A physicians' decision-making process in prescribing an artificial pancreas is influenced by their perceived social expectations of patients.

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ABSTRACT
There is a vast literature on technology acceptance and the intention to use new technologies for specific groups of people. However, the current works provide contrasting evidence of the influence of the subjective norm on the intention to use a new technology. This research focuses on 54 Dutch, German and Austrian physicians specialized in diabetes and the use of a new medical device known as the artificial pancreas. The study utilizes an adaptation of the Decomposed Theory of Planned Behavior approach and tests the subjective norm as a one-dimensional belief construct alongside several multi-dimensional belief constructs represented by the social referent groups of physicians, both in a combined setting (one construct) and separately (four distinct constructs), through regression analysis. The findings conclude that while the subjective norm is found to be a significant positive determinant of the intention to use or prescribe an artificial pancreas, it provides an insufficient accordance of the distinct social referent groups involved with the sample, as only the patient referent group exhibits a similar significant positive relationship. The fact that patients exercise a strong influence on physicians' decision-making reveals an interesting marketing approach to be heeded by companies producing and marketing an artificial pancreas, or a similar implant or prosthetic, as stimulating patient demand may lead to an increase in physicians' usage or prescribance intentions.

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1. INTRODUCTION

Diabetes mellitus – or diabetes – as it is referred to by most, is a common chronic disease that exists throughout the world among all age groups. Diabetes constitutes a condition in which the human body can no longer sustain viable blood glucose levels on its own. It is estimated that in 2013 there were approximately 381.1 million diabetes patients (Guariguata et al., 2014).

There are several distinct forms of diabetes, but most patients can be divided into three major categories: type 1 diabetes, type 2 diabetes, and gestational diabetes. (International Diabetes Federation, 2013). See Appendix 10.1 for a more elaborate overview on these different types as well as an indication of prevalence and an overview of the existing medical technology for diabetes patients.

The artificial pancreas is a state-of-the-art device that aids diabetes patients in maintaining their blood glucose levels. Klein (2009) rightfully states that compliance of monitoring blood glucose, even under well-controlled patients, is often poor. The artificial pancreas would instantly solve this problem as it would require no manual input. Kudva, Carter, Cobelli, Basu and Basu (2014) argue that for the pancreas to really be a closed-loop system it must be free of physiological, technological and algorithmic restraints. Thanks to advances in technology, research and development, many restraints have been lifted over the past couple of years, but there are still challenges to be overcome. Kudva et al. (2014) highlight, for instance, the different effects that daily activities may have on diabetes patients' glucose levels.

Inreda Diabetic B.V. is a Dutch company currently working on a bi-hormonal artificial pancreas. This artificial pancreas carries both insulin, which may be used in instances of high blood glucose levels, and glucagon, which may be used in instances of low blood glucose levels. They have constructed multiple prototypes and performed several clinical trials showing very promising results. Inreda Diabetic B.V. is currently working on certification for their product and plans to conduct several more clinical trials prior to the artificial pancreas being market-ready by 2015 (Inreda Diabetic, 2014). The research conducted in this paper is in cooperation with this company.

Renard (2010) states that while research on insulin pumps - and the artificial pancreas as an extension thereof - is highly focused in Europe, the use of the very same devices is rather limited in Europe, yet high in the United States. Moreover, Renard (2010) finds that this contradiction may be due to the difference in reimbursement schemes or the modes of healthcare delivery between these countries. For instance, in most of Europe physicians are mainly responsible for the delivery and application of health care (Renard, 2010). This means that the physician is an intricate part of the acceptance and adoption process of new technologies or devices created for their patients.

Therefore, this paper and its research will focus on the role of physicians in the acceptance of the artificial pancreas in the Netherlands, Germany and Austria. As the concept of acceptance is rather large and – to some extent – still not completely covered by existing literature (Venkatesh, Morris, Davis & Davis, 2003), a further focus will be exercised on the subjective norm which represents the perceptions one may have of the social expectations of referent others to commit or not commit to a certain behavior (Godin & Kok, 1996; Taylor & Todd, 1995a). This is particularly interesting as research has indicated that this relationship exists with a significant effect in some studies with physicians (Schepers & Wetzels, 2007), but not in others (Chismar & Wiley-Patton, 2003), and is therefore rather contradictory in nature. Moreover, the subjective norm is said to be more influential in an early development stage, prior to implementation, due to inexperience and unfamiliarity, which is exactly the stage at which the artificial pancreas is at now.

The study aims to answer the following research question: *to what extent does the subjective norm or its equivalent in multi-dimensional belief constructs influence a physician's intention to use or prescribe the artificial pancreas?*

This paper contributes to the existing literature on the acceptance of new technologies by investigating the subjective norm as a determinant of the intention to use a certain technology or device and highlights the importance of multi-dimensional belief constructs as a replacement for the subjective norm to alleviate its contradictory nature. In addition, this study aims to partly extend the empirical applicability and theoretical validity of existing models, such as the Extended Technology Acceptance Model – or TAM2 - and the (decomposed) Theory of Planned Behavior (TPB) model, which also incorporates the subjective norm, but now it is performed in the unique context of physicians and an artificial pancreas.

This paper will continue with a literature review on the concept of acceptance, both in general as well as in a physician-specific context, after which a survey will be constructed and distributed among a convenience sample of physicians. The surveys will then be collected, and data will be gathered for analysis. Finally, a set of results will be provided along with several limitations of the study, contributions to existing literature and research, as well as theoretical suggestions for future research and implications for practical use.

2. LITERATURE REVIEW

The role of physicians as providers of healthcare puts them in a unique position when it comes to technology acceptance. Normally the end user is prone to accept or reject new technologies or devices, but in the European health industry setting, the physicians are also important in this relationship as they play a large part in the decision process of whether to use new technologies or devices, such as the artificial pancreas, in practice and thus prescribe them to patients (Renard, 2010).

A theory that deserves to be highlighted in this literature review due to its recognition in academic research and applicability in reality is the Innovation Diffusion Theory (IDT) by Rogers (1995). This theory is focused on the rate of adoption of innovations, which represents the relative speed by which people within a social system adopt a particular innovation. The key determinants for this rate of adoption are found in five important perceptual attributes of innovations, which are relative advantage, compatibility, complexity, trialability and observability. Rogers (1995) defines relative advantage as "the degree to which an innovation is perceived as being better than the idea it supersedes" (p. 212). Compatibility is "the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters" (Rogers, 1995, p. 224). Complexity is "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 1995, p. 242). Trialability is "the degree to which an innovation may be experimented with on a limited basis" (Rogers, 1995, p. 243). And observability is "the degree to which the results of an innovation are visible to others" (Rogers, 1995, p. 244). Whilst relative advantage, compatibility, trialability and observability are positively related to the rate of adoption, complexity is negatively related. Even though the IDT of Rogers (1995) is widely used throughout research, it generally focuses more on all types of

innovations, whereas other models concentrate on innovations within certain domains or with certain characteristics.

An example of a model that extensively deals with acceptance of information technology is the Technology Acceptance Model (TAM) by Davis (1986). Subsequently, it was elaborated upon by Davis, Bagozzi and Warshaw (1989) and Davis (1989). They found that much of the previous research within different domains on the acceptation or rejection of information systems or technology relied on perceived usefulness and perceived ease of use. TAM is originally an extension of the Theory of Reasoned Action by Fishbein and Ajzen (1975). TAM was created to produce a model that could "provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations" (Davis et al., 1989, p. 985). Putting this in perspective, it could thus also be used in the case of physicians and an artificial pancreas – which is in essence a new technology that may enhance TAM's validity by extending its application to devices that differ from information technology. The first determinant, perceived usefulness, is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). The second determinant, perceived ease of use, is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Research indicates that as the perceived usefulness increases, so does the intention to use. This same positive and significant relationship exists for perceived ease of use (Davis, 1989).

Since the goal of TAM was to be applicable to multiple computing technologies and user populations, many studies have been conducted using different contexts, subjects and products to gain insight and knowledge on the concept of acceptance, adoption and use (Hu, Chau, Sheng & Tam, 1999; Straub, Keil & Brenner, 1997). While TAM is found to hold under different circumstances and in different contexts, there are observations that TAM does not hold completely for every situation. Straub et al. (1997), for instance, find that while the TAM model holds for a study of email usage among airline employees in the US and Switzerland, it does not hold in Japan. Straub et al. (1997) argue that there are different cultural factors at play which may affect the validity of TAM and urge for more research, especially in different countries. In addition, Hu et al. (1999) studied the acceptance of telemedicine technology among physicians in Hong Kong. This is a very specific context, namely the health care industry, which resembles the context of this paper's study. Hu et al. (1999) find that while the perceived usefulness remains a significant determinant, the perceived ease of use seems to have little influence on the intention to use. It is argued by Hu et al. (1999) that there may be more factors at play in this professional context.

Venkatesh and Davis (2000) theoretically extended TAM by incorporating social influence processes, which consist of the subjective norm, image, and voluntariness, and cognitive instrumental processes, which consist of job relevance, output quality, result demonstrability, and perceived ease of use as underlying variables for the perceived usefulness determinant (see Figure 1, Appendix 10.2). This extended version is also referred to as TAM2 (Venkatesh & Davis, 2000).

Venkatesh (2000) also provided underlying determinants for the perceived ease of use in a system-specific, namely anchors and adjustments. Anchors are defined as "general beliefs" (p. 345), while adjustments are defined as "beliefs shaped based on direct experience" (p. 345). The anchors consist of computer self-efficacy, perceptions of external control, computer anxiety and computer playfulness. The adjustments consist of perceived enjoyment and objective usability (Venkatesh, 2000).

TAM2, like TAM, was used and tested by researchers as well. Legris, Ingham and Collerette (2003) note that both models suffer from the limitation that samples often consist of students, that scales used in studies mostly focus on self-reported use and that the studies often involve an application of software or systems. Legris et al. (2003) also state that Venkatesh and Davis (2000) account for 40 to 60% of the variance (R^2) with regard to the usefulness perceptions and 24 to 52% of the variance (R^2) with regard to the usage intentions with TAM2, which, albeit high for social science research, still leaves quite some variance overall in the model unexplained and suggests that there are numerous factors unaccounted for, else this variance would be closer to 100%.

Furthermore, Legris et al. (2003) argue that findings produced by empirical research using the Technology Acceptance Model are sometimes inconsistent. This view is supported by Chismar and Wiley-Patton (2003) whom apply TAM2 in the context of the health care industry, namely to a sample of physicians in Hawaii who intend to adopt internet-based health applications. Chismar and Wiley-Patton (2003) find that the perceived usefulness determinant for intention to use holds, but that perceived ease of use is not significant. This is in line with a previously mentioned TAM study within the health care industry by Hu et al. (1999), who argued that this may be due to the higher levels of intellect, competence, access to resources, cognitive capacity, and the distinct professionalism that one finds more so in physicians than in other studies' sample groups which consisted mostly of students, developers or administrative staff. However, Hu et al. (1999) did not specifically control for these factors.

As prevalent in the literature as TAM is, the authors of TAM too recognize the existence of other factors and models. Venkatesh et al. (2003) combine 8 models into an integrative unified model called the Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT model accounts for approximately 69 to 70% of the variation in the intention to use (adjusted R^2), which is a better result than TAM2, but still not much closer to a full 100% (Venkatesh et al., 2003).

Another concept that deals with technology acceptance is the Technology Readiness Index (TRI) by Parasuraman (2000). While the index is less prevalent in research as IDT or TAM2, it contributes to the literature on technology acceptance by highlighting several determinants not considered by any of the before-mentioned models. Technology readiness is defined as "people's propensity to embrace and use new technologies for accomplishing goals in home life and work" (Parasuraman, 2000, p. 308). Parasuraman (2000) finds that students and young professionals tend to hold positive and negative beliefs toward technology which has an effect on their likelihood of taking up a new technology. Parasuraman (2000) also finds that these beliefs may be allocated to four categories: optimism, innovativeness, discomfort and insecurity, in which optimism and innovativeness are positively related to technology readiness, and discomfort and insecurity negatively related.

Godoe and Johansen (2012) combine the technology readiness index with the Technology Acceptance Model to create the Technology Readiness and Acceptance Model (TRAM) in which the four categories of optimism, innovativeness, insecurity and discomfort are tested as determinants of perceived usefulness and perceived ease of use in a study with hospital employees and employees from several private companies. However, only optimism and innovativeness proved to have a significant relationship as optimism positively

influenced perceived ease of use and perceived usefulness, whilst innovativeness negatively influenced perceived usefulness and positively influenced perceived ease of use (Godoe & Johansen, 2012).

All of these models have one thing in common, namely that they all largely consist of perceptions, and to a certain degree, subjectivity, which is where things could get interesting. It is clear that the wide usage of self-reported use is common and practical, even though it is argued by some that it may provide an inherent limitation (Legris et al., 2003). It is then also important to consider how respondents may judge how their social referents might perceive them, which is measured in TAM2 using the subjective norm (Venkatesh & Davis, 2000). It is interesting that the subjective norm was not originally included in TAM as the model was based on the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975), which does include the subjective norm. Also in the subsequent extension of the TRA to the Theory of Planned Behaviour (TPB), the subjective norm is present (Ajzen, 1991; Mathieson; 1991), indicating an intricate theoretical foundation. The review of Holden and Karsh (2010) highlights the complexity of the relationship between the subjective norm and the intention to use a new technology by indicating that 4 out of 8 tests proved significant. In addition, Finlay, Trafimow and Moroi (2007) find that the subjective norm is of great importance in healthcare contexts.

3. RESEARCH MODEL

The relationship between the subjective norm and the intention to use or prescribe an artificial pancreas to patients by physicians is the one that will be studied extensively in this paper. This will be done using the following model, which is partially adapted from the Decomposed Theory of Planned Behavior model in Taylor and Todd (1995a), which is based on the TPB model of Ajzen (1991). This model makes a distinction between the belief dimensions of social referent groups for every particular sample and the subjective norm. In essence, this paper aims to ascertain whether the subjective norm can function as a proxy to the combination of the different social referent group influences. This is interesting as it is hard to identify all possible referent groups of a specific sample and previous research often utilizes the subjective norm in a general sense instead of using the different social referent groups. Additionally, this paper will also investigate the influence of the social referent groups individually to see if there are distinctions between them when it comes to their relationship with the intention to use or prescribe an artificial pancreas.

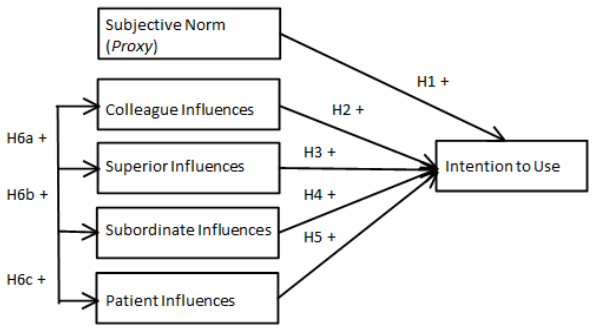

Figure 2. Proxy Variable Subjective Norm and the Social Influences as determinants of the Intention to Use.

Taylor and Todd (1995a) state that a subjective norm "is formed as the individual's normative belief (nb_j) concerning a particular referent weighted by the motivation to comply with that referent (mc_j)" (p. 149). This means that the subjective norm is measured as the product of the normative beliefs and the motivation to comply with important people in one's social environment.

Taylor and Todd (1995a) go on to mention that the influence of the subjective norm has been inconclusive in research, as some studies find no significant relationship (Davis, 1989), whilst others do (Moore & Benbasat, 1993). This is also in line with later research that is performed in a similar context as this study, which is the health industry with physicians as the sample (Yi, Jackson, Park & Probst, 2006; Rebergen et al., 2006; Chismar & Wiley-Patton, 2003). With this in mind as well as the argument that subjective norms are considerably more important in the early development and implementation stage due to limited knowledge, experience and familiarity with the product (Taylor & Todd, 1995a), I propose the following first hypothesis, based on the proxy variable which is the subjective norm:

H1. The subjective norm will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

Since the subjective norm in theory ultimately consists of all the different social referent groups of a sample, it is important to distinguish the social referents of physicians so that we may be able to test whether it can function as a proxy. Taylor and Todd (1995a) explicitly state that the opinions and motivations of social referent groups may differ so that one may encourage a certain behavior while another discourages that same behavior leading to a non-influential subjective norm. Therefore, it is important to pursue multi-dimensional belief constructs utilizing multiple social referent groups. Physicians typically work within an organizational setting or unit, such as a hospital or a clinic, which means that there are at least three key referent groups, namely peers (colleagues), superiors and subordinates (Taylor & Todd, 1995a).

Maue, Segal, Kimberlin and Lipowski (2004) find that fellow colleagues or coworkers constitute an important referent for physicians, whilst the relationship was positive, it was not significant. Nonetheless, it was positive and significant for Yi et al. (2006) whom also incorporated colleagues as a significant other in their measurement of the subjective norm. In a study by Gagnon et al. (2003) colleagues were also included in a construct consisting of self-reported perceptions of several referent groups of physicians and the physicians' role beliefs, which was significant and positive for intention to use. In previous research by Taylor and Todd (1995a) coworkers were also used as an important referent group.

H2. Colleague influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

Burnkrant and Page (1988) find no significance for a superior's influence, but argue that their study did not concern a work-related behavior and it is reasonable to expect that a superior would be an important referent when the behavior in question does concern a work setting. Yi et al. (2006) also identify superiors as a referent for physicians in a significant positive relationship for behavioral intention. Gagnon et al. (2003) come to a similar conclusion. Therefore, I propose the following third hypothesis:

H3. Superior influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

Taylor and Todd (1995a) argue for a subordinate referent group, but their study did not include this construct as their sample consisted of students whom had no subordinates. However, in the medical context with a sample of physicians, the subordinate referent group does exist in terms of assistants or nurses. The study by Yi et al. (2006) did include the

subordinate referent group which was part of a significant positive relationship of the subjective norm and the behavioral intention. Therefore, I propose the following fourth hypothesis:

H4. Subordinate influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

Patients are not mentioned often in the quest to uncover determinants of physicians' acceptance of new technology, which may be due to the fact that physicians should be objective at all times to make the right diagnoses and prescriptions in the best interest of their patient. Maue et al. (2004) do list patients as a referent for physicians, as previous studies have also indicated the potential influence of patient demand (Yarbrough & Smith, 2007; Denig, Haaijer-Ruskamp & Zijsling, 1988). While both studies did not find a significant positive relationship in the end, they did find a strong positive tendency in the data. Gagnon et al. (2003) included patients as one of their referent groups in a larger normative construct also encompassing role beliefs, and managed to find a positive significant relation with intention to use. Considering our case of an artificial pancreas which is supposed to be a unique and satisfactory, quality-of-life enhancing solution for type 1 diabetes patients everywhere, it may well be the case that patient demand does positively influence a physician's intention to administer or prescribe an artificial pancreas to a patient. Therefore, I propose the following fifth hypothesis:

H5. Patient influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

In addition to these hypotheses, it is reasonable to assume that certain referent groups may exercise a larger influence on a physician's intention to use or prescribe the artificial pancreas than other referent groups. Maue et al. (2004) find that fellow colleagues are considered the most likely group to influence practitioners, more so than patients, other staff members and the institution itself. Taylor and Todd (1995a) find that the influence group with colleagues has a larger effect than the influence group with superiors, yet both are significantly positive. Yi et al. (2006) do not state specific figures for each group, but the factor loading of their data indicates an order of colleagues, superiors and then subordinates. Denig et al. (1988) find patient demand to be negligible. Therefore, the following hypotheses are also considered:

H6a. Colleague influences on the intention to use or prescribe an artificial pancreas are greater than superior influences on the intention to use.

H6b. Superior influences on the intention to use or prescribe an artificial pancreas are greater than subordinate influences on the intention to use.

H6c. Subordinate influences on the intention to use or prescribe an artificial pancreas are greater than patient influences on the intention to use.

4. METHODOLOGY

4.1 Study Context

The context of the study takes place within the healthcare domain. The study revolves around the innovative product known as the artificial pancreas. The acceptance of the artificial pancreas by physicians practicing within the diabetes specialty is measured with the intention to prescribe treatment with the artificial pancreas to diabetes type 1 patients, based on Venkatesh and Davis (2000) and tailored to the context, similar to research performed by Chismar and Wiley-Patton (2003). The introductory text for respondents and the questions focus on the artificial pancreas created by Inreda Diabetic B.V., as this research is performed for this company and its product. Nevertheless, the results of this study may be extended to other types of artificial pancreases of other companies as the idea and the concept of the device remain the same. The results may also be extended to other types of implants or prosthetics that are comparable to an artificial pancreas.

4.2 Subject Sampling

The sample of physicians used for administering the questionnaire will be drawn from online profiles of physicians that are specialized in endocrinology or diabetology, which are both specialties that deal with diabetes. The sample will be focused on physicians from the Netherlands, Germany and Austria as these countries provide the first potential markets for Inreda Diabetic B.V. to market and launch their artificial pancreas in upon completion.

Contact information for endocrinologists and diabetologists was acquired through several distinct websites. For the Netherlands we used 'Zorgkaart Nederland', for Germany we used 'DiabSite', and for Austria we used 'Arztverzeichnis'. For Germany and Austria most contact details provided a personal email address to which the survey could be sent. For the Netherlands this was often not the case and phone calls were made to the physicians' hospitals to acquire their personal email addresses or that of a secretary willing and able to forward the survey to the physicians. In total - taking into account the multitude of physicians that may be reached by a survey emailed to a hospital's general email account – the questionnaire was sent to 177 Dutch, 241 German and 195 Austrian physicians specializing in diabetes.

This sampling technique may be perceived as convenience sampling and may bring about representativeness critique, due to the fact we only use endocrinologists or internists specializing in diabetes whom are listed on the internet (Fink, 2003). This means we may thus miss out on those specialists that work purely from their own practice, clinic or hospital without any online reference. However, considering the common use of the World Wide Web in organizations and institutions, public and private alike, it is assumed that this sampling technique will not pose a problem for the research.

4.3 Survey Construction and Operationalization

A survey was created based on existing validated scales, constructs and determinants of technology acceptance using 7 point Likert scales in which 1-3 represent the negative spectrum (e.g. "strongly disagree"), 4 represents neutrality and 5-7 represent the positive spectrum (e.g. "strongly agree"). The questions needed to be specifically tailored to the sample group of physicians, in a similar way as done by, for instance, Chismar and Wiley-Patton (2003) to ensure that the validity of the scales still hold, but so that the questions remain comprehensive and applicable in the study context. The same tailoring is performed throughout research (Davis, 1989). Examples of such tailor-made scales for this context include replacing "system" with "artificial pancreas". This also includes accounting for the different social referent groups that physicians may have. Table 1 provides an overview of the operationalization of the constructs, including the original scales used in previously validated research, the authors of previous research, as well as the adaptation currently applied to those scales. Whilst it is not included in Table 1 or the research model, the 4 distinct groups of social influence are further on in this paper also combined into an aggregate social influence variable in order to determine whether the subjective norm can adequately function as a proxy.

Table 1. Operationalization of the Research Model.

Construct	Definition	Original Scales	Source of Scales	Adapted Scales
Intention to Use	The intention of a subject sample to use – or in this case prescribe - a particular device or technology in practice	Assuming I have access to the system, I intend to use it	Venkatesh & Davis (2000)	Assuming I have access to an artificial pancreas, I intend to prescribe it
		Assuming I have access to the system, I predict that I would use it	Venkatesh & Davis (2000)	Assuming I have access to an artificial pancreas, I predict I would prescribe it
Subjective Norm (*Proxy Variable*)	Perceptions one may have of the social expectations of referent others to commit or not commit to a certain behavior	People who influence my behavior think that I should use the system	Venkatesh & Davis (2000)	People who influence my behavior think that I should prescribe the artificial pancreas
		People who are important to me think that I should use the system	Venkatesh & Davis (2000)	People who are important to me think that I should prescribe the artificial pancreas
Colleague Influences	Perceptions one may have of the social expectations of colleagues to commit or not commit to a certain behavior	My classmates would think that I should use the system	Taylor & Todd (1995a)	My coworkers would think that I should prescribe the artificial pancreas
		Generally speaking, I want to do what my classmates think I should do	Taylor & Todd (1995a)	Generally speaking, I want to do what my coworkers think I should do
Superior Influences	Perceptions one may have of the social expectations of superiors to commit or not commit to a certain behavior	My professors would think that I should use the system	Taylor & Todd (1995a)	My superiors would think that I should prescribe the artificial pancreas
		Generally speaking, I want to do what my professors think I should do	Taylor & Todd (1995a)	Generally speaking, I want to do what my superiors think I should do
Subordinate Influences	Perceptions one may have of the social expectations of subordinates to commit or not commit to a certain behavior	My subordinates would think that I should use the system	Based on Taylor & Todd (1995a)	My subordinates would think that I should prescribe the artificial pancreas
		Generally speaking, I want to do what my subordinates think I should do	Based on Taylor & Todd (1995a)	*No Change*
Patient Influences	Perceptions one may have of the social expectations of patients to commit or not commit to a certain behavior	My patients would think that I should use the system	Based on Taylor & Todd (1995a)	My patients would think that I should prescribe the artificial pancreas
		Generally speaking, I want to do what my patients think I should do	Based on Taylor & Todd (1995a)	*No Change*

This survey was subsequently translated from English to Dutch by myself as native speaker and author of this paper, and translated from English to German by my colleague, L. Schönbeck, whom is native in German. This was a logical choice as physicians in the Netherlands, Germany and Austria are not native English speakers and are likely to find more comprehension when the questions are asked in their own, native, language. The survey can be found in Appendix 10.3.

The surveys were set up in LimeSurvey, a survey construction program of the University of Twente. In order to ensure the validity and applicability of the surveys, both the Dutch and the German survey were subject to pretesting by 2 Dutch Bachelor students, 3 German Bachelor students, 1 Master student, 1 PhD student, 1 Doctor and 1 Dutch Endocrinologist.

Some changes were executed to both survey variants in order to ensure face validity and content validity in the particular study context. These changes included:

1. In the first draft of the surveys, only one scale was used for the dependent variable intention to use, while previous research (e.g. Venkatesh & Davis, 2000; Taylor & Todd, 1995a) utilizes two scales. This second scale was added to the final surveys.
2. In the first draft of the surveys, the physician questions focused on the use of the artificial pancreas, but a physician does not actually use the artificial pancreas, but rather prescribes it to a patient for him or her to use (Renard, 2010; Shah & Robinson, 2008). In the final surveys this important characteristic of physicians was taken into account in the formulation of questions and statements.
3. In the first draft of the surveys, a social referent group of friends was included in the different social influences. While this was in line with much previous research on acceptance (e.g. Taylor & Todd, 1995a), the question seemed out of touch in the pretest as friends hardly serve as a referent group for physicians in a professional capacity. These scales were omitted from the final surveys.
4. In the first draft of the surveys a construct of costs was included to ascertain the different kinds of costs associated with putting the artificial pancreas to use. It was found that this construct and its scales had too much overlap with TAM2's (Venkatesh & Davis, 2000) perceived usefulness construct. This construct was thus omitted from the final surveys.
5. In the first draft of the surveys a question regarding the different kinds of hospitals was asked to the physicians. However, there is a distinct difference between the hospital system in the Netherlands and the system used in Germany and Austria. Whereas in the Netherlands most specialists work in academic or general hospitals, in Germany and Austria it is also common for specialists to work in their own practices or private clinics. Therefore, different answer options were incorporated for this question in the Dutch and German variants of the survey.

4.4 Data Collection

After this initial pretesting the survey was distributed by sending out email invitations to the hospitals and specialized physicians through the LimeSurvey program. This invitation explained what the survey was about, that the responses on the survey would be used in final thesis projects of students at the university of Twente, and that the research is conducted in cooperation with several companies that work together in PCDIAB: AMC Amsterdam, University of Graz, University of Twente, Profil Research, Full Group, Novo Nordisk and Inreda Diabetic B.V.

Additionally, prior before respondents fill in the actual survey, they first get an information overview of what an artificial pancreas is, what its primary function is, and how it works, along with some pictures on what it looks like and how someone might wear it. This allows for respondents that do not know anything or little about the product to gain an understanding of its inner workings, implications and importance for diabetes patients. Providing such an introduction is in line with research conducted by Taylor and Todd (1995a).

The program allows for data to be collected during the procedure of filling it in, so that even the responses made by respondents that stop halfway through are still recorded. Where applicable, respondents were given the option to respond with 'not applicable', which was later recoded as missing values or a string of text. Some respondents may, for instance, not have superiors, due to the fact they run their own practice. A week after the initial survey invitations were sent, a reminder was sent to the emails who had not recorded a response yet. This was done to remind the potential respondents of their requested participation in an attempt to optimize the number of respondents.

4.5 Data Analysis

The data analysis will be performed using SPSS, which is a predictive analytics software frequently used in research studies. The database in which the data is gathered, which is LimeSurvey, can easily be transferred to an SPSS database. Once the data is in SPSS, it can be subject to several statistical analyses. Firstly, an overview of the sample size, means, standard deviations and correlations of the constructs will be given. Secondly, several key characteristics of the subject sample will be highlighted and analyzed. Third, a principal component analysis with oblimin rotation will be performed. Fourth, for each construct the reliability scores measured in Cronbach Alpha's will be given. Lastly, several regressions will aid in answering the research question both for the subjective norm as a construct and for the different multidimensional belief constructs of the different social referent groups.

5. RESULTS

5.1 Descriptive Statistics

In Table 2 the correlation matrix for the intention to use, subjective norm and the aggregate social influence are displayed. The aggregate social influence is not specified in the operationalization of the variables, but it represents the combination of the 4 different social referent groups; it is presented as an aggregate in the table so that the correlation between the social influence and the subjective norm can be observed to ascertain the proxy ability of the subjective norm. The table lists the sample size for the correlation, the means, the standard deviations, as well as Pearson's correlation coefficient (r) and the significance levels of the variables.

There is a clear substantial correlation ($p < .05$, one-tailed) for the aggregate social influence and the intention to use reflected by r = .276. There is also a highly substantial correlation ($p < .01$, one-tailed) between the subjective norm and the aggregate social influence reflected by r = .587. While it is not high enough to suggest multicollinearity in the data, in which case it should indicate a value higher than r = .9 according to Field (2009), it does draw attention to the fact that, while not completely, the subjective norm may have a partial ability to function as a proxy for the social expectations of different social referent groups of the subject sample.

The correlation matrix makes use of listwise case analysis, which means that not all the respondents were taken into account for the correlation between subjective norm and intention to use, due to the fact that some respondents answered the social influence questions with "not applicable". In a further section of this paper, the multiple regression of subjective norm on the intention to use will highlight a different outcome than is indicated here due to a higher sample size.

Table 3 gives the same information as Table 2, but then for the intention to use and the four distinct social referent groups. The only variable that shows a highly substantial correlation ($p < .01$, one-tailed) with the dependent variable intention to use is the social influence of patients with r = .447. Overall, there are highly substantial correlations ($p < .01$, one-tailed) amongst the different social referent groups, ranging from r = .504 to .795. Once again this does not constitute multicollinearity as the threshold does not exceed r = .9 (Field, 2009), but it does indicate that the variables correlate and may thus measure the same or similar things. Nonetheless, this result is not surprising as the scales of which the variables are made are all exactly the same except for the particular social referent group mentioned within them, which means that they did in fact measure different things, but they are much alike in the data.

Table 2. Correlation Matrix and Construct Summary of Intention to Use, Subjective Norm and Aggregate Social Influence.

	N	Mean	Std. Dev.	Intention to Use	Subjective Norm	Aggregate Social Influence
Intention to Use	45	5.2111	1.16037	1.000	0.220	.276*
Subjective Norm	45	17.6889	10.35028	.220	1.000	.587**
Aggregate Social Influence	45	220.6444	136.78951	.276*	.587**	1.000

Note: * $p < .05$ (one-tailed), ** $p < .01$ (one-tailed)

Table 3. Correlation Matrix and Construct Summary of Intention to Use and the Separated Social Referent Groups.

	N	Mean	Std. Dev.	Intention to Use	Social Influence Colleagues	Social Influence Superiors	Social Influence Subordinates	Social Influence Patients
Intention to Use	45	5.2111	1.16037	1.000	.173	.107	.227	.447**
Social Influence Colleagues	45	12.4444	8.86914	.173	1.000	.795**	.740**	.602**
Social Influence Superiors	45	10.9778	7.90710	.107	.795**	1.000	.643**	.504**
Social Influence Subordinates	45	12.8000	10.48722	.227	.740**	.643**	1.000	.725**
Social Influence Patients	45	20.6889	11.79527	.447**	.602**	.504**	.725**	1.000

Note: * $p < .05$ (one-tailed), ** $p < .01$ (one-tailed)

In all studies it is also important to check several descriptive statistics that constitute relevant characteristics for the subject sample, which in this case of physicians are gender, age, the number of years in the profession, the country of residence as well as whether the respondent has previously participated in clinical trials.

While males are relatively better represented in the sample with 30 respondents as compared to females with 24 respondents (Table 4), it is a rather small difference which should not lead toward gender-biased answers. This is in line with previous research: whilst in the past women were underrepresented in the medical profession, there is more of a gender balance nowadays (Riska, 2001). All respondents who completed the questionnaire filled in this question, so the valid sample size is 54. There were a total 17 invalid responses of respondents who had only completed the first or the first set of questions in this survey, which makes them completely obsolete for the purpose of this study and are thus omitted from the database. Ultimately, this constitutes a response rate of (54 / (177 + 241 + 195)) x 100% = 8,81%. Compared to previous studies in the healthcare domain (Chau & Hu, 2001; Chismar & Wiley-Patton, 2003), this is relatively low, however, the response rate may have been influenced by the fact that the survey was sent out just after the Ascension Holidays, which could mean that potential respondents are still on holidays. Furthermore, the collection period was a mere two weeks due to the scope and limited time duration of this paper, which may lead to potential respondents having insufficient time to fill out the survey as physicians are rather busy people.

Table 4. Distribution of Gender (N = 54).

	Frequency	Percentage
Female	24	44,44%
Male	30	55,56%
Total	**54**	**100%**

The average age of the respondents is approximately 47 years (Table 5). This is the mean of 53 respondents as 1 respondent failed to report his age correctly. This is very much in line with the number of years the respondents have been practicing their profession, as a large majority of 30 respondents, which is over 50% (Table 6) reports that they have been practicing their profession for over 15 years, which indicates that the sample consists primarily of experienced physicians that have undoubtedly dealt with previous innovations in healthcare technology.

Table 5. Distribution of Age (N = 53, Missing = 1).

	Age
Mean	46,91
Std. Error of Mean	1,45
Median	50,00
Mode	52,00
Std. Deviation	10,54

Table 6. Distribution of the Number of Years in Profession (N = 54).

	Frequency	Percentage
0 - 5 years	9	16,70%
6 – 10 years	8	14,80%
11 – 15 years	7	13,00%
More than 15 years	30	55,60%
Total	**54**	**100%**

In Table 7 the respondents' countries are listed. It is important to note that a majority of 34 of the 54 respondents lives in the Netherlands. The one respondent that lives in Belgium is assumed to be working in the Netherlands as he has filled out a Dutch survey which was sent to a Dutch hospital in Maastricht. Overall, this is a remarkable finding due to the fact that the majority of the sent surveys were in fact sent to German and Austrian physicians. Yet, their response has been relatively less as compared to the Dutch. Effectively, the response rates per country are as follows:

Netherlands: ((34 + 1) / 177) x 100% = 19,77%

Germany: (13 / 241) x 100% = 5,39%

Austria: (6 / 195) x 100% = 3,08%.

In essence, the sample is biased towards the Netherlands and its culture. This large difference in response rate may be attributed to the fact that the company producing the artificial pancreas is Dutch in origin, as are the majority of its partners. Another explanation for this difference may be that German and Austrian physicians are less inclined to participate in scientific research due to a cultural difference. Additionally, in Germany and Austria respondents often receive money for participating, this research did not incorporate such compensation. Lastly, one of the potential German respondents sent an email stating it was useless for him to fill out the survey as his insurance scheme would not be willing to reimburse it anyways.

Table 7. Distribution of Country of Residence (N = 54).

	Frequency	Percentage
Netherlands	34	63,00%
Belgium	1	1,90%
Germany	13	24,10%
Austria	6	11,10%
Total	**54**	**100%**

Table 8 lists the number of respondents that have committed previously to clinical trials involving an artificial pancreas. Only 7 out of 54 respondents have had previous affiliations with the artificial pancreas, whilst 47 had not. As the survey measures the perceived intention to use or prescribe an artificial pancreas as the dependent variable, it is good that the majority of the sample has no previous experience or affiliation with the artificial pancreas as this may lead to a biased response.

Table 8. Distribution of Clinical Trial Participation (N = 54).

	Frequency	Percentage
Yes	7	13,00%
No	47	87,00%
Total	**54**	**100%**

5.2 Principal Component Analysis

In the study of social sciences it is important to conduct an exploratory factor analysis due to the fact that constructs cannot be measured in a direct fashion (Field, 2009). In order to uncover the variables and its items, a principal component analysis with direct oblimin rotation was performed on 12 items from the dataset (Table 9).

The Kaiser-Meyer-Olkin (KMO) measurement states that the sampling adequacy is .772, which is considered to be a good value (Kaiser, 1974) and states that the identified factors are unique and reliable. Additionally, the Bartlett's test of sphericity indicates a highly significant difference ($p < .001$) with a Chi-Square of 437,499 and 66 degrees of freedom, which means that the identified correlations are, in general, significantly different from zero (Field, 2009).

Table 9. Principal Component Analysis with Loadings and Cross-Loadings.

	Component		
	1 (SI)	2 (ITU)	3 (SN)
Social Influence			
SI_01	**.354**	.152	.493
SI_02	**.893**	-.150	
SI_03	**.534**		.451
SI_04	**.711**	-.216	.216
SI_05	**.723**		.245
SI_06	**.948**		
SI_07	**.734**	.379	
SI_08	**.733**	.315	-.174
Intention to Use			
ITU_01		**.948**	
ITU_02		**.920**	.172
Subjective Norm			
SN_01			**.923**
SN_02		.110	**.931**

Extraction Method: Principal Component Analysis
Rotation Method: Oblimin with Kaiser Normalization with 7 iterations

According to Stevens (2002), as cited in Field (2009), "for a sample size of 50 a loading of 0,722 can be considered significant … based on an alpha level of .01 (two-tailed)" (p. 644). As the sample contains 54 respondents, SI_04 is considered to be significant as well with a loading of .711. This means that all factors, except for SI_01 and SI_03 load onto a component. SI_01 and SI_03 both constitute normative beliefs of social referents, SI_01 does so for fellow physicians and SI_03 does so for superiors. Since both work in conjunction with the motivations to comply, which are represented by SI_02 and SI_04, which do load on component 1, I will still use SI_01 and SI_03 in further analysis as they are imperative for the social referent groups. According to the principal component analysis, all the items for the different referent groups should be loaded onto 1 component, illustrating one variable. However, while logical, if this is done, there will no longer be an ability to see the differences between those referent groups.

Therefore, for a thorough analysis the initial following 3 components or constructs are created, in which the social constructs use Taylor and Todd's (1995a) calculation of the normative belief multiplied by the motivation to comply.

- Intention to Use: (ITU_01 + ITU_02) / 2
- Subjective Norm: SN_01 * SN_02
- Aggregate Social Influence: ((SI_01 + SI_03 + SI_05 + SI_07) * (SI_02 + SI_04 + SI_06 + SI_08))

According to the scree plot (see Figure 3, Appendix 10.2), points of inflexion occur at 4 or 6 components, which can be used to support the desire to create more variables. Moreover, in order to ascertain the distinct effects of the different social referent groups instead of the sum of the parts, the constructs below were also created to function in the regression analysis as an elaborative replacement of the aggregate social influence.

- Colleague Social Influences: SI_01 * SI_02
- Superior Social Influences: SI_03 * SI_04
- Subordinate Social Influences: SI_05 * SI _06
- Patient Social Influences: SI_07 * SI_08

The principal component analysis reflects a high discriminant and convergent validity.

5.3 Reliabilities

The reliabilities of the scales also need to be assessed in order to ensure that the measures consistently measure what the constructs want it to measure. This may be done using the Cronbach Alpha, which is one of the most common reliability measurements. In Table 10 an overview of the reliability scores of all constructs are indicated:

Table 10. Reliability Analysis with Cronbach Alpha.

Construct	Items	Number of items	Cronbach Alpha (α)
Intention to use	ITU_01 & ITU_02	2	**.931**
Subjective Norm	SN_01 & SN_02	2	**.902**
Aggregate Social Influence	SI_01, SI_02, SI_03, SI_04, SI_05, SI_06, SI_07 & SI_08	8	**.919**
Colleague Social Influences	SI_01 & SI_02	2	**.730**
Superior Social Influences	SI_03 & SI_04	2	**.689**
Subordinate Social Influences	SI_05 & SI_06	2	**.866**
Patient Social Influences	SI_07 & SI_08	2	**.861**

The Cronbach Alpha's for most of the constructs are all indicating high reliability. The Cronbach Alpha of the superior influences is somewhat lower than it should be as it is under .70 (Gliem & Gliem, 2003). However, it's on the border of acceptable, and Kline (1999) states that this is not uncommon for psychological constructs as they are most diverse. Therefore, it is assumed that the reliability of the superior influences is also sufficient.

5.4 Multiple Regression

In order to ascertain the influence of the subjective norm and the 4 social referent groups combined and separate respectively, several linear regressions must be conducted. Initially, a simple linear regression of subjective norm on intention to use will be conducted to assess the effect and direction of this relationship.

Afterwards, a simple linear regression of the 4 social referent groups combined into the aggregate social influence variable on intention to use will be performed to assess the effect and direction for this relationship.

The before-mentioned two regressions will give a good overview of which variable best explains the intention to use and whether or not the subjective norm can be used a proxy for numerous social referent groups combined as a sum of the parts. However, it does not specifically state which referent groups exercise the greatest influence and what direction that influence might be. Therefore, a multiple linear regression will be done on the 4 social referent groups as individual independent variables and the intention to use.

In Table 11 the simple linear regression of subjective norm on intention to use is summarized. The subjective norm accounts for approximately 7.5% (R^2) of the variation in the intention to use, which is only a small portion and suggests there are many more variables in play that have an effect on the intention to use. This is in line with previous research, such as that of Venkatesh and Davis (2000). The casewise diagnostics show that there are 4 cases which exhibit high residuals, but the maximum Cook's distance is .424, which does not reveal any cause for concerns (Cook & Weisberg, 1982). This same argument applies for the maximum Mahalanobis' distance of 8,260 (Field, 2009). It is interesting to note that the subjective

norm has a significant and positive effect ($p < .05$) on the intention to use, which confirms the 1st hypothesis, namely:

☑ **H1.** The subjective norm will have a significant positive effect on the intention to use or prescribe an artificial pancreas

Table 11. Simple Regression of Independent Subjective Norm and Dependent Intention to Use.

	B	SE B	Beta (β)	Sig
Constant	4.808	.304		
Subjective Norm	.029	.014	.273	.046*

Note: N = 54. $R^2 = .075$. * $p < .05$ (one-tailed).

In Table 12 the simple linear regression of the four social referent groups combined into the aggregate social influence variable on the intention to use is summarized. The aggregate of the social influence accounts for approximately 7.6% (R^2) in the variation of the intention to use, which like the previous regression, is relatively small and suggests there are more factors at play. However, it is interesting that it does in fact explain 0.1% more than the subjective norm does which may not be much, but does partially undermine the subjective norm's ability to function as a proxy variable. Since the 1st hypothesis indicates a direction, this regression is also significant and positive as Sig = (.066 / 2) = .033 ($p < .05$) The casewise diagnostics reveal 2 cases with high residuals, but the maximum Cook's distance is .942, which indicates no concern (Cook & Weisberg, 1982). Additionally, Mahalanobis' distance shows a maximum of 5,451, which is acceptable (Field, 2009).

Table 12. Simple Regression of Independent Aggregate Social Influences and Dependent Intention to Use.

	B	SE B	Beta (β)	Sig
Constant	4.694	.322		
Aggregate Social Influences	.002	.001	.276	.066*

Note: N = 45. $R^2 = .076$. * $p < .05$ (one-tailed).

In Table 13 the multiple linear regression of the four different social referent groups individually on the intention to use is summarized. The model accounts for approximately 22.6% (R^2) of the variation in the intention to use, which is noticeably more than either of the previous 2 regressions. The casewise diagnostics reveal 2 cases with high residuals, but the maximum Cook's distance is .429, which means there is little cause for concern (Cook & Weisberg, 1982). Mahalanobis' distance has a maximum of 17,717 which is high and possibly due to the fact that the independent variables possess collinearity, but since Cook's distance is far below 1 there should be no cases that wrongly influence the model. The VIF's range from 2,154 to 3,640 with tolerances above .2, confirming that there is no cause for concern of multicollinearity (Field, 2009 Menard, 1995; Myers, 1990). The outcome shows surprising results. For instance, the social influence of the colleagues, superiors and subordinates of the subject sample of physicians is not significant. Therefore, the following hypotheses are rejected:

☒ **H2.** Colleague influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

☒ **H3.** Superior influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

☒ **H4.** Subordinate influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

However, the social influence exhibited by the patients is significant and positive ($p < .05$), which confirms the 5th hypothesis:

☑ **H5.** Patient influences will have a significant positive effect on the intention to use or prescribe an artificial pancreas.

While not all the regressed relationships are significant, it is clear that patients exercise the greatest positive influence on the intention to use, which is derived from the B reflecting a greater gradient and the standard error of B which is relatively low. Additionally, there is a tendency in the data for subordinates and superiors to negatively influence the intention to use, while the influence tendency exhibited by colleagues is negligible. This means that the last 3 hypotheses are also rejected:

☒ **H6a.** Colleague influences on the intention to use or prescribe an artificial pancreas are greater than superior influences on the intention to use.

☒ **H6b.** Superior influences on the intention to use or prescribe an artificial pancreas are greater than subordinate influences on the intention to use.

☒ **H6c.** Subordinate influences on the intention to use or prescribe an artificial pancreas are greater than patient influences on the intention to use.

Table 13. Multiple Regression of Independent Social Influence Groups and Dependent Intention to Use.

	B	SE B	Beta (β)	Sig
Constant	4.355	.345		
S.I. Colleagues	-.001	.035	-.004	.988
S.I. Superiors	-.015	.034	-.103	.660
S.I. Subordinates	-.016	.027	-.142	.563
S.I. Patients	.059	.020	.604	.005**

Note: N = 45. $R^2 = 0.226$ ** $p < 0.01$ (one-tailed).

6. CONCLUSION

The aim of this study is to answer the research question as is "*to what extent does the subjective norm or its equivalent in multi-dimensional belief constructs influence a physician's intention to use or prescribe the artificial pancreas?"*

In much previous research the subjective norm is measured as an independent variable for numerous dependent variables in multiple domains of research. However, the subjective norm as it is measured in prevalent models such as Venkatesh & Davis (2000)'s TAM2 or Fishbein and Ajzen (1975)'s TRA is based on the general concept of 'people who are important to me' and 'people who influence my behavior'. In light of this study this may be an inadequate, overarching and generalizing statement of social referents. Although the subjective norm proves to be a positive significant independent variable for intention to use, looking further at its equivalent distinct multi-dimensional belief constructs for the sample of physicians in terms of colleagues, superiors, subordinates and patients, it is clear that this 'general' subjective norm does not thoroughly enough indicate the potentially differing influences of unique social referent groups. While this study incorporated only 4 social referent groups which are theoretically known for physicians, it already suggests that using distinct social referent groups as individual independent variables provides a far better explanation of variance in the intention to use, as illustrated by the greater R^2.

To answer the research question, the subjective norm has a positive and significant influence on the intention to use or prescribe an artificial pancreas for physicians. Additionally, the aggregate social influence construct also exhibited a significant positive relationship and explained slightly more of the variation (0.1%). This means that the subjective norm reflects a

close proxy for social referents, but it really only says something about people's general social environment. It proves to be insufficient and inadequate in the sense that it does not explain which people play an important part in this positive and significant influence and because it does not accurately reflect the direction and effect size of all the potential social referent groups. This study perpetrates that the patient group exercises a strong significant positive influence on the intention to use or prescribe an artificial pancreas, and that the other groups consisting of colleagues, superiors and subordinates do not contribute to this relationship and may even prove to do the opposite as they possess negative tendencies towards the intention to use or prescribe the artificial pancreas.

7. DISCUSSION

7.1 Limitations and Evaluation of Accuracy

This study is subject to several limitations. First, the study is limited to countries that have closely related cultures, namely the Netherlands, Germany and Austria. Even though that is within the scope of the assignment, it limits the generalizability of the findings to countries with similar or the same cultures and medical systems as previous research indicates differences between countries for subjective norms (Bagozzi & Lee, 2002). Additionally, the sample is biased towards the Netherlands as that is where the majority of the respondents come from, amounting to nearly 65%. The number of respondents from Germany and Austria are far less and make up for a little over 35%. Second, the surveys were based on previously validated scales in English; translating them to Dutch and German may subject the scales to differing interpretations or possible loss of validity due to an incorrect or insufficient translation. Third, social referent groups of physicians were identified in existing literature, but it is not an exhaustive list. It is likely there are more, potentially more important, social referent groups that play an essential role in a physician's decision-making and may thus exercise an influence. Fourth, the surveys make use of self-reported measures which are considered to be relatively unreliable by critics (Legris et al., 2003). Fifth, the total sample size of 54 respondents is adequate for this study, but is rather low for conducting multiple regression with a total of 5 constructs (Table 13). Generally, it is hard to acquire physician responses as they are quite busy with their day-to-day workload and activities. Lastly, this study focuses on the concept of an artificial pancreas, which is not yet a common device in the market. According to Taylor and Todd (1995a) this may elicit a stronger association for subjective norms as respondents are inexperienced and unfamiliar with the technology.

7.2 Contributions

This study contributes to the current state-of-the-art of the concept of technology acceptance by indicating the significant importance of the subjective norm, in particular the use of multi-dimensional belief constructs. Previous research is contradictory and mostly limits itself to a one-dimensional belief construct which is the subjective norm. Some studies, such as that of Schepers and Wetzels (2007) find a significant relationship for the subjective norm, while others do not (Chismar & Wiley-Patton, 2003). The findings of this study support that of, for instance, Taylor and Todd (1995a), which creates the belief that the influence of the subjective norm may change over time, may have different effects based on the subject sample or on the technology under investigation. The findings of this study also support the claims made by Taylor and Todd (1995a) that the investigation of multiple social referent groups is important and may influence the subjective norm in different ways. If researchers intend to study a sample's general social environment, the subjective norm is a fine proxy variable to use, but when one wants to research the influence of certain groups it is better to use multi-dimensional belief constructs. As such, this study provides a probable cause for the contradictions in previous research using the subjective norm.

Furthermore, this study enhances the empirical applicability and theoretical validity of models such as TAM2 by illustrating that the use of the subjective norm is also relevant for situations that do not explicitly involve information technology or make use of student samples. This was often the case for applications of the TAM2 model in previous research, which was extensively and rightfully so critized by Legris et al. (2003).

Lastly, this study contributes to the domain of healthcare research and application, as it provides a concise summary on the artificial pancreas, undoubtedly a to-be important device for type 1 diabetes patients worldwide. Moreover, it indicates a marketing path for companies such as Inreda Diabetic B.V. that construct artificial pancreases or similar devices – such as implants or prosthetics – which is the target group of the patients intended to use these devices. They, as a referent group, exert a significant and positive influence on a physician's intention to use or prescribe such devices in practice and as such may be used and stimulated to create a need-pull innovation in which the artificial pancreas is pulled through manufacturers, hospitals and clinics by and toward the patients.

7.3 Directions for Future Research

7.3.1 Practical Directions

It may be prudent to research the influence of distinct social referent groups on other subject samples or technologies within the healthcare domain, as significance for other technologies or samples may reveal marketing target groups for market expansion or interesting focus groups for co-creation.

It is also a wise idea to apply this study in a longitudinal perspective and re-submit the questionnaire in a later stadium to the same sample when the artificial pancreas is more commonly used to see if the subjective norm and/or the multi-dimensional belief constructs relationships are consistent over time.

7.3.2 Theoretical Directions

The findings of this paper are highly interesting, but, whilst adequate, the sample size (N = 54) is not excellent. A larger sample may reveal other or different relationships.

This research intended to focus on Dutch, German and Austrian respondents, but ultimately ended up focusing more on the Dutch component due to a difference in response rates. It would be wise to re-investigate this study in other countries with other cultures, particularly in Asian countries where the state-of-the-art of the artificial pancreas is similar to that in Europe.

There are only a few articles which identify social referent groups of physicians, while for many other groups of people a whole range of referent groups is available. Expanding the list for physicians would allow for a more extensive, more profound research model incorporating a multitude of social referents which may all exhibit different relationships.

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10. APPENDIX

10.1 Background information on diabetes

Type 1 diabetes consists of an autoimmune reaction which destroys the beta-cells in the human pancreas, which causes the cessation of the insulin production. Insulin, in turn, is the peptide hormone responsible for reducing excess blood glucose levels to normal levels. Without it, blood glucose levels may rise sky high to fatal levels and ultimately lead to death. The external intake of insulin is vital for type 1 diabetes patients (International Diabetes Federation, 2013; Klein, 2009). About 5 to 10% of the diabetes population suffers from type 1 diabetes (Business Insights, 2011).

Type 2 diabetes consists of a shortage of insulin production as well as partial resistance to insulin. Because of this, insulin is unable to fulfil its function of regulating blood glucose levels. This type of diabetes may not be noticed for many years. (International Diabetes Federation, 2013; Klein, 2009). About 90 to 95% of the diabetes population suffers from type 2 diabetes (Business Insights, 2011).

Gestational diabetes also deals with resistance to insulin, but only in the unique situation of pregnant women where the hormones produced by the placenta interfere with the functionality of insulin (International Diabetes Federation, 2013).

Estimating the prevalence of diabetes as well as the consequences it brings about is important to ensure sufficient advances and allocation of medical resources as well as raising awareness on how one might prevent or delay diabetes type 2. (Guariguata et al., 2014). Over the years many researchers and organizations, such as the IDF, have made estimates of the total number of diabetes patients. One of the latest studies is performed by Guariguata et al. (2014) whom state that "previous estimates of the prevalence of diabetes have demonstrated a large and increasing burden, with significant regional variability" (p. 137). Guariguata et al. (2014) find that all regions will have progressively more growth in adult diabetes patients than the rate of growth of the adult population. Furthermore, Guariguata et al. (2014) estimate a total of 381.1 million diabetes patients in 2013 and 591.9 million in 2035, which, as is typical in this specific research domain, exceeds all previous estimations. These same statistics can be found in the IDF Diabetes Atlas 6th ed. (International Diabetes Federation, 2013).

Over the past couple of decades much research has been conducted on the diabetes disease and various treatments have come to life, none of them fully cure one from the disease, though. Initially, following a diet and committing to sufficient body exercise can help many people, especially those with type 2 diabetes. However, some may need to take medicine in order to really get a grip on their blood glucose levels. There are different types of insulin that work in different ways, but the most common methods of intake are through vials and syringes, insulin pens, which together represent the multiple daily injections techniques (MDI) and insulin pumps, which represents the continuous subcutaneous insulin infusion technique (CSII). (Hirsch et al., 2005; Doyle et al., 2004); Lately, the concept of an artificial pancreas has come into play, which also fits within the CSII technique and has shown great promise in the field as it is a closed-loop system (Hovorka, 2011; Klein, 2009; Kowalski, 2009).

10.2 Figures

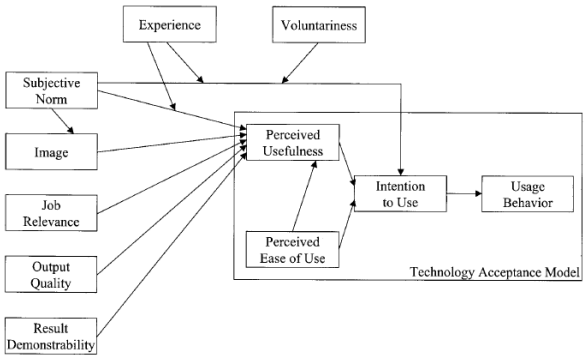

Figure 1. Proposed TAM2 – Extension of the Technology Acceptance Model.

Figure 3. Scree Plot of the Principal Component Analysis of the items of the Subjective Norm, Social Influence and Intention to Use.

10.3 Surveys

Construct (Dutch/German)	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 künstlichten Bauchspeicheldrüse gehört oder gelezen, bevor ich diesen Fragenbogen ausgefüllt habe.
	BR_02	De kunstmatige alvleesklier is zichtbaar in mijn beroepspraktijk	Die künstliche Bauchspeicheldrüse ist in meinem professionellen Umfeld present.
	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	Ich bin über die neuesten technologischen Entwicklungen in

Construct (Dutch/German)	Itemcode	Item in Dutch	Item in German
		werkveld.	Gebieten, die mich interessieren, auf dem Laufenden.
	INN_05	U heeft over het algemeen minder problemen dan andere mensen om u een technologie eigen te maken.	Ich habe weniger Probleme als andere Menschen mit technischen Geräten 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	VN_01	Ik verwacht dat het gebruik van de	Ich erwarte, dass die Nutzung der

Construct (Dutch/German)	Itemcode	Item in Dutch	Item in German
DE: Wahrgenommener Nutzen EN: Perceived Usefulness		kunstmatige alvleesklier de prestaties in mijn werk zal verbeteren	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	SN_01	Ik denk dat mensen die mijn gedrag beïnvloeden vinden dat ik de	Ich denke, dass Menschen, die mein Verhalten beeinflussen, meinen, dass

Construct (Dutch/German)	Itemcode	Item in Dutch	Item in German
DE: Subjektive Norm EN: Subjective Norm		kunstmatige alvleesklier zou moeten voorschrijven aan mijn patiënten.	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 DE: Demographische Fragen EN: Demographical Questions	AGE	Wat is uw leeftijd	Alter
	GEN	Wat is uw geslacht?	Geschlecht
	EDU	Wat is uw hoogst genoten opleiding waarvan u een diploma heeft	Höchster erzielter Abschluss

Construct (Dutch/German)	Itemcode	Item in Dutch	Item in German
		behaald?	
	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?

10.4 Syntax of SPSS.

Recoding all Social Influences to exclude the "not applicable" option

```
DATASET ACTIVATE DataSet1.
RECODE SI_1_SI_01 SI_1_SI_02 SI_2_SI_03 SI_2_SI_04 SI_3_SI_05 SI_3_SI_06 SI_4_SI_07 SI_4_SI_08
    (8=SYSMIS) (1=1) (2=2) (3=3) (4=4) (5=5) (6=6) (7=7).
EXECUTE.
```

Factor Analysis of the items of the Subjective Norm, all 4 groups of Social Influences and the Intention to Use

```
FACTOR
  /VARIABLES SN_00_SN_01 SN_00_SN_02 SI_1_SI_01 SI_1_SI_02 SI_2_SI_03 SI_2_SI_04 SI_3_SI_05
    SI_3_SI_06 SI_4_SI_07 SI_4_SI_08 ITU_00_ITU_01 ITU_00_ITU_02
  /MISSING LISTWISE
  /ANALYSIS SN_00_SN_01 SN_00_SN_02 SI_1_SI_01 SI_1_SI_02 SI_2_SI_03 SI_2_SI_04 SI_3_SI_05
    SI_3_SI_06 SI_4_SI_07 SI_4_SI_08 ITU_00_ITU_01 ITU_00_ITU_02
  /PRINT UNIVARIATE INITIAL CORRELATION SIG DET KMO INV REPR AIC EXTRACTION ROTATION
  /FORMAT SORT BLANK(.10)
  /PLOT EIGEN ROTATION
  /CRITERIA MINEIGEN(1) ITERATE(25)
  /EXTRACTION PC
  /CRITERIA ITERATE(25) DELTA(0)
  /ROTATION OBLIMIN
  /METHOD=CORRELATION.
```

Reliability test of the items of the Subjective Norm

```
RELIABILITY
  /VARIABLES=SN_00_SN_01 SN_00_SN_02
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Reliability test of the items of the Intention to Use

```
RELIABILITY
  /VARIABLES=ITU_00_ITU_01 ITU_00_ITU_02
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Reliability test of the items of the Social Influences (Aggregate)

```
RELIABILITY
  /VARIABLES=SI_1_SI_01 SI_1_SI_02 SI_2_SI_03 SI_2_SI_04 SI_3_SI_05 SI_3_SI_06 SI_4_SI_07 SI_4_SI_08
  /SCALE('ALL VARIABLES') ALL
```

```
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Reliability test of the items of the Colleague Social Influences

```
RELIABILITY
  /VARIABLES=SI_1_SI_01 SI_1_SI_02
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Reliability test of the items of the Superior Social Influences

```
RELIABILITY
  /VARIABLES=SI_2_SI_03 SI_2_SI_04
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Reliability test of the items of the Subordinate Social Influences

```
RELIABILITY
  /VARIABLES=SI_3_SI_05 SI_3_SI_06
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Reliability test of the items of the Patient Social Influences

```
RELIABILITY
  /VARIABLES=SI_4_SI_07 SI_4_SI_08
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR
  /SUMMARY=TOTAL.
```

Creation of the variable Intention to Use based on its 2 scales

```
COMPUTE Intention_To_Use=(ITU_00_ITU_01 + ITU_00_ITU_02) / 2.
VARIABLE LABELS  Intention_To_Use 'Intention to Use'.
EXECUTE.
```

Creation of the variable Subjective Norm based on its 2 scales (multiplication as in Taylor & Todd (1995a)

```
COMPUTE Subjective_Norm=(SN_00_SN_01  * SN_00_SN_02).
VARIABLE LABELS  Subjective_Norm 'Subjective Norm'.
```

```
EXECUTE.
```

Creation of the variable Normative Beliefs based on the 4 normative beliefs for the social referent groups

```
COMPUTE Normative_Beliefs=SI_1_SI_01 + SI_2_SI_03 + SI_3_SI_05 + SI_4_SI_07.
VARIABLE LABELS  Normative_Beliefs 'Normative Beliefs'.
EXECUTE.
```

Creation of the variable Motivation to Comply based on the 4 motivations to comply for the social referent groups

```
COMPUTE Motivation_To_Comply=SI_1_SI_02 + SI_2_SI_04 + SI_3_SI_06 + SI_4_SI_08.
VARIABLE LABELS  Motivation_To_Comply 'Motivation to Comply'.
EXECUTE.
```

Creation of the variable Social_Influence_Agg based on its 2 components of Normative Beliefs and Motivation to Comply (multiplication as in Taylor & Todd (1995a)

```
COMPUTE Social_Influence_Agg=Normative_Beliefs * Motivation_To_Comply.
VARIABLE LABELS  Social_Influence_Agg 'Social Influence Aggregate'.
EXECUTE.
```

Creation of the variable SI_Colleagues based on its 2 scales (multiplication as in Taylor & Todd (1995a)

```
COMPUTE SI_Colleagues=SI_1_SI_01 * SI_1_SI_02.
VARIABLE LABELS  SI_Colleagues 'Social Influence Colleagues'.
EXECUTE.
```

Creation of the variable SI_Superior based on its 2 scales (multiplication as in Taylor & Todd (1995a)

```
COMPUTE SI_Superior=SI_2_SI_03 * SI_2_SI_04.
VARIABLE LABELS  SI_Superior 'Social Influence Superiors'.
EXECUTE.
```

Creation of the variable SI_Subordinate based on its 2 scales (multiplication as in Taylor & Todd (1995a)

```
COMPUTE SI_Subordinate=SI_3_SI_05 * SI_3_SI_06.
VARIABLE LABELS  SI_Subordinate 'Social Influence Subordinates'.
EXECUTE.
```

Creation of the variable SI_Patient based on its 2 scales (multiplication as in Taylor & Todd (1995a)

```
COMPUTE SI_Patient=SI_4_SI_07  * SI_4_SI_08.
VARIABLE LABELS  SI_Patient 'Social Influence Patients'.
EXECUTE.
```

Checking the frequencies to uncover demographic descriptive statistics

```
DATASET ACTIVATE DataSet1.
FREQUENCIES VARIABLES=AGE GEN NAT BER KLITEST TYPHOS
  /NTILES=4
```

```
  /STATISTICS=STDDEV VARIANCE RANGE MINIMUM MAXIMUM SEMEAN MEAN MEDIAN MODE SUM
SKEWNESS SESKEW
    KURTOSIS SEKURT
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
```

Regression of Independent Variable Subjective Norm (supposed Proxy) on Dependent Variable Intention to Use

```
DATASET ACTIVATE DataSet1.
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Intention_To_Use
  /METHOD=ENTER Subjective_Norm
  /RESIDUALS DURBIN
  /CASEWISE PLOT(ZRESID) OUTLIERS(2)
  /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDRESID SDBETA SDFIT.
```

Regression of Independent Variable Social Influences Aggregate (the 4 social referent groups combined) on Dependent Variable Intention to Use

```
DATASET ACTIVATE DataSet1.
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Intention_To_Use
  /METHOD=ENTER Social_Influence_Agg
  /RESIDUALS DURBIN
  /CASEWISE PLOT(ZRESID) OUTLIERS(2)
  /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDRESID SDBETA SDFIT.
```

Regression of Indepent Variables SI_Colleagues, SI_Superior, SI_Subordinate and SI_Patient on Dependent Variable Intention to Use

```
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Intention_To_Use
```

```
  /METHOD=ENTER SI_Colleagues SI_Superior SI_Subordinate SI_Patient
  /RESIDUALS DURBIN
  /CASEWISE PLOT(ZRESID) OUTLIERS(2)
  /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDRESID SDBETA SDFIT.
```

Correlation Matrix of Independent Variables Subjective_Norm and Social_Influence_Agg and Dependent Variable Intention to Use

```
DATASET ACTIVATE DataSet1.
CORRELATIONS
  /VARIABLES=Intention_To_Use Subjective_Norm Social_Influence_Agg
  /PRINT=ONETAIL NOSIG
  /STATISTICS DESCRIPTIVES
  /MISSING=LISTWISE.
```

Correlation Matrix of Independent Variables SI_Colleagues, SI_Superior, SI_Subordinate, SI_Patient and Dependent Variable Intention to Use

```
CORRELATIONS
  /VARIABLES=Intention_To_Use SI_Colleagues SI_Superior SI_Subordinate SI_Patient
  /PRINT=ONETAIL NOSIG
  /STATISTICS DESCRIPTIVES
  /MISSING=LISTWISE.
```