Influence of Sex on Product Characteristics' and Subjective Norm's Impact on the Acceptance of the Artificial Pancreas

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ABSTRACT

This empirical research aims at determining to what degree differences in sex account for the acceptance of the artificial pancreas (AP). The focus of this paper is put on the communication strategy the Dutch organization Inreda Diabetic B.V. targets to enhance to market their product to diabetes type 1 patients. Results are generated on the basis of existing scientific literature and through the creation of a website survey by the usage of 'Lime Survey', forwarded to 601 Inreda Diabetic B.V. patient contacts of which 413 responses were collected. On the basis of 395 valid replies the impact of the five independent variables; perceived usefulness, compatibility, complexity, normative beliefs and motivation to comply, on acceptance were measured by using the statistical analysis program SPSS. Acceptance was operationalized by intention to use, which is the willingness of patients to use the AP. This paper reveals that there are slight differences existing between sex and male and female's degree of acceptance. Usefulness is of higher importance for women, whereas normative beliefs is of greater influence for men, complexity and motivation to comply are both insignificant regardless sex and compatibility impinges on men and women's intention to use by a moderate degree. Inreda Diabetic B.V. is advised to use the gained information as a rough outline of which factors may be necessary to be taken into account when pursuing their marketing and communication strategy and gives a first insight on the impact of sex and male and female's likeliness to accept the AP. Nevertheless, the outcomes may be different if other factors such as age, culture, race or trialability and observability were included.

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Keywords

Artificial pancreas (AP), sex, acceptance, perceived usefulness, compatibility, complexity, normative beliefs, motivation to comply

1. INTRODUCTION

Today's life is ruled and regulated by technology allowing science to develop medical devices to save patients' lives and enhance their day-to-day activities. As Herzlinger (2006) states, innovations in this field can provide time-stressed and increasingly empowered consumers with a "more-convenient, more-effective, and less expensive" (p. 59) treatment. This is also the case for diabetes patients who have to be self-caring in the management of their disease (Fitzgerald, Anderson & Davis, 1995) with the current state of the art medical devices. Thus, when aiming at gaining foothold within the medical industry, companies have to be aware of the stakeholders and their needs. One major stakeholder group is patients who should not only accept, but also use the new medical device proposed. Therefore, businesses have to develop a matching marketing strategy.

People with diabetes have a chronic disorder in the regulation or even creation of insulin leading to the control malfunction of their blood glucose. A distinction between Type 1 and Type 2 diabetes is to be made as the former patients lack insulin production, resulting in high blood sugar since the abundance of insulin leads to closed cells rejecting incoming glucose whereas the latter describes patients suffering of the resistance of insulin to unlock body cells for glucose entrance which causes a higher blood glucose level. Thus, diabetes patients are dependent on the intake of insulin and glucagon (Diabetes ATLAS, 2013). However, this intake can vary as there are different medical devices from which patients can choose which are the insulin pen, insulin pump and the sensor augmented insulin pump. (Inreda, n.d.)

The latest device that is being slowly introduced into the market is the 'artificial pancreas' (AP) which is a medical device supporting a person's malfunctioning pancreas. Its advantages are the less medical support it requires and that it is less time consuming through its automatically operating injection systems of insulin and glucagon. Since 2004, Inreda Diabetic B.V. is on the mission to develop and market a fully automated closed loop system in which insulin and glucagon intakes are integrated into the system by 2015 (Inreda, n.d.).

However, the acceptance of such a device is expected to be dependent on the degree of its novelty for the patient and the patient's innovativeness (Agarwal & Prasad, 1998). There surely is a difference on acceptance when a patient should transfer from the common and popular insulin pen to the AP as this is different in its handling and usability. In 1997, Sitzia and Wood already mentioned, that patient satisfaction may be determined by factors like marital status, social class, age or sex. On the last factor, this research paper focuses on, since it is not only the one about which authors seem to have very contradicting opinions but also because sex may have an effect on the communication strategies Inreda Diabetic B.V. has to aim for when marketing the AP. Sex is for example one of the factors found by Veloo and Masood (2013), affecting the acceptance of the technology they analyzed, the iLearn. This technology was a new e-Learning system for which women perceive its ease of use as a more important factor than men do. In contrast, men perceive the system's usefulness as more important than females in regard to their acceptance level. (Veloo & Masood, 2013) Nevertheless, authors of current medical literature vary in their opinions whether sex is an influencing variable, although sex has not been studied in the context of artificial pancreas yet. Moreover, models such as the Technology Acceptance Model (TAM) introduce factors affecting technological acceptance disregard individual user variables such as sex "although it is evident from daily life

experience that people may have different adoption behaviors due to individual characteristics" (Ziefle & Schaar, 2011, p. 2). Authors such as Rogers (1983), Davis (1989) and Bagozzi and Lee (1999) mention perceived usefulness, compatibility and complexity as possible factors influencing sex's acceptance of new devices. Subjective norm is another factor which deals with a person's social environment which affects one's intention to use (Venkatesh & Davis, 2000; Vries, Dijkstra, & Kuhlman, 1988) a newly introduced product. Subjective norm, in the opinion of Vries et al. (1988) as well as Weerdt, Visser, Kok and Veen (1990), can be subcategorized into normative beliefs and the actual motivation to comply with that what others say.

Thus, the goal of this research paper is to identify whether sex has an influence on the acceptance of innovations such as the AP, in order to give Inreda Diabetic B.V. an insight into the factors influencing sex's decisions and thus allowing the organization to generate a communication strategy in line with consumers' expectations and needs.

Therefore, the following research question is aimed to be answered: *To what degree do differences in sex account for the acceptance of the artificial pancreas?*
To answer this question properly, two subquestions are used:

- *What is the impact of sex on the relationship between product characteristics (perceived usefulness, compatibility and complexity) and acceptance?*
- *What is the impact of sex on the relationship between subjective norm (normative beliefs and motivation to comply) and acceptance?*

To answer the research question, the paper is structured into several sections. Firstly, existing literature is reviewed and an introduction is given to the theoretical background. Secondly, a model is presented, stating and describing all variables which are assumed to impact this research's outcome in form of hypotheses. Afterwards, study of subjects, measurements, and the realized data collection method and data analysis are each explained in the methodology section. Results will then precede discussion including implications, limitations and further research and at final this research paper will end with a conclusion.

2. THEORETICAL FRAMEWORK

To define a common understanding, the main variable of this paper, 'sex' is defined. Throughout the whole article the term 'sex' is used, referring to a person's biological status and differences leading to the categorization of male and female (APA, 2011). Thereby one has to clarify the difference between sex and gender, in which gender does partially indicate a person's sex (APA, 2011; Nobelius, 2014; Killermann, 2013) but is especially characterized by "the attitudes, feelings, and behaviors given by a culture" (APA, 2011) in regard of a person's sex. Gender implies gender identity, gender expression and hence the roles implied on people's expectation of one's sex (APA, 2011; Nobelius, 2014; Killermann, 2013).

2.1 Literature Review

Existing literature often picks up sex as a possible control factor impacting differing relationships of two variables. Ajzen and Fishbein (1969) did a research on behavioral choices and analyzed differences in attitudes and normative beliefs towards single, dichotomous and multiple behavioral choices. Next to their intended results, they realized differences in the relationship of male and female behavior towards choices such as their interest in doing certain activities (Ajzen & Fishbein, 1969). Differences were also identified by Ha et al. (2007) as

cited by Leong, Hew, Tan and Ooi (2013) who, in contrast, could not classify sex as a moderating effect in their model which dealt with the factors of social influence, personal innovativeness, trust, financial costs and perceived usefulness and perceived ease of use as potential factors for the acceptance of the Near Field Communication mobile credit card. However, with a focus on technological acceptability, Ziefle and Schaar (2011) examined sex differences in the acceptance towards invasive medical stents and found that in their research women perceive barriers towards the usage of technology much greater than the benefits it would bring them and that women tend to use misconceptions and false information over medical technology to shape their acceptance degree. Furthermore, women are less open and interactive with technology as well as less confident using it. This is supported by Fitzegerald, Anderson and Davis (1995) who found differences in diabetes attitudes and adherence between male and female for which the latter one has a "greater use of health services and [has] a larger network of people with whom to discuss medical problems" (p. 523). Nonetheless, Wilkowska, Gaul and Ziefle (2010) found a contrasting result in their research in which they analyzed the influence of sex on a medical device called 'smart textiles' and no relationship was found. They only found that sex in combination with age seems to be significant when analyzing usage barriers and technical experience.

As can be seen, the current state of literature does not give a unified overview whether sex plays a significant role in accepting a medical device or not, especially when focusing on the AP. Acceptance stated by Ziefle and Schaar (2011) already as highly complex, since perceived benefits as well as serious concerns needs to be weighted and is influenced by "individuals and situational aspects" (p. 3). Nonetheless, authors like Agudo-Peregrina, Hernández-García, and Pascual-Miguel (2013) or Veloo and Masood (2014) mention that the degree of acceptance, which is often also described as the 'intention to use' a novel object, is dependent on factors widely discussed in contemporary literature.

Rogers' diffusion model (1983) presents five factors which impact the degree of dispersion of an innovation, namely: relative advantage, compatibility, complexity, trialability and observability. Roger defines relative advantage as the degree of advantage perceived as being "better than the idea it supersedes" (p. 213). Compatibility describes to what degree an innovation is seen as consistent with a person's values, experiences and needs. Complexity is the degree to which the innovation is realized as being "difficult to understand and use" (p. 230). Trialability is the degree to which people can try out and experiment with the innovation on a limited basis during the adoption process. Observability is explained as the degree to which the innovation's results are observable and visible to others. (Rogers, 1983) Rogers' factors of the diffusion model is used in this research since it is a widely accepted model in current literature (Agarwal & Prasad, 1997; Bagozzi & Lee, 1999; Cain & Mittman, 2002) and gives the possibility to measure the influence of acceptance on sex.

Next to Rogers, Davis (1989) introduces two factors having an influence on acceptance. Firstly, the perceived usefulness of a certain innovation defined as the degree to which it will increase a person's performance. Secondly, the perceived ease of use which is determined as the degree of effort needed to use the novel system. Both factors were also identified as being determinants of intention to use in the research of Venkatesh and Davis (1996, 2000) and Venkatesh, Morris, Davis and Davis (2003) as well as Godoe and Johansen (2012).

Moreover, several authors propose factors such as subjective norm as possible indicators on the degree of acceptance. Subjective norm is thereby defined as a "person's perception that most people who are important to him think he should or should not perform the behavior in question" (as cited in Venkatesh & Davis, 2000, p. 187; as cited in Venkatesh et al., 2003, p. 452). Hence, subjective norm indicates a persons' behavior towards the choice this person would not favor without the impact of the referent (Venkatesh & Davis, 2000). In addition, Vries et al. (1988) differentiate subjective norm into normative beliefs and the motivation to comply. The latter describes "the degree to which an individual is inclined to agree" (Vries et al., 1988, p. 273) with the opinions of important persons and the former describes the expectations of those important persons (Vries et al. 1988). This differentiation is also supported by Weerdt et al. (1990). Taylor and Todd (1995) propose in their model of the 'Decomposed Theory of Planned Behavior' in which subjective norm is further specified to two referent groups, student and professor. In the authors opinion by decomposing subjective norm "a larger number of factors that may influence usage" (p. 151) can be detected. A differentiation between those social influences is thereby "related to the possible divergence of opinion among the referent groups" (Taylor & Todd, 1995, p. 152). This fits well with Bagozzi and Lee's (2002) statement that other people's expectations are significant and is further extended by Weerdt et al. (1990) found that for patients the most important referents influencing their behavior are "partner, house-mates, family, children, friends, physician, dietitian, colleagues and fellow patients with diabetes" (Weerdt et al., 1990, p. 607).

2.2 The Research Model

To systemize, increase comprehension, allow the creation of a model and simplify future analysis the upper mentioned factors are categorized into two overarching factors which are: product characteristics and subjective norm.

However, Rogers' factors of trialability and observability are excluded since they cannot be rated yet in the relationship of the artificial pancreas which is until now not a common and well-known diabetic device. Rogers' three remaining factors in contrast can be used to describe a person's relation towards the artificial pancreas' characteristics. They are categorized under product characteristics, whereas relative advantage is used interchangeably with Davis's perceived usefulness. Davis's ease of use will not be used in the further context as Roger's variable of complexity already picks up on the effort needed to be spent by patients into using the artificial pancreas. Roger's three factors also seem to have an impact as Tornatzly and Klein (1982) found those three characteristics to be the "most consistent significant relationships to innovation adoption" (p. 28).

Product characteristics contain perceived usefulness, compatibility as well as complexity. *Perceived usefulness* will thereby also stand as a synonym for relative advantage based on the fact that both deal with the degree of advantage a person perceive to have in using an artificial pancreas (Rogers, 1983; Davis, 1989). *Compatibility* is used, resembling Rogers (1983) definition of it in the context of the AP. So, it describes the degree to which the AP is in line with the values and experiences of a person which is expected to have a positive effect on the acceptance level of patients. *Complexity* describes the degree of effort needed by a person to deal with the artificial pancreas. Hence, the degree of which a person perceives the artificial pancreas to be "difficult to understand and use" (Rogers, 1983, p. 230), indicating the negative influence on acceptance.

Subjective norm contains of normative beliefs and motivation to comply which effects a person's perception by the degree of attachment to its social environment (Vries et al. 1988). *Normative beliefs* is used as Vries et al. propose it in their article which describes it to be the expectations and impressions of the referent groups. *Motivation to comply* considers the likelihood with which a person agrees on the opinion of those referents and decides in their favor (Vries et al., 1988; Weerdt et al., 1990).

Both factors are stated to influence acceptance (Vries et al., 1988; Weerdt et al., 1990). **Acceptance** is defined as an agreement of a situation in which a person does not comply or protest and thus, agrees and grants consent on the provided condition (acceptance, n.d.; acquiesce, n.d.). The acceptance process is therefore understood as "the manner by which resistance is overcome" (Bagozzi & Lee, 1999, p. 7). Since acceptance is hard to measure, a person's intention to use is rather applied in the way Venkatesh and Davis (2000) introduced it in their paper. This relies on the fact that the technology acceptance model (Venkatesh & Davis, 2000) analyzes intention to use to identify user behavior. Hence, "acceptance models are based on the assumption that behavioral intention is a valid predictor of actual use behavior" (Agudo-Peregrina et al., 2013, p. 301) Therefore, one's intention to use can be stated to rely on the foregoing acceptance of an application.

2.2.1. Perceived usefulness

Perceived usefulness is identified by Veloo and Masood (2013) to be more important in the acceptance degree for males than for females. Men in general appear to have a higher technical knowledge through which their self-esteem and experience builds a positive attitude towards using technology (Wilkowska et al., 2010). In addition, Ziefle and Schaar (2011) found in their results that women tend to base their decisions on misconceptions and false information about the medical technology. Putting these results into hypotheses in the context of the artificial pancreas and with a focus on women, they are:
H1: Perceived usefulness has a positive effect on intention to use.
H2: Female type 1 patients negatively moderate the positive relationship between perceived usefulness and intention to use.

2.2.2. Compatibility

As compatibility deals with the degree of overlap and consistency towards a person's values, experience and needs, women are highly dependent on their level of knowledge and capabilities in uncertain or new situations (Maes, Leroy & Sels, 2014). In extension, Ziefle and Schaar (2011) reported in their research that women have a lower interest in technology and thus a lower level of "literacy and handling competence" (p. 13). Moreover, they are less confident and thus have a higher computer anxiety (Ziefle & Schaar, 2011). Both depict women as having a tendency to reject a new medical device because of their lack of knowledge created through the absence of interest on technology. However, Fitzgerald et al.'s (1995) research led to the conclusion that women have a greater interest in using health services and report themselves to be sick more often than men. In addition, Sitzia and Wood (1997) cite a British study which found that women complain to a greater extent about the lack of privacy and the rigid timetables of their treatment than man. This would contrast the aforementioned points and rather militates for the acceptance of a new medical device. While the latter is a more general statement, the second point by Ziefle and Schaar (2013) already proposes first results within a technical and medical context. Thus, one can create following hypotheses:

H3: Compatibility has a positive effect on intention to use.
H4: Female type 1 patients negatively moderate the positive relationship between compatibility and intention to use.

2.2.3. Complexity

Complexity deals with the difficulty with which a person associates a device. Veloo and Masood (2013) realized in their research that for women the ease of use of a new technology is of greater importance than for men. Thus, the easier something is for women, the less complex it is to them. So, since complexity contrasts ease of use which has a positive effect on intention to use, the following hypotheses can be concluded.
H5: Complexity has a negative effect on intention to use.
H6: Female type 1 patients positively moderate the negative relationship of complexity and intention to use.

2.2.4. Normative Beliefs & Motivation to Comply

On the measures on subjective norm and the impact of one's social influence, Wilkowska et al. (2010) found that women are affected by their social environment when it is about the acceptance of new technology. Normative beliefs and motivation to comply thus play an important part in it as one can assume. Moreover, the authors mention women to be more reliable and help-searching in "their social environment" (p. 84) which is greatly in relation to a person's social influence and one's attachment to the social environment. Likewise, Fitzgerald et al. (1995) found women to have "a larger network of people with whom to discuss medical problems" (p. 523) wherefore one can expect the other's opinion to be influential on the decision to be made and one's willingness to comply. One can expect that the greater the support by one's surrounding is, the higher is a person motivated to comply with a new medical device. Overall, applying these findings on the two components of subjective norm one can assume that:
H7: Normative beliefs has a positive effect on intention to use.
H8: Female type 1 patients positively moderate the positive effect of normative beliefs on intention to use.
H9: Motivation to comply has a positive effect on intention to use.
H10: Female type 1 patients positively moderate the positive effect of normative beliefs on intention to use.

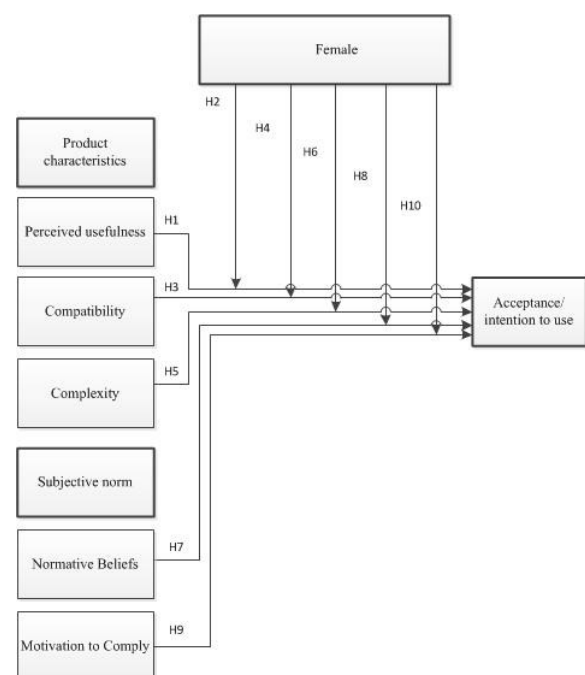## 2.2.5. Overview of Variables and Hypotheses

Figure 1. Females moderating effect on the relationship between product characteristics and subjective norm on acceptance

On the basis of the aforementioned factors and the generated hypotheses, a model is created to the context of the artificial pancreas in which those factors are put into relationship with sex affecting acceptance. Rogers' factors, summarized under the topic product characteristics as well as the two components of subjective norm are independent variables. Acceptance is the dependent variable impacted by the independent variables and females represent the moderating, independent variable which influences the relationship between the independent and dependent variable.

3. METHODOLOGY

3.1 Research Setting

3.1.1. Subjects for Study

601 Diabetes Type I patients are the subject for research as their knowledge and daily experience on their disease cannot be expressed by someone better than themselves. Based on their expectations on technology, diabetes and their quality of life, information can be drawn on which factors play a role in their acceptance of a new device and whether men and women perceive different factors as more important. Patients who are already aware of the latest medical progress and have already some knowledge about AP are approached. Contacts to patients are therefore given by Inreda Diabetic B.V. as their presence in Dutch TV shows and their marketing attempts already attracts patient's attention and let more than 2000 diabetes patients' sign up for future contacting which is why most patients are Dutch.

3.1.2. Artificial Pancreas

The artificial pancreas is a medical device for diabetes treatment which supports a person's malfunctioning pancreas. It consists of three components in which the first sensors and monitors the glucose level, the second is an insulin pump used as a storage and delivering device of insulin and the third component is a little attachable device called control algorithm, which computes "the amount of insulin to be delivered and communicate[s] between the sensor and the pump" (Klein, 2009, p. 35). Since the AP is a close-looped system, less control is needed on diabetes type 1 patient's dietary plans as glucose control works before and after meals but also during sleep (Klein, 2009). Based on the sensors, the control algorithm calculates the intake rate of needed glucagon and insulin which is then automatically injected by the insulin pump (Inreda, n.d.). Therefore, patients gain advantages through the tight glucose control and the decrease of their treatment burdens (Klein,

2009).

3.1.2. Sex

Sex can be differentiated into male or female when focusing on their biological status. It is illustrated as a moderating factor since being e.g. female seems to affect the influence of product characteristic and subjective norm on acceptance. (Miles & Shevlin, 2007) Specific concentration is given to females because afore-mentioned literature proposes more information on females than males. Thus, female is an independent, also called predictor variable, forecasting the direction of the outcome and acceptance is therefore the variable which is dependent and influenced by other variables.

3.2 Measurement

This explorative research bases on a quantitative, multivariate analysis of responses of diabetes type 1 patients to a technology acceptance survey. Variables are measured on the basis of a multi-item scaling. As a moderating factor females are used representing sex and directly affecting each single variable in its relationship to acceptance. Since gender is not measurable, no scaling can be given. For measuring the other five variables Likert's 7-point scaling is used. The Likert scale is based on standardized response categories ranging from strongly agree to strongly disagree (Babbie, 2010). Each variable is defined by several questions, also called 'items' which can be seen in detail in Table 10 (p. 16) in the appendix. The items for measuring each single variable are based on the items of other authors, for which most are persuasive by their Cronbach's Alpha which describes whether there is consistency existing between each item to its intended variable, thus the "homogeneity across items" (Rank, n.d.,b, p. 4). The original Cronbach's Alpha are presented in Table 10 in the appendix (p. 16). However, since items are adapted to the context of APs, the extent to which these questions are "reliable and form valid" (Raesfeld Meijer & Oukes, 2014, p. 4) has to be identified.

To measure the questionnaire's validity these steps are followed: Firstly, the exploratory factor analysis is made to group many questions of the questionnaire into a few factors "representing meaningful constructs" (Rank, n.d.a, p. 8). One part of it is the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) executed to identify if each variable has a value close to 1 to indicate that a pattern of correlation is present and that a factor analysis is applicable. It is appropriate if the KMO value exceed cores of 0.5 (Field, 2009). The significance factor should be as close to the .000 as possible. Secondly, the total variance should also show that each variable has an initial total eigenvalue of 1.0 or higher, which describes "how much of the total variance

Table 1. Operationalization of the dependent and independent variables

		Adapted Definition	Based on	Scaling	Measured by
Dependent variables	Perceived Usefulness	Degree of advantage a person perceive to have in using an artificial pancreas	Rogers (1983) & Davis (1989)	7 point Likert	Perceived Usefulness
	Compatibility	Degree to which artificial pancreas is in line with the values and experiences of a person	Rogers (1983)	7 point Likert	Compatibility
	Complexity	Degree of which a person perceive the artificial pancreas to be "difficult to understand and use "	Rogers (1983)	7 point Likert	Complexity
	Normative Beliefs	The expectations of referent groups	Vries et al. (1988)	7 point Likert	Normative Beliefs
	Motivation to Comply	Degree to which an individual inclines to agree on the opinion of the referent	Vries et al. (1988)	7 point Likert	Motivation to Comply
Independent variables	Acceptance	The agreement of a situation in which a person does not comply or protest and thus agrees and grants consent on the provided condition.	acceptance (n.d.); acquiesce (n.d.)	7 point Likert	Intention to Use

of all variables (items) is accounted for by a specific factor" (Rank, n.d.a, p. 8). A variable with an eigenvalue of 1 should be retained. Thirdly, to identify the impact of one item (one question) and a factor (preferably one of the chosen variables), the factor loading is calculated via the exploratory factor analysis. A factor loading of over .50 is best to explain an item's loading on one factor (Field, 2009).

Reliability is measured by recalculating the Cronbach's Alphas for which a score of .70 or higher should be reached to show internal consistency between the item and variable (SPSS Wizard, 2012).

3.2.1 Validity

Perceived usefulness, compatibility and complexity score a .89 in the KMO sampling adequacy, which makes a factor analysis appropriate. The significance rate of .000 indicates that all three variables are significant. Also the 'total variance explained' section shows that three components were identified by an initial total eigenvalue of 1.0 and higher. All items (questions) also fit their component (the variable it should intend to measure) by a factor of .70 or even higher (see appendix, Table 7, p. 14). The only exception is the item of perceived usefulness "I expect that the artificial pancreas will be useful in my daily life." which only scores a factor rank of .407 for which it is disregarded in further calculations.

Analyzing subjective norm, the factor analysis also shows a KMO and Bartlett's Test significance rate of .000. In addition, the 'total variance explained' displays an initial total eigenvalue of 9.875, 2.417 and a third one of 1.420. After fixed to two factors, two variables are recognized as intended, representing normative beliefs and motivation to comply. The first mentioned illustrates all questions saying 'My... think that I', e.g. "My friends would think that I should use the artificial pancreas.", whereas the second one asks all items starting with 'Generally speaking, I want to do ...', e.g. "Generally speaking, I want to do what my friends think I should do.". All items have a factor level which is high enough to be significant, however two exceptions exist. First, the statement "Generally speaking, I want to do what my diabetes nurse thinks I should do." is left out based on its low and non-matching factor rate of .438 and -.351. Moreover, the item "Generally speaking, I want to do what my physician thinks I should do." is excluded reasoned on its factor rate of .305 and -.372 (see appendix Table 8, p. 14). Both categories are named 'normative beliefs', dealing with the items 'My... think that I' and 'motivation to comply' which incorporates all 'Generally speaking' items. Since both deal with a person's social environment, they fall under the subcategory subjective norm. Intention to use is however excluded because of the factor analysis since its logical correlation with other variables would only derange the correlation of the other items to their constructs.

3.2.2. Reliability

Table 10 in the appendix (p. 16) shows the newly calculated Cronbach's Alphas of all the items of the variables and demonstrates internal consistency by a score of 0.7 or higher (SPSS Wizard, 2012). The Cronbach's Alpha of perceived usefulness is .89, of compatibility .88, complexity .86, normative beliefs .94, motivation to comply .95 and intention to use of .87. In the example of the intention to use, both items measure intention to use and nothing else. Therefore intention to use is reliable. Nonetheless, in the calculations for motivation to comply two items are left out as identified in the factor analysis as well as one item in perceived usefulness.

3.3 Data Collection Method

Empirical data is collected by using an online survey created via a system called 'Lime Survey'. Overall, 601 invitations have been sent to diabetes type 1 patients for the questionnaire (see appendix, Table 10, p. 16). Answers were collected within a time range of 13 days from June 3rd until 16th. Hence, the results are gained from a sample made at one point in time, for which a cross-sectional study is executed (Babbie, 2010).

Via the Lime Survey emails were send out to all possible respondents, inviting them to fill out the questionnaire in which the email gives first a short explanation of the purpose, the goal as well as the importance of it. The survey itself starts with a short introduction into the AP, to ensure respondents' understanding of all the questions related to the AP. It also indicates the cooperation between the University of Twente and all members of the PCDIAB, which are AMC Amsterdam, University of Graz, University of Twente, Profil Research, Full Group, Novo Nordisk and Inreda Diabetic B.V.

The survey is constructed in such, to allow respondents to pause in between and start over where they have stopped. A "previous"-button was activated to permit each individual to review his/her answers and the information given about the AP. The system gives a date stamp to every response and saves all answers in a separate list which can easily be transmitted into SPSS for further analysis.

This data collection method allows gaining a first overview of whether sex has an influence on the acceptance of the artificial pancreas and allows identifying factors influencing sex differences on acceptance. Nonetheless, this research has to be treated as a pilot study to be extended by others in the future.

3.4 Data Analysis

This section explains how results are gained via the usage of SPSS. Since all constructs are detected to be valid and reliable a correlation matrix can be conducted and a regression analysis performed.

If one wants to define whether there is a correlation between two items, the result of the Pearson Correlation coefficient should be as close to ±1 to show a linear correlation between two constructs. A coefficient of +1 indicates a positive relationship whereas a coefficient of -1 means a negative relationship. A value of " ± .1 represent a small effect, ± .3 is a medium effect and ± .5 a large effect" (Field, 2009, p. 170), used and translated in this research paper into a weak, medium and strong correlation. Therefore, the correlation score describes the strength of the relationship of the two items it represents and gives additional information on the direction of those. The significance should be over .05 for which the significance rate should be as close to .000 as possible.

The regression follows the correlation calculations and gives an overview of the causal relation between the constructs and which independent variable is related to the dependent variables (Rank, n.d.b). The regression weight is depicted by the beta value (B) and evaluates which predictors are related to the criterion and the direction (either positive or negative) it indicates. The higher B is, the stronger is the relationship degree which is why a value close to 1 is preferable. Within the regression analysis, the determination coefficient R Squared (R^2) illustrates the variation in the dependent variable by the independent variable. It measures the variance on the criterion variable, the dependent variable intention to use. The score explains the percentage of the difference to the independent variable. (Rank, n.d.c)

Table 2. Means, Standard Deviation and Correlations of the variables

Sex	Variables	Mean	Std. Deviation	1	2	3	4	5	6
Female									
	1. Perceived usefulness	6.0182	.91164	1					
	2. Compatibility	6.2167	.86186	.730[**]	1				
	3. Complexity	2.3091	1.16867	-.325[**]	-.455[**]	1			
	4. Intention to use	6.4750	.84565	.522[**]	.579[**]	-.358[**]	1		
	5. Normative beliefs	5.6646	1.33020	.232[**]	.261[**]	-.228[**]	.344[**]	1	
	6. Motivation to comply	4.5201	1.61805	-.007	.021	.023	.092	.652[**]	1
Male									
	1. Perceived usefulness	5.9566	.86566	1					
	2. Compatibility	6.2095	.80819	.463[**]	1				
	3. Complexity	1.9214	.81069	-.303[**]	-.437[**]	1			
	4. Intention to use	6.5286	.81423	.451[**]	.582[**]	-.265[**]	1		
	5. Normative beliefs	5.5600	1.40669	.404[**]	.320[**]	-.183[**]	.421[**]	1	
	6. Motivation to comply	4.6653	1.53692	.266[**]	.074	-.041	.168[*]	.706[**]	1

Female N = 220; male N = 175

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

4. RESULTS

4.1 Descriptive Statistics

On June 15th, 2014, the survey was stopped with 413 full and 93 incomplete responses giving a total response rate of 506 patients out of the 601 patients it was originally sent to. However, the sample size of 413 also includes non-valid samples because type 2 diabetes and some incorrect statements within age and diagnosing age had to be excluded, reducing the data set to a total of 395 valid responses.

Table 5 (see appendix, p. 13) shows the distribution of sex. Out of all 395 valid responses 55,7% are female replies and 44,3% were male reactions. Overall, most respondents are resident in the Netherlands (97,3% and 94,3%) whereas the minority with less than 1.4% for females and 4% of males live in Belgium, Germany or other countries. Taking a look at females' and males' education, it is noticeable that more females have a secondary vocational education (MBO) by 31.4% in comparison to males' 22.3% as well as the higher rate of females having secondary education by 25.5% compared to the 18.9% of men. Table 6 (see appendix, p.13) illustrates the distribution of age which does not vary greatly between male and female where the mean is 37.4 and 41.6 respectively. The average diagnosing age is 22 (male) and 20 (female) years.

4.2 Comparing Constructs

The Table presented above (Table 2) is about the correlation coefficient stating the following: firstly, there is a correlation between almost all independent variables (perceived usefulness, compatibility, complexity, normative beliefs) and the dependent variable, intention to use. Secondly, there is a difference in the correlation degree between women and men when analyzing motivation to comply.

Overall, all independent variables except for motivation to comply correlate with intention to use significantly at a level of 0.01. Furthermore, women's perceived usefulness and intention to use have a strong coefficient of .522 for which they positively correlates with each other. Similarly, compatibility and intention to use strongly correlate positively by .579. Men, in comparison show a weaker correlation between intention to use and perceived usefulness with a coefficient of .451, whereby the correlation between intention to use and compatibility is even slightly higher than the one of females with the coefficient .582. Complexity correlates negatively by a weaker coefficient of -.358 for females, which can be found to be even weaker for males with a coefficient of -.265. Intention to use, however, positively coheres with normative beliefs at a rate of .421 by men, whereas women's normative beliefs show a weaker correlation of .344. Most outstanding is that females do not show a significant response on intention to use and motivation to comply whereas male's motivation to comply significantly correlates with intention to use at a level of .05 with a weak coefficient of .168.

4.3 Regression

To determine if all independent variables actually have a unique contribution to intention to use a regression analysis is conducted as well as a hierarchical regression analysis which splits the result into female and male as depicted in Table 3. The beta value (B) shows the weight of each independent variable on the model and the p-value represents the statistical significance of this weight if p<.05 is fulfilled as all hypotheses are 1-tailed. Starting with Table 3, only perceived usefulness, compatibility and normative beliefs have significant effects on intention to use. All three have a positive effect, whereby the former and latter influence is weak with a beta value of only .155 and .159. Compatibility already has a positive and stronger effect with a B of .379. Complexity and motivation to comply have a negative but insignificant effect on intention to use with a B of -.044.

Table 3. Determinants of independent variables' influence on intention to use with focus on sex

| | Sex | | | | | | | | |
| | Unseperated | | | Female | | | Male | | |
Independent variable	B	s.e.	p	B	s.e.	p	B	s.e.	p
Perceived Usefulness	.155	.047	.001	.177	.072	.015	.160	.066	.015
Compatibility	.379	.053	.000	.335	.081	.000	.426	.073	.000
Complexity	-.044	.035	.210	-.063	.044	.156	.023	.066	.731
Normative beliefs	.159	.035	.000	.147	.048	.003	.180	.052	.001
Motivation to comply	-.044	.028	.119	-.033	.038	.391	-.067	.045	.136
R2	.408			.402			.426		

*Valid N = 395

a. Dependent Variable: Intention to use

Separating the data set by sex gives a more detailed overview of the influence of independent variables on the dependent one and whether sex plays a moderating effect on it. Perceived usefulness, which does not vary between male and female, has a significant relationship to intention to use as p is .015 but is nonetheless too weak to show a positive relationship with a B of .177. Compatibility in contrast is not only significant with p being .000, but also has a B of .335 for women, and for men even .426 which illustrates a medium effect of +.3 (Field, 2009). Complexity by females is insignificant and has a very weak negative relationship to intention to use whereas male's significance rate of .731 deviates even more from a p-value of .05. Also, B of .023 does not show an actual weighting of complexity on intention to use. The significance rate of .731 of males makes complexity much more unlikely to have a relationship to intention to use, especially with B being .023. Normative beliefs has a weak positive weight with .147 for females and .180 for males, both being significant. Motivation to comply has for both a negative weight with the difference that women's weight is much more insignificance than men's with .391 to .136.

Concluding, only perceived usefulness and compatibility are significant and have a positive weight. Complexity and motivation to comply are insignificant with both having a negative direction except for men having a positive weight on complexity. Normative beliefs is significant although it only has a weak beta value.

To check whether multicollinearity will bias the regression analysis the correlation matrix was scanned finding that all correlation values did not exceed 0.8, indicating that multicollinearity does not seem to be present (Field, 2009). This is further analyzed with the tolerance statistics. Values below 0.1 suggest problems of collinearity (Menard, 1995) which however, was not found for all variables in this research in which perceived usefulness scores a .597, compatibility .536, complexity .796, normative beliefs .465 and motivation to comply .519. Thus, "there is no perfect linear relationship between two or more of the predictors" (Field, 2009, p. 220) and the conclusion can be drawn that on average the regression model depicts more or less the situation in the actual population (Field, 2009).

Thus, disregarding all insignificant relationships, R2 (Table 3) states that the five independent variables contribute to 40% on women' and 43% of men's acceptance and thus intention to use an AP. Sex in general accounts for 41% of the variance on intention to use.

5. DISCUSSION
5.1 Summary of Findings
The analysis demonstrates that there are consistencies as well as dissimilarities between the examined literature and the results they proposed to the outcomes of this research. By creating a relation between the information gained by literature and the hypotheses made, the following can be said:

Hypothesis 1, which describes perceived usefulness having a positive effect on intention to use, is accepted based on the given data set. This is on the basis of the positive and significant but weak B which exists between both variables in Table 3 (unseparated). A positive relationship is being in line with what literature proposes (Rogers, 1983; Davis, 1989). Thus, the more useful the AP is perceived to be, the more it will be accepted by patients. Nonetheless, perceived usefulness affects a person's decision only to a small degree whereby other factors will be more powerful in the decision making process.

Hypothesis 2 conversely is rejected because no negatively moderating effect of female type 1 patients is found on the positive relationship between perceived usefulness and intention to use. The regression analysis indicates that female's degree of intention to use is positive, even if B has a weak weight. Moreover, both sexes' mean values (Table 2) reveal, that the average of all respondents chose 6 out of the 7 Likert scale offered as answer options, which gives the statement and its answer options a positive direction. The rejection of hypothesis 2 challenges the findings of Veloo's and Masood's (2013) which stated perceived usefulness to be higher for male than female albeit this research found women's B value to be higher than men's. Assuming the statement to be right that men have more experience with technology for which they are more self-confident with it and more positive about it than women (Wilkowska et al. 2010), then this research would at least identify no difference between sex to exist since men as well as women show a positive correlation which is even higher for females. A possible reason is offered under hypothesis 4 which picks up on this outcome.

Hypothesis 3 has proven to be right, reasoned on the results showing a positive correlation between compatibility and complexity, which is further approved in Table 3 that depicts a positive effect of compatibility on the dependent variable. The mean rate of 6.2 of the chosen 7 Likert scale gives a further hint on the positive impact compatibility has on intention to use (see appendix, Table 9, p. 15). Therefore, hypothesis 3, saying that compatibility has a positive effect on intention to use adds to Rogers' (1983) stance on compatibility. So, a fit between one's values, experience and expectations will have an increasing positive influence on the acceptance level of the AP.

Even so, hypothesis 4, stating female type 1 patients to negatively moderate this positive relationship, is rejected because of the positive effect compatibility has on female's intention to use as seen in Table 3. In this case, the mean also gives a hint to the positive relationship between compatibility and intention to use with an average of 6. The rejection of this hypothesis is inconsistent to the existing knowledge as proposed by Ziefle and Schaar (2011), stating that women reject new medical devices because of their lacking knowledge and

interest in technology. It rather complements to Davis's (1995) research mentioning women to have greater concern about their health and thus using more health services. This may go hand in hand with perceived usefulness which was at first said to be more important for men because of their bigger technical knowledge. Since the knowledge level in this research seems to be at least similar for both sexes, one can assume that a lack of information because of the disinterest into technology, does not add to the rejection of a new medical device. Rather, a same knowledge level may be reached by women because of their own health concerns whereas men may gain their information based on their simple interest and curiosity.

Hypothesis 5 is rejected although it seems to be supported at first by Table 3 pointing towards a negative effect between complexity and intention to use. The regression analysis however shows not only a negative but also an insignificant effect of complexity on intention to use for which hypothesis 5 is rejected. Rogers (1983) claims complexity and so the difficulty to use a new medical device as a factor impacting a person's acceptance. Hypothesis 5 which would have supported Rogers' opinion is nonetheless rejected for which one can conclude that the difficulty to understand and use the AP is not an important and significant criterion for diabetes type 1 patients for using the AP.

Hypothesis 6 is rejected too, albeit Table 3 also shows that female type 1 patients negatively moderate the effect of complexity on intention to use rather indicating that women tend to accept the AP when it is perceived as complex. Even though, complexity is the only variable of which the statements are directed into an undesirable direction, dealing with a problematic and rather negative topic compared to usefulness, compatibility, and subjective norm overall, one has to keep in mind that a negative and low response (females mean answer is 2.31 as shown in Table 2) indicates the disagreement of respondents on the statement. Thus, as a statement about complexity is disregarded by patients, it is seen as easy instead of complex. Therefore, hypothesis 6 would be accepted if it was significant, since female type 1 patients would positively moderate the negative effect complexity has on intention to use. Though, since it is insignificant, hypothesis 6 is rejected. Veloo and Masood (2013) realized in their research that ease of use is more important for women than men for which the harder a new device is to understand, the less likely women would be willing to accept it. Comparing their outcomes with this research's results one can say that in the context of an AP, women

perceive it as rather non-complex and thus easy to use, disregarding the fact that this factor is not influential in their decision about using the AP.

Seventh, according to Table 3, normative beliefs is not only significant but also has a weak positive effect on intention to use for which it supports hypothesis 7. Table 9 (see appendix, p. 15) underlines this result by a mean value of 5.62 displaying that patients value normative beliefs is influenced by their referent groups to a slight degree as a score of 5-6 depicts their agreement on the statements about normative beliefs. Also literature refers to normative beliefs being an indicator of a person's acceptance level (Vries et al., 1988; Weerdt et al., 1990) for which this paper's results support the authors outcomes. Translating it into the AP context it indicates, that the higher the degree of expectations of referents are on the patient, the more likely is the patient's acceptance of the AP.

Hypothesis 8 is also maintained, which assumes female type 1 patients to positively moderate the positive relationship of normative beliefs and intention to use, since women's acceptance on using the AP is slightly influenced by the expectations of referent groups. With accepting this hypothesis, a first detailed insight into normative beliefs being influenced by sex and not only subjective norm in general is generated.

The ninth point addresses motivation to comply, the other component of subjective norm, which contrasts normative beliefs as it does not have a positive but rather a negative effect on intention to use with a B of -.044. Furthermore, its relationship is insignificant, for which hypothesis 9 is rejected. It connotes, that even if it would be influential, the higher the degree of a patient to agree on what the referent group expects, the less likely it is for them to accept the AP. Henceforth, it is supposable that in case of rejection of the AP, it would have been because the referent discourages the patient's willingness to use an AP.

Hypothesis 10, stating females having a positive moderating effect on this relationship, also concludes to be wrong since the B is -.033 and insignificant. Hence, no proper statement can be made about whether there is a negative or positive relationship. It only gives indication that it does not matter as a factor influencing patient's decision to accept the AP, whereas men would be more concerned about it than women if it would be significant. Consequently, one can state that if another medical device would be analyzed, a chance would exist that men perceive motivation to comply as an impacting factor.

Table 4. Summarizing Findings

Number	Hypotheses	Evaluation	Direction, Magnitude & Significance
H1	Perceived usefulness has a positive effect on intention to use.	✓	+, weak, significant
H2	Female type 1 patients negatively moderate the positive relationship between perceived usefulness and intention to use.	✗	+, weak, significant
H3	Compatibility has a positive effect on intention to use.	✓	+, good, significant
H4	Female type 1 patients negatively moderate the positive relationship between compatibility and intention to use.	✗	+, good, significant
H5	Complexity has a negative effect on intention to use.	✗	-, weak, insignificant
H6	Female type 1 patients positively moderate the negative relationship of complexity and intention to use.	✗	-, weak, insignificant
H7	Normative beliefs has a positive effect on intention to use.	✓	+, weak, significant
H8	Female type 1 patients positively moderate the positive effect of normative beliefs on intention to use.	✓	+, weak, significant
H9	Motivation to comply has a positive effect on intention to use.	✗	-, weak, insignificant
H10	Female type 1 patients positively moderate the positive effect of normative beliefs on intention to use.	✗	-, weak, insignificant

9

All in all, one can say that there is a difference in sex on the relationship between the three product characteristics and acceptance. Compatibility is the one factor which is most vital for both sexes, albeit males perceive compatibility as more essential than females. This is contrasting to perceived usefulness which is slightly more impacting females' acceptance level than males'. Usefulness is nonetheless weak in its influence capabilities on women and men's decision process, although ranked to be the second major component in the decision making of accepting an AP. Complexity, the third of the tree product characteristics, does not impact sex's intention to use the AP significantly.

An equally weak impact on acceptance next to perceived usefulness is one of the components of subjective norm, namely normative beliefs. It is important for females, but only creates a slight reason to comply. This is also the case for men, who even count more on their social environment than females do. Motivation to comply, the second component of subjective norm's, does not seem to play a role in actually accepting and using the AP Subsequently, sex accounts for slight differences in the acceptance level of the artificial pancreas.

An overview of the outcomes of this research is put into Table 4.

5.2 Implications

The research conducted extends current knowledge by illustrating which factors influence acceptance in general, especially when focusing on the artificial pancreas. Moreover, it depicts whether sex plays a significant role in influencing the relationship between these factors and the acceptance of the AP. As a result, literature can now propose further information of those correlations which may have changed over the last decades since technology develops rapidly and little research has been done in the past decades.

Practically, this research can be used by Inreda Diabetic B.V. as a rough guideline on what they have to be aware of and in contrast which factors are not worth the effort. Inreda Diabetic B.V. should take people's possible perception of its product's usefulness into account as well as its compatibility with patient's current lifestyle and values which may differ by country. Moreover, the company should bear in mind that referent groups are consulted and can by chance impact the patient's feeling of needing and wanting an AP. All those little details should be used by Inreda Diabetic B.V. to market their product foresightedly and advantageously.

5.3 Limitations & Further Research

Despite the contributions, this paper offers to existing knowledge, it is limited by several factors.

Firstly, the results concluded within this research are not generalizable to other countries, industries and businesses because of the specific medical business it is made for and the tailor-made survey with explicit variables matching the context of Inreda Diabetic B.V.

Secondly, all participants in the survey were given by Inreda Diabetic B.V. They chose to attend Inreda Diabetic B.V.'s research and being volunteers for clinical trials by themselves. Hence, they already heard of the artificial pancreas before and were willing to accept it to some degree for which the research is biased and results may not represent the overall behavior of diabetes type 1 patients. Using randomly assigned participants with diabetes type 1 could have led to other results.

Moreover, this research was restricted in its duration and the maximum number of pages to present all necessary information. If sample attendees would have had more time to fill out the

questionnaire, it could have led to a differing outcome. Additionally, data was based on the grounds of found information. Nonetheless, not all knowledge proposed in existing literature was enabled to be used and applied for this research. Taking other models or possible variables into account may have changed the results.

Although these points limit this research, a first step was made to clarify whether sex impacts the acceptance of the artificial pancreas. It is obviously a pilot project but offers the rough fundaments for further research.

Future studies could pick up on Roger's two variables of the diffusion model which were left out in this research because of their inapplicability at this moment of time. So, observability and trialability may give a greater insight on the acceptance degree of sex on the artificial pancreas.

Next to that, personal innovativeness as proposed and defined by Argawal and Prasad (1997) as "the willingness of an individual to try out an innovation" (p. 18) is left out in this paper but may be worth identifying as well.

In addition, a bigger sample size, a longer time period, or the inclusion of other nationalities may either support or reject the outcomes of this research paper. Similarly, factors such as age and a division into age groups may indicate differences in the decision making by sex for which elderly may accept new technical devices such as the AP, less likely than their younger generation. Also cultural effects may play a role in the acceptance of the AP as discrimination on women may decrease their self-confidence or knowledge and education level, affecting their likeliness to use the AP. The economical stance of a country may also be interesting to analyze as it may impact the degree of diabetes awareness, the possible diabetes treatment types patients can choose from and the values and experiences patients have and have made with them.

6. CONCLUSION

Summing up, to analyze whether sex is a moderating factor influencing the potential relationship of perceived usefulness, compatibility, complexity, normative beliefs and motivation to comply on acceptance, operationalized by intention to use, a questionnaire was created asking 601 diabetes type 1 patients to respond on their likeliness to accept an artificial pancreas as proposed by Inreda Diabetic B.V. The outcome states that perceived usefulness as well as normative beliefs slightly affect a person's decision. For both types of sex, compatibility is the most impacting construct, while complexity and motivation to comply do not play a role. Unlike expected, women perceive usefulness as more important than men do, for which men find normative beliefs more influencing than their counterpart.

7. ACKNOWLEDGMENTS

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9. APPENDIX
9.1 Tables of Descriptive Statistics

Table5. Distribution of Sex by Place of Residence and Education

	Sex				
	Female			Male	
	Frequency	Percentage		Frequency	Percentage
	N = 220	55,7%		N = 175	44,3%
Place of residence					
Netherland	214	97,3%		165	94,3%
Belgium	3	1,4%		7	4,0%
Germany	2	0,9%		1	0,6%
Others	1	0,5%		2	1,1%
Total	220	100%		175	100%
Education					
Primary education (class 1-8)	12	5,5%		11	6,3%
Secondary education (High School, HAVO, VWO)	56	25,5%		33	18,9%
Secondary vocational education (MBO)	69	31,4%		39	22,3%
Higher Vocational Education (HBO)	62	28,2%		69	30,4%
University education (WO) or higher	21	9,5%		23	13,1%
Total	220	100%		175	100%

*Valid N = 395

Table 6. Distribution of sex on Age and Diagnosi

		Sex	
		Female	Male
		N = 220	N = 175
Age			
	Min.	4	3
	Max.	74	85
	Mean	37.39	41.62
	Sd.	15.75	15.94
Diagnosing age			
	Min.	1	1
	Max.	64	69
	Mean	20.17	22.37
	Sd.	13.83	13.21

*Valid N = 395

9.2 Tables of the Factor Analysis

Table 7. Factor Analysis on Product Characteristics

	Component		
	1	2	3
Perceived Usefulness			
VN_00_VN_01	.908		
VN_00_VN_02	.877		
VN_00_VN_03	.856		
VN_00_VN_04	.792		
VN_00_VN_05	.775		
VN_00_VN_06	.407	-.147	.366
Compatibility			
COM_00_COM_01			.939
COM_00_COM_02			.878
COM_00_COM_03	.126		.790
Complexity			
ING_00_ING_01		.903	
ING_00_ING_02		.879	
ING_00_ING_03		.806	
ING_00_ING_04		.779	

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Table 8. Factor Analysis on Subjective Norm

	Component	
	1	2
Normative Beliefs		
SI_1	.848	
SI_3	.891	
SI_5	.703	-.222
SI_7	.775	-.135
SI_9	.751	-.113
SI_11	.896	.148
SI_13	.914	.130
SI_15	.680	-.106
SI_17	.733	-.105
Motivaiton to Comply		
SI_2		-.810
SI_4		-.933
SI_6	.180	-.769
SI_8		-.937
SI_10		-.904
SI_12	.305	-.372
SI_14	.438	-.351
SI_16		-.873
SI_18		-.834

Extraction Method: Principal Component

Rotation Method: Oblimin with Kaiser

a. Rotation converged in 6 iterations.

9.3 General Info on Variables

Table 9. Minimum, Maximun, Mean & Std. Deviation of Independent & Dependent Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Independent variables					
Perceived Usefulness	395	1.00	7.00	5.9909	.89097
Compatibility	395	1.00	7.00	6.2135	.83746
Complexity	395	1.00	7.00	2.1373	1.04239
Normative beliefs	395	1.67	8.00	5.6183	1.36385
Motivation to comply	395	1.00	8.00	4.5844	1.58228
Dependent variable					
Intention to use	395	2.00	7.00	6.4987	.83126
Valid N	395				

9.4 Overview Table of Items of the Questionnaire

Table 10. Each Construct and its adapted items, Chronbach's Alpha and Exclusion

Variables	Adapted Items	Based on	Original Cronbach's Alpha	Newly Calculated Cronbach's Alpha	Excluded by the Factor Analysis
Perceived Usefulness	I expect that using the artificial pancreas would enable me to accomplish tasks more quickly. I expect that using the artificial pancreas improves my performance in daily life. I expect that using the artificial pancreas in my daily life increases my productivity. I expect that using the artificial pancreas enhances my effectiveness in daily life. I expect that using the artificial pancreas would make it easier for me to accomplish my daily activities. I expect that the artificial pancreas will be useful in my daily life.	Godoe & Johansen (2012); Davis (1989)	0.87	0.89	 X
Compatibility	I expect that using the artificial pancreas is compatible with all aspects of my life, including work as well as free time activities. I think that using the artificial pancreas fits well with the way I like to live and work. I expect that using the artificial pancreas fits into the way I perform my daily duties.	Adapted from Venkatesh et al. (2003) based on Moore and Benbasat (1991)	0.7	0.88	
Complexity	I expect that using the artificial pancreas will take too much time from my normal duties. I expect that working with the artificial pancreas is so complicated, it is difficult to understand what is going on. I expect that using the artificial pancreas involves too much time doing mechanical operations. I expect that it takes too long to learn how to use an artificial pancreas to make it worth the effort.	Adapted from Venkatesh et al. (2003) based on Thompson et al. (1991)	0.73	0.86	
Normative beliefs	My partner would think that I should use the artificial pancreas. My family would think that I should use the artificial pancreas. My children would think that I should use the artificial pancreas. My friends would think that I should use the artificial pancreas. My coworkers would think that I should use the artificial pancreas. My physician would think that I should use the artificial pancreas. My diabetes nurse would think that I should use the artificial pancreas. Patient associations would think that I should use the artificial pancreas. Other diabetes patients would think that I should use the artificial pancreas.	Original items and scaling based on Taylor & Todd (1995a); adapted to reference groups of Weerdt et al. (1990)	n/a	0.94	
Motivation to comply	Generally speaking, I want to do what my partner thinks I should do. Generally speaking, I want to do what my family thinks I should do. Generally speaking, I want to do what my children think I should do. Generally speaking, I want to do what my friends think I should do. Generally speaking, I want to do what my coworkers think I should do. Generally speaking, I want to do what my physician thinks I should do. Generally speaking, I want to do what my diabetes nurse thinks I should do. Generally speaking, I want to do what patient associations think I should do. Generally speaking, I want to do what other diabetes patients think I should do.	Original items and scaling based on Taylor & Todd (1995a); adapted to reference groups of Weerdt et al. (1990)	n/a	0.95	 X X
Intention to use	Assuming I have access to an artificial pancreas, I intend to use it. Assuming I have access to the system, I predict that I would use it	Venkatesh & Davis (2000)	0.82	0.87	

9.5 Syntax to Gain SPSS Output

*exclusion of diaebetes type 2 patients

```
DATASET ACTIVATE DataSet2.
USE ALL.
COMPUTE filter_$=(DIATYP = 1).
VARIABLE LABELS filter_$ 'DIATYP = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
```

*recoding SI - leaving out 8 as 'other' choice in survey

```
RECODE SI_00_SI_01 SI_00_SI_02 SI_00_SI_03 SI_00_SI_04 SI_00_SI_05 SI_00_SI_06 SI_00_SI_07
   SI_00_SI_08 SI_00_SI_09 SI_00_SI_10 SI_00_SI_11 SI_00_SI_12 SI_00_SI_13 SI_00_SI_14 SI_00_SI_15
   SI_00_SI_16 SI_00_SI_17 SI_00_SI_18 (8=SYSMIS) (1=1) (2=2) (3=3) (4=4) (5=5) (6=6) (7=7) INTO SI_1
   SI_2 SI_3 SI_4 SI_5 SI_6 SI_7 SI_8 SI_9 SI_10 SI_11 SI_12 SI_13 SI_14 SI_15 SI_16 SI_17 SI_18.
VARIABLE LABELS  SI_1 'w/out 8' /SI_2 'w/out 8' /SI_3 'w/out 8' /SI_4 'w/out 8' /SI_5 'w/out 8'
   /SI_6 'w/out 8' /SI_7 'w/out 8' /SI_8 'w/out 8' /SI_9 'w/out 8' /SI_10 'w/out 8' /SI_11 'w/out 8'
   /SI_12 'w/out 8' /SI_13 'w/out 8' /SI_14 'w/out 8' /SI_15 'w/out 8' /SI_16 'w/out 8' /SI_17
   'w/out 8' /SI_18 'w/out 8'.
EXECUTE.
```

*factor analysis of complexity, compatibility and perceived usefulness

```
FACTOR
 /VARIABLES   VN_00_VN_01   VN_00_VN_02   VN_00_VN_03   VN_00_VN_04   VN_00_VN_05   VN_00_VN_06
COM_00_COM_01
   COM_00_COM_02 COM_00_COM_03 ING_00_ING_01 ING_00_ING_02 ING_00_ING_03 ING_00_ING_04
 /MISSING LISTWISE
 /ANALYSIS   VN_00_VN_01   VN_00_VN_02   VN_00_VN_03   VN_00_VN_04   VN_00_VN_05   VN_00_VN_06
COM_00_COM_01
   COM_00_COM_02 COM_00_COM_03 ING_00_ING_01 ING_00_ING_02 ING_00_ING_03 ING_00_ING_04
 /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.
```

*factor analysis normative beliefs & motivation to comply

```
FACTOR
 /VARIABLES SI_1 SI_2 SI_3 SI_4 SI_5 SI_6 SI_7 SI_8 SI_9 SI_10 SI_11 SI_12 SI_13 SI_14 SI_15 SI_16
   SI_17 SI_18
 /MISSING LISTWISE
 /ANALYSIS SI_1 SI_2 SI_3 SI_4 SI_5 SI_6 SI_7 SI_8 SI_9 SI_10 SI_11 SI_12 SI_13 SI_14 SI_15 SI_16
   SI_17 SI_18
 /PRINT UNIVARIATE INITIAL CORRELATION SIG DET KMO INV REPR AIC EXTRACTION ROTATION
 /FORMAT SORT BLANK(.10)
 /PLOT EIGEN ROTATION
 /CRITERIA FACTORS(2) ITERATE(25)
 /EXTRACTION PC
 /CRITERIA ITERATE(25) DELTA(0)
 /ROTATION OBLIMIN
 /METHOD=CORRELATION.
```

*cronbach's alpha of perceived usefulness VN_04 excluded by factor analysis

```
RELIABILITY
 /VARIABLES=VN_00_VN_01 VN_00_VN_02 VN_00_VN_03 VN_00_VN_05 VN_00_VN_06
 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA
 /STATISTICS=CORR
 /SUMMARY=TOTAL.
```

*cronbach's alpha of compatibility

```
RELIABILITY
 /VARIABLES=COM_00_COM_01 COM_00_COM_02 COM_00_COM_03
 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA
 /STATISTICS=CORR
 /SUMMARY=TOTAL.
```

* cronbach's alpha of complexity

```
RELIABILITY
 /VARIABLES=ING_00_ING_01 ING_00_ING_02 ING_00_ING_03 ING_00_ING_04
 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA
 /STATISTICS=CORR
 /SUMMARY=TOTAL.
```

* cronbach's alpha of normative beliefs

```
RELIABILITY
 /VARIABLES=SI_1 SI_3 SI_5 SI_7 SI_9 SI_11 SI_13 SI_15 SI_17
 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA
 /STATISTICS=CORR
 /SUMMARY=TOTAL.
```

*cronbach's alpha of motivation to comply excluded: SI_12 and SI_14

```
RELIABILITY
 /VARIABLES=SI_2 SI_4 SI_6 SI_8 SI_10 SI_16 SI_18
 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA
 /STATISTICS=CORR
 /SUMMARY=TOTAL.
```

*compute variable: perceived usefulness

```
COMPUTE Perceived_Usefulness=(VN_00_VN_01 + VN_00_VN_02 + VN_00_VN_03 + VN_00_VN_05 +
  VN_00_VN_06)/5.
VARIABLE LABELS  Perceived_Usefulness 'Perceived Usefulness'.
EXECUTE.
```

*compute variable: compatibility

```
COMPUTE Compatibility=(COM_00_COM_01 + COM_00_COM_02 + COM_00_COM_03)/3.
VARIABLE LABELS  Compatibility 'Compatibility'.
EXECUTE.
```

*compute variable: complexity

```
COMPUTE Complexity=(ING_00_ING_01 + ING_00_ING_02 + ING_00_ING_03 + ING_00_ING_04)/4 .
VARIABLE LABELS  Complexity 'Complexity'.
EXECUTE.
```

*compute variable: intention to use

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

*compute variable: normative beliefs

```
COMPUTE Normative_beliefs=(SI_00_SI_01 + SI_00_SI_03 + SI_00_SI_05 + SI_00_SI_07 + SI_00_SI_09 +
  SI_00_SI_11 + SI_00_SI_13 + SI_00_SI_15 + SI_00_SI_17)/9.
VARIABLE LABELS  Normative_beliefs 'Normative beliefs'.
EXECUTE.
```

*compute variable: motivation to comply

```
COMPUTE Motivation_to_comply=(SI_00_SI_02 + SI_00_SI_04 + SI_00_SI_06 + SI_00_SI_08 + SI_00_SI_10 +
    SI_00_SI_16 + SI_00_SI_18)/7.
VARIABLE LABELS  Motivation_to_comply 'Motivation to comply'.
EXECUTE.
```

*regression analysis – intention to use, perceived usefulness, compatibility, complexity, normative beliefs, motivation to comply

```
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 Perceived_Usefulness Compatibility Complexity Normative_beliefs Motivation_to_comply
  /RESIDUALS DURBIN
  /CASEWISE PLOT(ZRESID) OUTLIERS(3)
  /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDRESID SDBETA SDFIT.
```

*split files for comparing groups

```
SORT CASES  BY GEN.
SPLIT FILE LAYERED BY GEN.
```

*regression by gender

```
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 Perceived_Usefulness Compatibility Complexity Normative_beliefs Motivation_to_comply
  /RESIDUALS DURBIN
  /CASEWISE PLOT(ZRESID) OUTLIERS(3)
  /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDRESID SDBETA SDFIT.
```

*exclusion of age and diagnosing age which exceeds 100 - excluded are rows: 79, 396 and 360 because their numbers are invalid

```
USE ALL.
COMPUTE filter_$=(AGE < 100  &  DIAGAGE < 100).
VARIABLE LABELS filter_$ 'AGE < 100  &  DIAGAGE < 100 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
```

*turning off splitting file for gaining general overview in following descriptive analysis

```
SPLIT FILE OFF.
```

*sexes descriptive statistics via frequencies

```
FREQUENCIES VARIABLES=GEN
 /NTILES=4
 /ORDER=ANALYSIS.
```

*descriptive statistics of age and diagnosing age

```
 DESCRIPTIVES VARIABLES=AGE DIAGAGE
 /STATISTICS=MEAN STDDEV MIN MAX.
```

*descriptive statistics of nationality and education

```
DESCRIPTIVES VARIABLES=NAT EDU
 /STATISTICS=MEAN STDDEV MIN MAX
 /SORT=NAME (A).
```

*correlation between all items of perceived usefulness, compatibility, complexity, normative beliefs, motivation to comply and intention to use

*exclusion of VN04, SI12 and SI14 (as based on factor analysis)

```
DATASET ACTIVATE DataSet1.
CORRELATIONS
 /VARIABLES=VN_00_VN_01 VN_00_VN_02 VN_00_VN_03 VN_00_VN_05 VN_00_VN_06 COM_00_COM_01
   COM_00_COM_02   COM_00_COM_03   ING_00_ING_01   ING_00_ING_02   ING_00_ING_03   ING_00_ING_04
ITU_00_ITU_01
   ITU_00_ITU_02 SI_00_SI_01 SI_00_SI_02 SI_00_SI_03 SI_00_SI_04 SI_00_SI_05 SI_00_SI_06 SI_00_SI_07
   SI_00_SI_08 SI_00_SI_09 SI_00_SI_10 SI_00_SI_11 SI_00_SI_13 SI_00_SI_15 SI_00_SI_16 SI_00_SI_17
   SI_00_SI_18
 /PRINT=ONETAIL NOSIG
 /MISSING=PAIRWISE.
NONPAR CORR
 /VARIABLES=VN_00_VN_01 VN_00_VN_02 VN_00_VN_03 VN_00_VN_05 VN_00_VN_06 COM_00_COM_01
   COM_00_COM_02   COM_00_COM_03   ING_00_ING_01   ING_00_ING_02   ING_00_ING_03   ING_00_ING_04
ITU_00_ITU_01
   ITU_00_ITU_02 SI_00_SI_01 SI_00_SI_02 SI_00_SI_03 SI_00_SI_04 SI_00_SI_05 SI_00_SI_06 SI_00_SI_07
   SI_00_SI_08 SI_00_SI_09 SI_00_SI_10 SI_00_SI_11 SI_00_SI_13 SI_00_SI_15 SI_00_SI_16 SI_00_SI_17
   SI_00_SI_18
 /PRINT=SPEARMAN ONETAIL NOSIG
 /MISSING=PAIRWISE.
```

*descriptive statistics on education

```
FREQUENCIES VARIABLES=EDU
 /STATISTICS=STDDEV MEAN MEDIAN
 /ORDER=ANALYSIS.
```

*descriptive statistics on nationality

```
FREQUENCIES VARIABLES=NAT
 /STATISTICS=STDDEV MEAN MEDIAN
 /ORDER=ANALYSIS.
```

* cronbach's alpha intention to use

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

*exclusion of type 2 patients, wrong age input and wrong diagnosing age input

```
USE ALL.
COMPUTE filter_$=(AGE < 100 & DIAGAGE < 100 & DIATYP = 1).
VARIABLE LABELS filter_$ 'AGE < 100 & DIAGAGE < 100 & DIATYP = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
```

*split by sex

```
SORT CASES  BY GEN.
SPLIT FILE LAYERED BY GEN.
```

*descriptive statistics of sex, education, place of residence

```
FREQUENCIES VARIABLES=GEN EDU NAT
 /ORDER=ANALYSIS.
```

*descriptive statistics of age and diagnosing age

```
DESCRIPTIVES VARIABLES=AGE DIAGAGE
 /STATISTICS=MEAN STDDEV MIN MAX.
```

*correlation between all items

```
CORRELATIONS
 /VARIABLES=VN_00_VN_01 VN_00_VN_02 VN_00_VN_03 SI_00_SI_15 SI_00_SI_16 SI_00_SI_17 SI_00_SI_18
   VN_00_VN_05   VN_00_VN_06   COM_00_COM_01   COM_00_COM_02   COM_00_COM_03   ING_00_ING_01
ING_00_ING_02
   ING_00_ING_03 ING_00_ING_04 SI_00_SI_01 SI_00_SI_02 SI_00_SI_03 SI_00_SI_04 SI_00_SI_05 SI_00_SI_06
   SI_00_SI_07 SI_00_SI_08 SI_00_SI_09 SI_00_SI_10 SI_00_SI_11 SI_00_SI_13 ITU_00_ITU_01 ITU_00_ITU_02
 /PRINT=ONETAIL NOSIG
 /MISSING=PAIRWISE.
```

*correlation between all variables

```
CORRELATIONS
 /VARIABLES=Perceived_Usefulness Compatibility Complexity Intention_to_use Normative_beliefs
  Motivation_to_comply
 /PRINT=ONETAIL NOSIG
 /STATISTICS DESCRIPTIVES
 /MISSING=PAIRWISE.
```

*regression analysis all variables

```
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 Perceived_Usefulness Compatibility Complexity Normative_beliefs Motivation_to_comply
 /RESIDUALS DURBIN
 /CASEWISE PLOT(ZRESID) OUTLIERS(3)
 /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDBETA SDFIT.

EXAMINE VARIABLES=Intention_to_use BY Perceived_Usefulness Compatibility Complexity
   Normative_beliefs Motivation_to_comply
 /PLOT BOXPLOT
 /COMPARE GROUPS
 /STATISTICS DESCRIPTIVES
 /CINTERVAL 95
 /MISSING LISTWISE
 /NOTOTAL.
```

*turn off split modus by sex

```
SPLIT FILE OFF.
```

*no split btw sex - answering hypotheses with no moderating factor

```
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 Perceived_Usefulness Compatibility Complexity Normative_beliefs Motivation_to_comply
 /RESIDUALS DURBIN
 /CASEWISE PLOT(ZRESID) OUTLIERS(3)
 /SAVE PRED ZPRED ADJPRED MAHAL COOK LEVER ZRESID DRESID SDBETA SDFIT.
```

*exlusion of age <100, diagnosing age,100 and type 2 diabetes patients

```
USE ALL.
COMPUTE filter_$=(AGE < 100 & DIAGAGE < 100 & DIATYP = 1).
VARIABLE LABELS filter_$ 'AGE < 100 & DIAGAGE < 100 & DIATYP = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
```

*descriptive statistics of independent and dependent variables

```
DESCRIPTIVES VARIABLES=Perceived_Usefulness Compatibility Complexity Normative_beliefs
    Motivation_to_comply Intention_to_use
  /STATISTICS=MEAN STDDEV MIN MAX.
```