VN_06	Ik verwacht dat het gebruik van de kunstmatige alvleesklier het makkelijker maakt om mijn werk uit te oefenen	Ich erwarte, dass mir die Nutzung der künstlichen Bauchspeicheldrüse die Ausführung meiner Arbeit erleichtert.
NL: Compatibiliteit DE: Kompatibilität EN: Compatibility	COM_01	Ik verwacht dat het gebruik van de kunstmatige alvleesklier aansluit bij alle aspecten van mijn werk	Die Nutzung der künstlichen Bauchspeicheldrüse ist kompatibel mit sämtlichen Aspekten meiner Arbeit.
	COM_02	Ik denk dat het gebruik van de kunstmatige alvleesklier goed past bij de manier waarop ik graag werk	Ich denke, dass die Nutzung der künstlichen Bauchspeicheldrüse gut in die Art und Weise, wie ich arbeite, passt.
	COM_03	Ik verwacht dat het gebruik van de kunstmatige alvleesklier past bij mijn werkstijl	Ich denke, dass die Nutzung der künstlichen Bauchspeicheldrüse gut zu meinem Arbeitsstil passt.
NL: Ingewikkeldheid DE: Komplexität EN: Complexity	ING_01	Ik verwacht dat het gebruik van de kunstmatige alvleesklier te veel tijd wegneemt van mijn normale taken	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse zu viel Zeit von meiner regulären Arbeitszeit beansprucht.
	ING_02	Ik verwacht dat het werken met de kunstmatige alvleesklier zo ingewikkeld is dat het moeilijk is om te begrijpen is wat er precies gaande is	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse derart kompliziert ist, dass es schwierig wird die Anwendung zu verstehen.
	ING_03	Ik verwacht dat het gebruik van de kunstmatige alvleesklier te veel tijd kost in de vorm van de uit te voeren handelingen	Ich erwarte, dass die Nutzung der künstlichen Bauchspeicheldrüse zu viel Zeit für mechanische Vorgänge beansprucht.
	ING_04	Ik verwacht dat het te lang zal duren om te leren hoe de kunstmatige alvleesklier gebruikt dient te worden om het de moeite waard te maken	Ich erwarte, dass das Erlernen der Nutzung der künstlichen Bauchspeicheldrüse zu viel Zeit benötigt, sodass der Nutzen verringert wird.
NL: Subjectieve Norm DE: Subjektive Norm EN: Subjective Norm	SN_01	Ik denk dat mensen die mijn gedrag beïnvloeden vinden dat ik de kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten.	Ich denke, dass Menschen, die mein Verhalten beeinflussen, meinen, dass ich die künstliche Bauchspeicheldrüse verschreiben sollte.
	SN_02	Ik denk dat mensen die belangrijk voor mij zijn vinden dat ik de kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten.	Ich denke, dass Menschen, die mir wichtig sind, meinen, dass ich die künstliche Bauchspeicheldrüse verschreiben sollte.
NL: Sociale Influenties DE: Sozialer Einfluss EN: Social Influences	SI_01	Mijn collega artsen vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten	Meine Kollegen denken, dass ich die künstliche Bauchspeicheldrüse verschreiben sollte.

	SI_02	Over het algemeen wil ik doen wat mijn collega artsen vinden dat ik zou moeten doen	Im Großen und Ganzen möchte ich das tun, was meine Kollegen denken das ich tun sollte.
	SI_03	Mijn leidinggevenden vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten	Meine Vorgesetzten denken, dass ich die künstliche Bauchspeicheldrüse verschreiben sollte.
	SI_04	Over het algemeen wil ik doen wat mijn leidinggevenden vinden dat ik zou moeten doen	Im Großen und Ganzen möchte ich das tun, was meine Vorgesetzten denken das ich tun sollte.
	SI_05	Mijn ondergeschikten vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten	Meine Untergebenen denken, dass ich die künstliche Bauchspeicheldrüse verschreiben sollte.
	SI_06	Over het algemeen wil ik doen wat mijn ondergeschikten vinden dat ik zou moeten doen	Im Großen und Ganzen möchte ich das tun, was meine Untergebenen denken das ich tun sollte.
	SI_07	Mijn patiënten vinden waarschijnlijk dat ik de kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten	Meine Patienten denken, dass ich die künstliche Bauchspeicheldrüse verschreiben sollte.
	SI_08	Over het algemeen wil ik doen wat mijn patiënten vinden dat ik zou moeten doen	Im Großen und Ganzen möchte ich das tun, was meine Patienten denken das ich tun sollte.
NL: Bedoeling tot Gebruik DE: Nutzungsabsicht EN: Intention to Use	ITU_01	Er van uitgaande dat ik toegang zou hebben tot een kunstmatige alvleesklier, ben ik van plan om het voor te schrijven	Vorausgesetzt ich habe Zugang zur künstlichen Bauchspeicheldrüse, plane ich diese einzusetzen.
	ITU_02	Er van uitgaande dat ik toegang zou hebben tot een kunstmatige alvleesklier, voorspel ik dat ik het zou voorschrijven	Vorausgesetzt ich habe Zugang zur künstlichen Bauchspeicheldrüse, nehme ich an, dass ich diese nutzen würde.
NL: Demografische Vragen	AGE	Wat is uw leeftijd	Alter
DE: Demographische Fragen	GEN	Wat is uw geslacht?	Geschlecht
EN: Demographical Questions	EDU	Wat is uw hoogst genoten opleiding waarvan u een diploma heeft behaald?	Höchster erzielter Abschluss
	NAT	In welk land bent u woonachtig?	In welchem Land sind Sie derzeit wohnhaft?
	BER	Hoeveel Jaren werkt u in uw huidige beroep?	Wie lange sind Sie bereits in Ihrem jetzigen Beruf tätig?
	KLITEST	Heeft u deelgenomen aan een klinische test van de kunstmatige alvleesklier?	Haben Sie bereits an einer klinischen Teststudie der künstlichen Bauchspeicheldrüse teilgenommen?
	TYPHOS	In wat voor type ziekenhuis bent u werkzaam?	In welcher Art von Krankenhaus sind Sie zur Zeit tätig?
	COMMAP	Door middel van welk communicatie kanaal wordt u normaliter op de hoogte gebracht van nieuwe (medische) technologieën zoals de kunstmatige alvleesklier?	Wie erfahren Sie im regelfall von den neusten (medizinischen) Technologien, wie zB der künstlichten Bauchspeicheldrüse?

8.3 Appendix C: Introduction text survey Dutch diabetes patient

Geachte mevrouw/meneer,
Graag willen wij u uitnodigen om een vragenlijst in te vullen over de kunstmatige alvleesklier. Het invullen van deze vragenlijst duurt ongeveer 10 minuten. De kunstmatige alvleesklier is bedoeld voor de behandeling van diabetes. Dit onderzoek is opgezet vanuit de afdelingen Bedrijfskunde en Communicatie aan de Universiteit Twente in het kader van een Europees project (PCDIAB) waarin een kunstmatige alvleesklier wordt ontwikkeld in samenwerking met Inreda Diabetic B.V., AMC Amsterdam, Universiteit van Graz, Profil Research, Full Group en Novo Nordisk.
Hieronder krijgt u eerst twee foto's en een uitleg over de kunstmatige alvleesklier. Vervolgens worden de vragen gesteld. Het doel van deze vragenlijst is om inzicht te krijgen in uw algemene mening ten opzichte van nieuwe technologieën en tevens wordt uw mening over het verwachte gebruik van de kunstmatige alvleesklier vastgesteld.
Omdat er verschillende afstudeerprojecten zijn verbonden aan dit onderzoek zouden wij u vriendelijk willen verzoeken om de vragenlijst zo snel als mogelijk in te vullen. Ook zouden wij u willen verzoeken de vragenlijst ineenkeer in te vullen. Begin hier dus alleen aan als u voldoende tijd heeft. Uw gegevens worden anoniem verwerkt.

Alvast hartelijk dank voor uw medewerking,
Dr. A.M. von Raesfeld
T.Oukes (Msc)
C.E. Uncu (Student M-BA/ M-CS)
Student B-IBA: E.J. Bolks, W.J.W. Klabbers, J. Scharr, R. Schnarr & L. Schoenbeck
Hieronder vindt u een korte beschrijving van de kunstmatige alvleesklier. Leest u deze alstublieft aandachtig door.

Hiernaast ziet u een foto van de kunstmatige alvleesklier. De kunstmatige alvleesklier bevat twee pompsystemen, één voor insuline en één voor glucagon (om de bloedsuikerspiegel te verhogen), met beiden een aansluiting op een eigen infuus. Door gebruik te maken van een continue glucosemeting met twee sensoren, kan de kunstmatige alvleesklier actief blijven bij het vervangen van een sensor en zijn de metingen nauwkeuriger. Hierdoor kan de juiste hoeveelheid insuline of glucagon worden bepaald en afgegeven. De kunstmatige alvleesklier functioneert op twee AA batterijen en zorgt elke 24 uur voor een verzending van de gegevens naar de database.

De kunstmatige alvleesklier maakt gebruik van een regeling die bepaalt wanneer en hoeveel insuline of glucagon toegediend moet worden. Uit wetenschappelijk onderzoek blijkt dat door gebruik te maken van twee hormonen een betere regulatie van uw bloedsuikerwaarde mogelijk is en dat deze tussen de reguliere waardes van 4 en 11 mmol/l blijft. De glucoseregeling verloopt geheel automatisch waardoor u bijvoorbeeld niet hoeft aan te geven of u gaat eten of sporten. Interne veiligheidsmaatregelen zorgen er voor dat er nooit teveel toegediend wordt of dat er ongemerkt dingen fout gaan, hoorbare alarmen waarschuwen als u iets moet doen of controleren. M.b.v. de scroll balk (1) en de bevestigingsknop (2) kunt u de kunstmatige alvleesklier bedienen.

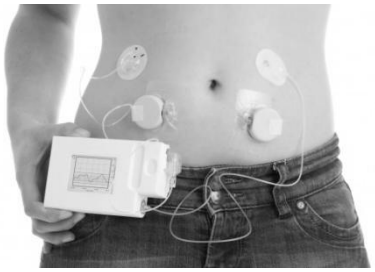
8.4 Appendix D: Introduction text survey Dutch Physicians

Geachte mevrouw/meneer,
Graag willen wij u uitnodigen om een vragenlijst in te vullen over de kunstmatige alvleesklier. Het invullen van deze vragenlijst duurt ongeveer 10 minuten. De kunstmatige alvleesklier is bedoeld voor de behandeling van diabetes. Dit onderzoek is opgezet vanuit de afdelingen Bedrijfskunde en Communicatie aan de Universiteit Twente in het kader van een Europees project (PCDIAB) waarin een kunstmatige alvleesklier wordt ontwikkeld in samenwerking met Inreda Diabetic B.V., AMC Amsterdam, Universiteit van Graz, Profil Research, Full Group en Novo Nordisk.
Hieronder krijgt u eerst twee foto's en een uitleg over de kunstmatige alvleesklier. Vervolgens worden de vragen gesteld. Het doel van deze vragenlijst is om inzicht te krijgen in uw algemene mening ten opzichte van nieuwe technologieën en tevens wordt uw mening over het verwachte gebruik van de kunstmatige alvleesklier vastgesteld.
Omdat er verschillende afstudeerprojecten zijn verbonden aan dit onderzoek zouden wij u vriendelijk willen verzoeken om de vragenlijst zo snel als mogelijk in te vullen. Ook zouden wij u willen verzoeken de vragenlijst ineenkeer in te vullen. Begin hier dus alleen aan als u voldoende tijd heeft. Uw gegevens worden anoniem verwerkt.

Alvast hartelijk dank voor uw medewerking,

Dr. A.M. von Raesfeld
T.Oukes (Msc)
C.E. Uncu (Student M-BA/ M-CS)
Student B-IBA: E.J. Bolks, W.J.W. Klabbers, J. Scharr, R. Schnarr & L. Schoenbeck

Hieronder vindt u een korte beschrijving van de kunstmatige alvleesklier. Leest u deze alstublieft aandachtig door.



Hiernaast ziet u een foto van de kunstmatige alvleesklier. De kunstmatige alvleesklier bevat twee pompsystemen, één voor insuline en één voor glucagon (om de bloedsuikerspiegel te verhogen), met beiden een aansluiting op een eigen infuus. Door gebruik te maken van een continue glucosemeting met twee sensoren, kan de kunstmatige alvleesklier actief blijven bij het vervangen van een sensor en zijn de metingen nauwkeuriger. Hierdoor kan de juiste hoeveelheid insuline of glucagon worden bepaald en afgegeven. De kunstmatige alvleesklier functioneert op twee AA batterijen en zorgt elke 24 uur voor een verzending van de gegevens naar de database.

De kunstmatige alvleesklier maakt gebruik van een regeling die bepaalt wanneer en hoeveel insuline of glucagon toegediend moet worden. Uit wetenschappelijk onderzoek blijkt dat door gebruik te maken van twee hormonen een betere regulatie van uw bloedsuikerwaarde mogelijk is en dat deze tussen de reguliere waardes van 4 en 11 mmol/l blijft. De glucoseregeling verloopt geheel automatisch waardoor de patiëntbijvoorbeeld niet hoeft aan te geven of deze gaat eten of sporten. Interne veiligheidsmaatregelen zorgen er voor dat er nooit teveel toegediend wordt of dat er ongemerkt dingen fout gaan, hoorbare alarmen waarschuwen als de patiënt iets moet doen of controleren. M.b.v. de scrol balk (1) en de bevestigingsknop (2) kan de kunstmatige alvleesklier worden bediend.

8.5 Appendix E: Introduction text survey German Physicians

Sehr geehrte Damen und Herren,

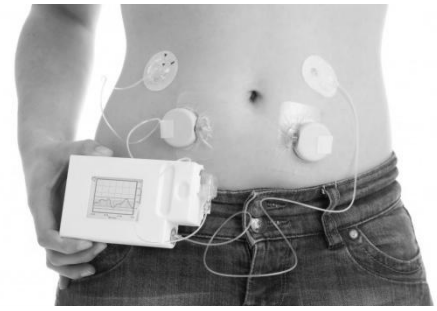
hiermit möchten wir Sie gerne dazu einladen diesen Fragebogen, der sich mit der künstlichen Bauchspeicheldrüse zur Behandlung von Diabetes befasst, auszufüllen. DieserFragebogen wird etwa 10 Minuten Ihrer Zeit beanspruchen und wird zuerst mit einer kurzen Beschreibung der künstlichen Bauchspeicheldrüse beginnen (inklusive Bilder).

Diese Studie wurde von den Abteilungen für Wirtschaft und Kommunikation an der Universität Twente im Rahmen eines europäischen Projekts (PCDIAB), bestehend aus der Zusammenarbeit von Inreda Diabetic B.V., AMC Amsterdam, Universität Graz, Profil Research, Full Group und Novo Nordisk, erstellt. Das Ziel ist, Ihre persönliche Einstellung zur voraussichtlichen Anwendung der künstlichen Bauchspeicheldrüse zu messen.

Da mehrere Abschlussarbeiten auf den Resultaten dieser Studie beruhen, bitten wir Sie freundlichst, diese Umfrage so schnell wie möglich auszufüllen. Ihre Daten werden dabei anonym und vertraulich behandelt.
Sie können an der Umfrage teilnehmen, wenn Sie behandelnder Arzt von Diabetespatienten sind und älter als 18 Jahre sind.

Wir danken Ihnen herzlichst für Ihre Mitarbeit,
Dr. A.M. von Raesfeld
T.Oukes (Msc)
C.E. Uncu (Student M-BA/ M-CS)
Student B-IBA: E.J. Bolks, W.J.W. Klabbers, J. Scharr, R. Schnarr & L. Schoenbeck

Nachfolgend finden Sie eine kurze Beschreibung der künstlichen Bauchspeicheldrüse. Bitte lesen Sie diese sorgfältig durch.



Hier sehen Sie die künstliche Bauchspeicheldrüse. Die künstliche Bauchspeicheldrüse umfasst zwei Pumpsysteme, eines für Insulin und eines für Glucagon (zur Erhöhung des Blutzuckerspiegels). Beide Systeme sind dabei jeweils an ein individuelles Infusionsset angeschlossen. Durch die kontinuierliche Glucosemessung mit zwei Sensoren, kann die künstliche Bauchspeicheldrüse beim Wechsel eines Sensors aktiv bleiben wodurch die Messungen genauer werden. Auf diese Weise kann die richtige Menge an Insulin oder Glucagon bestimmt und abgegeben werden. Die künstliche Bauchspeicheldrüse arbeitet mit zwei AA-Batterien und überträgt die Daten alle 24 Stunden an eine Datenbank.

Die künstliche Bauchspeicheldrüse macht Gebrauch von einer Steuerung, die bestimmt, wann und wie viel Insulin zu verabreichen ist. Eine wissenschaftliche Untersuchung hat ergeben, dass durch die Anwendung zweier Hormone eine bessere Regulierung Ihres Blutzuckerwertes möglich ist, und dass dieser Wert zwischen den regulären Werten von 4 und 11 mmol/l bleibt. Die Glucoseregelung verläuft völlig automatisch, so dass Patienten beispielsweise nicht anzugeben brauchen, ob Sie essen gehen oder Sport treiben wollen. Integrierte Sicherheitsmaßnahmen sorgen dafür, dass niemals eine Übermenge abgegeben wird, oder unbemerkt etwas schief gehen kann. Akustische Alarmsignale warnen Patienten, wenn Ihre Interaktion gefragt ist. Mit Hilfe der drei Bedientasten können Patienten dann die künstliche Bauchspeicheldrüse bedienen.

8.6 Appendix F: Invitation survey German Physicians

An: Endokrinologen / Diabetes -Spezialisten (Abteilung für Innere Medizin, Endokrinologie)

Wenn Sie Mitarbeiter(in) des Sekretariats sind, bitten wir Sie freundlichst diese Umfrage an den jeweiligen Diabetes-Spezialisten weiterzuleiten.

Sehr geehrte(r) Fr./ Hr.

Hiermit möchten wir Sie zu einer Umfrage einladen, die sich mit Ihrer Akzeptanz und Ihrer Bereitschaft eine künstlichen Bauchspeicheldrüse zu nutzen, befasst.

Klicken Sie hier um die Umfrage zu starten:

Dieser Fragebogen, handelt über die künstliche Bauchspeicheldrüse zur Behandlung von Diabetes und beansprucht etwa 10 Minuten Ihrer Zeit.

Die Studie wurde von den Abteilungen für Wirtschaft und Kommunikation an der Universität Twente im Rahmen eines europäischen Projekts (PCDIAB), bestehend aus der Zusammenarbeit von Inreda Diabetic B.V., AMC Amsterdam, Universität Graz, Profil Research, Full Group und Novo Nordisk, erstellt.
Das Ziel ist, Ihre allgemeine Meinung im Bezug auf neue Technologien sowie Ihr Verständnis, Ihre Bereitschaft und Ihre Meinung zu der erwarteten Nutzung der künstlichen Bauchspeicheldrüse zu messen.

Da mehrere Abschlussarbeiten auf den Resultaten dieser Studie beruhen, bitten wir Sie freundlichst, diese Umfrage so schnell wie möglich auszufüllen. Der Vollständigkeit halber bitten wir Sie ebenso, diese Umfrage in einem Zug auszufüllen ohne mehrmalige Unterbrechungen. Ihre Daten werden dabei anonym und vertraulich behandelt.

Herzlichen Dank für Ihre Mitarbeit,

Dr. A.M. von Raesfeld
T.Oukes (MSc)

Universität Twente

Um an dieser Umfrage teilzunehmen, klicken Sie bitte auf den unten stehenden Link.

Klicken Sie hier um die Umfrage zu starten:

8.7 Appendix G: Invitation Dutch patients

Beste,

Graag willen wij u uitnodigen om een vragenlijst in te vullen over acceptatie en bereidheid voor gebruik van de kunstmatige alvleesklier.

Om de vragenlijst te starten klik op:

Het invullen van deze vragenlijst duurt ongeveer 10 minuten. De kunstmatige alvleesklier is bedoeld voor de behandeling van diabetes.

Dit onderzoek is opgezet vanuit de afdelingen Bedrijfskunde en Communicatie aan de Universiteit Twente in het kader van een Europees project (PCDIAB) waarin een kunstmatige alvleesklier wordt ontwikkeld in samenwerking met Inreda Diabetic B.V., AMC Amsterdam, Universiteit van Graz, Profil Research, Full Group en Novo Nordisk.

Het doel van deze vragenlijst is om inzicht te krijgen in uw algemene mening ten opzichte van nieuwe technologieën en tevens wordt uw mening over het verwachte gebruik van de kunstmatige alvleesklier vastgesteld.

Omdat er verschillende afstudeerprojecten zijn verbonden aan dit onderzoek zouden wij u vriendelijk willen verzoeken om de vragenlijst zo snel als mogelijk in te vullen. Ook zouden wij u willen verzoeken de vragenlijst ineenkeer in te vullen. Begin hier dus alleen aan als u voldoende tijd heeft. Uw gegevens worden anoniem verwerkt.

Alvast hartelijk dank voor uw medewerking,

Dr. A.M. von Raesfeld

T.Oukes (Msc)

Universiteit Twente

Om aan de vragenlijst deel te nemen kunt u op onderstaande link klikken.

Klik op
om aan het onderzoek deel te nemen.

8.8 Appendix H: Invitation Dutch physicians

T.a.v. Endocrinologen/ Diabetes specialisten (Afdeling Interne Geneeskunde, Endocrinologie)

Als u een medewerker bent van het secretariaat, zou u dan zo vriendelijke willen zijn om deze vragenlijst door te sturen naar de desbetreffende diabetes specialist die bij uw organisatie werkzaam is.

Geachte Dr,

Graag willen wij u uitnodigen om een vragenlijst in te vullen over acceptatie en bereidheid voor gebruik van de kunstmatige alvleesklier.

Om de vragenlijst te starten klik op:

Klik op

om aan het onderzoek deel te nemen.

Het invullen van deze vragenlijst duurt ongeveer 10 minuten. De kunstmatige alvleesklier is bedoeld voor de behandeling van diabetes.

Dit onderzoek is opgezet vanuit de afdelingen Bedrijfskunde en Communicatie aan de Universiteit Twente in het kader van een Europees project (PCDIAB) waarin een kunstmatige alvleesklier wordt ontwikkeld in samenwerking met Inreda Diabetic B.V., AMC Amsterdam, Universiteit van Graz, Profil Research, Full Group en Novo Nordisk.

Het doel van deze vragenlijst is om inzicht te krijgen in uw algemene mening ten opzichte van nieuwe technologieën en tevens wordt uw mening over het verwachte gebruik van de kunstmatige alvleesklier vastgesteld.

Omdat er verschillende afstudeerprojecten zijn verbonden aan dit onderzoek zouden wij u vriendelijk willen verzoeken om de vragenlijst zo snel als mogelijk in te vullen. Ook zouden wij u willen verzoeken de vragenlijst ineenkeer in te vullen. Begin hier dus alleen aan als u voldoende tijd heeft. Uw gegevens worden anoniem verwerkt.

Alvast hartelijk dank voor uw medewerking,

Dr. A.M. von Raesfeld

T.Oukes (Msc)'

Universiteit Twente

Om aan de vragenlijst deel te nemen kunt u op onderstaande link klikken.

Klik op

om aan het onderzoek deel te nemen.

8.9 Appendix I: Original and adapted constructs TRI

Construct	Definition	Original Item	Author and Cronbach's alpha	Adapted item	Adapted for respondent group	Excluded by the factor analysis
Optimism	A positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their live (Parasuraman & Colby, 2001, p. 34).	1. Technology gives people more control over their daily lives 2. Products and services that use the newest technologies are much more convenient to use 3. You prefer to use the most advanced technology available 4. Technology makes you more efficient in your occupation 5. Technology gives you more freedom of mobility 6. You feel confident that machines will follow through with what you instructed them to do	Godoe and Johansen (2012), Parasuraman (2000), Cronbach's alpha: ≥0.83	1. Technology gives people more control over their daily lives 2. Products and services that use the newest technologies are much more convenient to use 3. You prefer to use the most advanced technology available 4. Technology makes you more efficient in your occupation 5. Technology gives you more freedom of mobility 6. You feel confident that machines will follow through with what you instructed them to do	Patients and Physicians	
Innovativeness	A tendency to be a technology pioneer and thought leader (Parasuraman & Colby, 2001, p. 36).	1. Other people come to you for advice on new technologies 2. In general, you are among the first in your circle of friends to acquire new technology when it appears 3. You can usually figure out new high-tech products and services without help from others 4. You keep up with the latest technological developments in your areas of interest 5. You find you have fewer problems than other people in making technology work for you	Godoe and Johansen (2012), Lin & Hsieh (2005); Parasuraman (2000), Cronbach's alpha: ≥0.85	1. Other people come to you for advice on new technologies 2. In general, you are among the first in your circle of friends to acquire new technology when it appears 3. You can usually figure out new high-tech products and services without help from others 4. You keep up with the latest technological developments in your areas of interest 5. You find you have fewer problems than other people in making technology work for you	Patients and Physicians	Yes (Physicians)
Discomfort	A perceived lack of control over technology and a feeling of being overwhelmed by it (Parasuraman & Colby, 2001, p. 41).	1. Technical support lines are not helpful because they do not explain things in terms you understand 2. Sometimes, you think that technology systems are not designed for use by ordinary people 3. There is no such thing as a manual for a high-tech product or service that is written in plain language 4. If you buy a high-tech product or service, you prefer to have the basic model over one with a lot of extra features 5. There should be caution in replacing important people-tasks with technology because	Godoe and Johansen (2012), Cronbach's alpha: ≥0.74	1. Technical support lines are not helpful because they do not explain things in terms you understand 2. Sometimes, you think that technology systems are not designed for use by ordinary people 3. There is no such thing as a manual for a high-tech product or service that is written in plain language 4. If you buy a high-tech product or service, you prefer to have the basic model over one with a lot of extra features 5. There should be caution in replacing important people-tasks with technology because	Patients and Physicians	Yes (Physicians) Yes (Patients and Physicians)

		new technology can breakdown or get disconnected		new technology can breakdown or get disconnected		
		6. Many new technologies have health or safety risks that are not discovered until after people have used them		6. Many new technologies have health or safety risks that are not technology work for you		Yes (Physicians)
		7. Technology always seems to fail at the worst possible time		7. Technology always seems to fail at the worst possible time		Yes (Patients and Physicians)
Insecurity	Distrust of technology and scepticism about its ability to work properly (Parasuraman & Colby, 2001, p. 44).	1. Revolutionary new technology is usually a lot safer than critics lead people to believe. [reverse scored]	Godoe and Johansen (2012), Cronbach's alpha: ≥0.88	1. Critics lead people to believe that revolutionary new technologies are less safe than they usually are	Patients and Physicians	
		2. A machine or computer is going to be a lot more reliable in doing a task than a person. [reverse scored]		2. A machine or computer is going to be less reliable in doing a task than a person		
		3. It can be risky to switch to a revolutionary new technology too quickly.		3. It can be risky to switch to a revolutionary new technology too quickly.		Yes (Physicians)
		4. If you buy products that are too high-tech, you may get stuck without replacement parts or service.		4. If you buy products that are too high-tech, you may get stuck without replacement parts or service.		
		5. Technological innovations always seem to hurt a lot of people by making their skills obsolete.		5. Technological innovations always seem to hurt a lot of people by making their skills obsolete.		

8.10 Appendix J: Constructs Technology Acceptance and Complexity and Compatibility

Construct	Definition	Original Item	Author and Cronbach's alpha	Adapted item	Adapted for respondent group	Excluded by the factor analysis
Perceived usefulness	An individual's perception that the application of a certain technology or innovation will outperform existing practices	1. Using the system improves my performance in my job 2. Using the system in my job increases my productivity 3. Using the system enhances effectiveness in my job 4. I find the system to be useful in my job 5. (. . .) enables me to accomplish tasks more quickly 6. Using (. . .) makes it easier to do my job	Venkatesh (2000); Godoe and Johansen (2012), Cronbach's alpha: ≥0.87	1. I expect that using the artificial pancreas improves my performance in my job 2. I expect that using the artificial pancreas in my job increases my productivity 3. I expect that using the artificial pancreas enhances effectiveness in my job 4. I expect that the artificial pancreas will be useful in my job 5. I expect that using the artificial pancreas in my job would enable me to accomplish tasks more quickly 6. I expect that using the artificial pancreas would make it easier to do my job	Physicians	Yes (Physicians)
Perceived usefulness	An individual's perception that the application of a certain technology or innovation will outperform existing practices	1. Using the system improves my performance in my job 2. Using the system in my job increases my productivity 3. Using the system enhances effectiveness in my job 4. I find the system to be useful in my job 5. (. . .) enables me to accomplish tasks more quickly 6. Using (. . .) makes it easier to do my job	Venkatesh (2000); Godoe and Johansen (2012), Cronbach's alpha: ≥0.87	1. I expect that using the artificial pancreas improves my performance in daily life. 2. I expect that using the artificial pancreas in my daily life increases my productivity. 3. I expect that using the artificial pancreas enhances my effectiveness in daily life. 4. I expect that the artificial pancreas will be useful in my daily life. 5. I expect that using the artificial pancreas would enable me to accomplish tasks more quickly. 6. I expect that using the artificial pancreas would make it easier to do my job	Patients	
Complexity	The degree to which a system is perceived as relatively difficult to understand and use	1. Using the system takes too much time from my normal duties 2. Working with the system is so complicated, it is difficult to understand what is going on 3. Using the system involves too much time doing mechanical operations 4. It takes too long to learn how to use the system to make it worth the effort	Venkatesh et al. (2003) based on Thompson et al. (1991), Cronbach's alpha: ≥0.73	1. I expect that using the artificial pancreas takes too much time from my normal duties 2. I expect that working with the artificial pancreas is so complicated, it is difficult to understand what is going on 3. I expect that using the artificial pancreas involves too much time doing mechanical operations 4. I expect that it takes too long to learn how to use the artificial pancreas to make it worth the effort	Patients	

Compatibility	The more accommodation needed, the less readily changes will be accepted (Rogers, 2002)	1. Using the system is compatible with all aspects of my work 2. I think that using the system fits well with the way I like to work 3. Using the system fits into my work style	Venkatesh et al. (2003); Moore and Benbasat (1991), Cronbach's alpha: ≥0.70	1. I expect that using the artificial pancreas is compatible with all aspects of my life, including work as well as free time activities. 2. I think that using the artificial pancreas fits well with the way I like to live and work. 3. I expect that using the artificial pancreas fits into the way I perform my daily duties.	Patients
Intention to use	An individual's intention to use a particular device or technology (Venkatesh & Davis, 2000)	1. Assuming I have access to the system, I intend to use it 2. Assuming I have access to the system, I predict that I would use it	Venkatesh and Davis (2000), Cronbach's alpha: ≥0.82	1. Assuming I have access to an artificial pancreas, I intend to prescribe it 2. Assuming I have access to an artificial pancreas, I predict I would prescribe it	Physicians
Intention to use	An individual's intention to use a particular device or technology (Venkatesh & Davis, 2000)	1. Assuming I have access to the system, I intend to use it 2. Assuming I have access to the system, I predict that I would use it	Venkatesh and Davis (2000), Cronbach's alpha: ≥0.82	1. Assuming I have access to an artificial pancreas, I intend to use it. 2. Assuming I have access to the system, I predict that I would use it	Patients

8.11 Appendix K: Personas

Persona; A diabetes specialists' (technology readiness) profile

Dr. de Groot is 47 years old and has more than 15 years of experience in his profession treating diabetes patients. Dr. de Groot's usual mediums of receiving information regarding new medical devices are scientific and/or professional journals and visits to conferences. Also news letters are often used to receive updates on new medical devices. Dr. de Groot has a quite high level of optimism towards new technologies. His level of innovativeness is also well above average. Furthermore, Dr. de Groot shows average levels of insecurity and discomfort towards new technologies.

Persona; A diabetes patients' (technology readiness) profile

Ellen de Vries is 39 years old and has been diagnosed with diabetes type 1 at the age of 21. Ellen prefers to use an insulin pump at the moment to cope with diabetes. Ellen most used medium to stay updated on all medical innovations is her connection to the diabetes association (e.g., the diabetes foundation). Furthermore, Ellen receives information through journals and (diabetes) magazines. Also through television a lot of updates are received and to a lesser extent Social Media is also monitered. In addition, regarding advices and news on new medical devices, Ellen often talks and listens to her diabetes nurse and her diabetes physician. But more information is received from her diabetes nurse. In general, Ellen is very optimistic about technology and also quite innovative regarding (new) technologies. Ellen finds herself having a lower rate of discomfort and insecurity towards technology.