Acceptance of the Artificial Pancreas: Comparing the Effect of Technology Readiness, Product Characteristics and Social Influence between Invited and Self-Selected Respondents

H. Blauw[1,2], T. Oukes[3], A.C. van Bon[4], J. H. DeVries[1] and A.M. von Raesfeld[3], on behalf of the PCDIAB consortium

[1]Academic Medical Centre at the University of Amsterdam, Endocrinology, Amsterdam, the Netherlands. [2]Inreda Diabetic BV, Research & Development, Goor, the Netherlands. [3]University of Twente, Center for Entrepreneurship, Strategy and Innovation Management (NIKOS), Enschede, the Netherlands. [4]Rijnstate Hospital, Internal Medicine, Arnhem, the Netherlands

BACKGROUND

- Human factors that may affect acceptance of artificial pancreas (AP) systems have been investigated in small samples of highly motivated, self-selected persons with type 1 diabetes (T1DM) with a focus on product characteristics.
- A robust and standardized questionnaire to investigate the effect of human factors on AP acceptance is lacking.

Aims
- To investigate the impact of technology readiness, product characteristics and social influence on AP acceptance in a larger sample, including both self-selected and invited respondents with T1DM.
- To develop a reliable and valid questionnaire.

METHODS

Subjects
- Self-selected group: convenience sample of 601 persons with T1DM from >3000 persons who had indicated their wish to participate in scientific research into the AP on the website of Inreda Diabetic (Goor, the Netherlands).
- Invited group: 270 persons with T1DM listed using insulin pump therapy at the Rijnstate Hospital (Arnhem, the Netherlands).

Survey
- Intention to use the AP was chosen as measure of AP acceptance.
- The variables (Table 1) were grounded in well-established theories: the Technology Readiness Index [1], the Technology Acceptance Model [2], Innovation Diffusion Theory [3] and Theory of Planned Behavior [4].
- Questions were answered on a 7-point Likert scale (1 to 7).
- Scores per variable were calculated as mean of the questions.
- Information about demographics, current diabetes treatment, and (the) satisfaction with the current treatment (Diabetes Treatment Satisfaction Questionnaire [5]) was collected.
- The introduction to the questionnaire described and showed the AP system of Inreda Diabetic [6].

Measured variables with the number of questions and Cronbach's α

Table 1	Variable	Nr. of questions	Cronbach's α
Technology readiness [1]	Optimism	6	.866
	Innovativeness	5	.886
	Discomfort	5	.792
	Insecurity	7	.814
Product characteristics [7]	Usefulness	6	.906
	Compatibility	3	.893
	Complexity	4	.854
Social influence [7]	Social influence	2	.819
Acceptance [2]	Intention to use	2	.895

RESULTS

Baseline characteristics
- The survey was completed by 425 self-selected persons (response rate: 69.7%) and 109 invited persons (response rate: 42.2%).
- Compared to the self-selected respondents, the invited respondents were older, had diabetes for a longer period, were more satisfied with their treatment, perceived less frequently hyperglycemia and more often used insulin pump therapy.

Comparison of the variables between self-selected and invited respondents

Table 2	Self-selected respondents	Invited respondents	p-value
Optimism	5.90 ± 0.86	5.61 ± 1.00	.007
Innovativeness	4.99 ± 1.24	4.66 ± 1.40	.025
Discomfort	2.97 ± 1.21	2.86 ± 1.16	.397
Insecurity	3.13 ± 0.97	3.18 ± 0.89	.671
Perceived usefulness	6.06 ± 0.84	5.66 ± 1.04	<.001
Compatibility	6.21 ± 0.85	5.88 ± 1.14	.006
Complexity	2.13 ± 1.04	2.31 ± 1.06	.129
Social influence	4.95 ± 1.66	4.66 ± 1.65	.105
Intention to use	6.49 ± 0.82	6.10 ± 0.99	<.001

Data are mean ± SD. Independent t-tests, two-tailed.

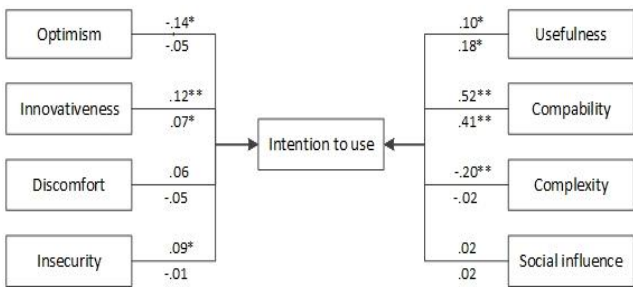**Relationship between the variables and the intention to use the AP**

Figure 1. Multiple regression with intention to use as dependent variable for invited (above the line) and self-selected (below the line) respondents separately. Data represent standardized β, *p < .05, **p < .001.

CONCLUSIONS

- Product characteristics have a larger impact on AP acceptance than technology readiness, while social influence does not seem to impact AP acceptance.
- As the (strength of) influencing factors differ between self-selected and invited persons, researchers and product developers should be cautious when relying on self-selected persons with T1DM in the design, development, and testing of AP systems.
- A valid and reliable questionnaire to measure AP acceptance and potentially explanatory factors was developed.

REFERENCES

[1] Parasuraman A. Technology Readiness Index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *Journal of service research.* 2000;2(4):307-320.
[2] Venkatesh V, Davis FD. A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science.* 2000;46(2):186-204.
[3] Moore GC, Benbasat I. Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research.* 1991;2(3):192-222.
[4] Ajzen I. The theory of planned behavior. *Organizational behavior and human decision processes.* 1991;50(2):179-211.
[5] Bradley C. The diabetes treatment satisfaction questionnaire: DTSQ. *Handbook of Psychology and Diabetes: a guide to psychological measurement in diabetes research and practice.* 1994:111-132.
[6] Blauw H, van Bon AC, Koops R, DeVries JH. Performance and safety of an integrated bihormonal artificial pancreas for fully automated glucose control at home. *Diabetes, Obesity and Metabolism.* 2016;18(7):671-677.
[7] Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. *MIS Quarterly.* 2003;27(3):425-478.

am Clinical diabetology

Correspondence: Helga Blauw, h.blauw@amc.uva.nl