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Computer-Aided Learning in Insulin Pump Training

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Abstract

This technical report concerns a novel, computer-aided learning tool for patients with diabetes. The goal of the tool is to make training in the use of an insulin pump "painless," practical, effective, and educationally rewarding. This learning tool (or application) is unique because it

- uses a virtual pump to facilitate learning and allow the patient to practice pump operation,
- presents training tasks in a standardized format, and
- provides corrective feedback to help patients better understand and manage their diabetes.

The application's acceptability was surveyed by 126 health care professionals who are experienced in diabetes education and certified in pump training. Results suggest that use of Insulet's OmniPod® Interactive Training is associated with increased training efficiency and promotes a positive attitude toward insulin pump therapy.

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Introduction

Advances in insulin infusion technology have provided new therapeutic options for patients with type 1 diabetes. Along with advances in insulin pumps come new challenges in educating patients about the use of these devices for maximum benefit and safety. Insulin pump training involves learning about specific brand features to master pump operation and acquiring advanced diabetes self-management skills to successfully manage diabetes with pump therapy.[1,2] Beginning insulin pump therapy requires a significant time commitment from the patient and medical practitioner for education and training activities. Historically, this process may take from two to six months in some complicated cases.[2] Intensive training requirements contribute to the cost of therapy and often become a barrier to the efficient introduction of new technology in diabetes care.

Traditionally, pump manufacturers have been the primary sources of information about their devices via marketing brochures and user manuals and have provided general diabetes management information as well. However, none of these sources is based on principles derived from educational curriculum development and learning theories, nor do they present opportunities for interactive practice.

In this technical report, we describe a novel, interactive, computer-aided application called Insulet's OmniPod® Interactive Training (training CD), and we present a survey study of its unique features and benefits. In addition to its unique pump simulation component, the application organizes basic and advanced self-management concepts, standardizes the delivery of training tasks, and provides users with corrective feedback as they learn pump operation.

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Abbreviations: (CAL) computer-aided learning, (PDM) Personal Diabetes Manager, (training CD) OmniPod® Interactive Training application

Keywords: computer-aided learning, insulin pump training

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Methods

To develop the training CD, we relied on principles of interactive computer-aided learning (CAL). Computer-aided learning is established as a cost-effective adjunct to conventional education; specifically, CAL can contribute to the efficiency of training, reduce training time and associated costs, and eliminate educational barriers.[3–5]

Product Design

A computer-based interactive training environment was designed to guide patients through the key areas of diabetes management and the use of the OmniPod Insulin Management System (OmniPod System, Insulet Corporation, Bedford, MA; **Figure 1**). Building on Gagne's theory, the training framework included three essential ingredients of teaching:[6,7]

1. Knowledge presentation and skill demonstration
2. Practice opportunity with feedback
3. User guidance

Specifically, users were guided in their interaction with the virtual OmniPod System, OmniPod System features were demonstrated via simulation of insulin management tasks, and corrective feedback was provided (if needed) at each step in skill learning. In addition, the training

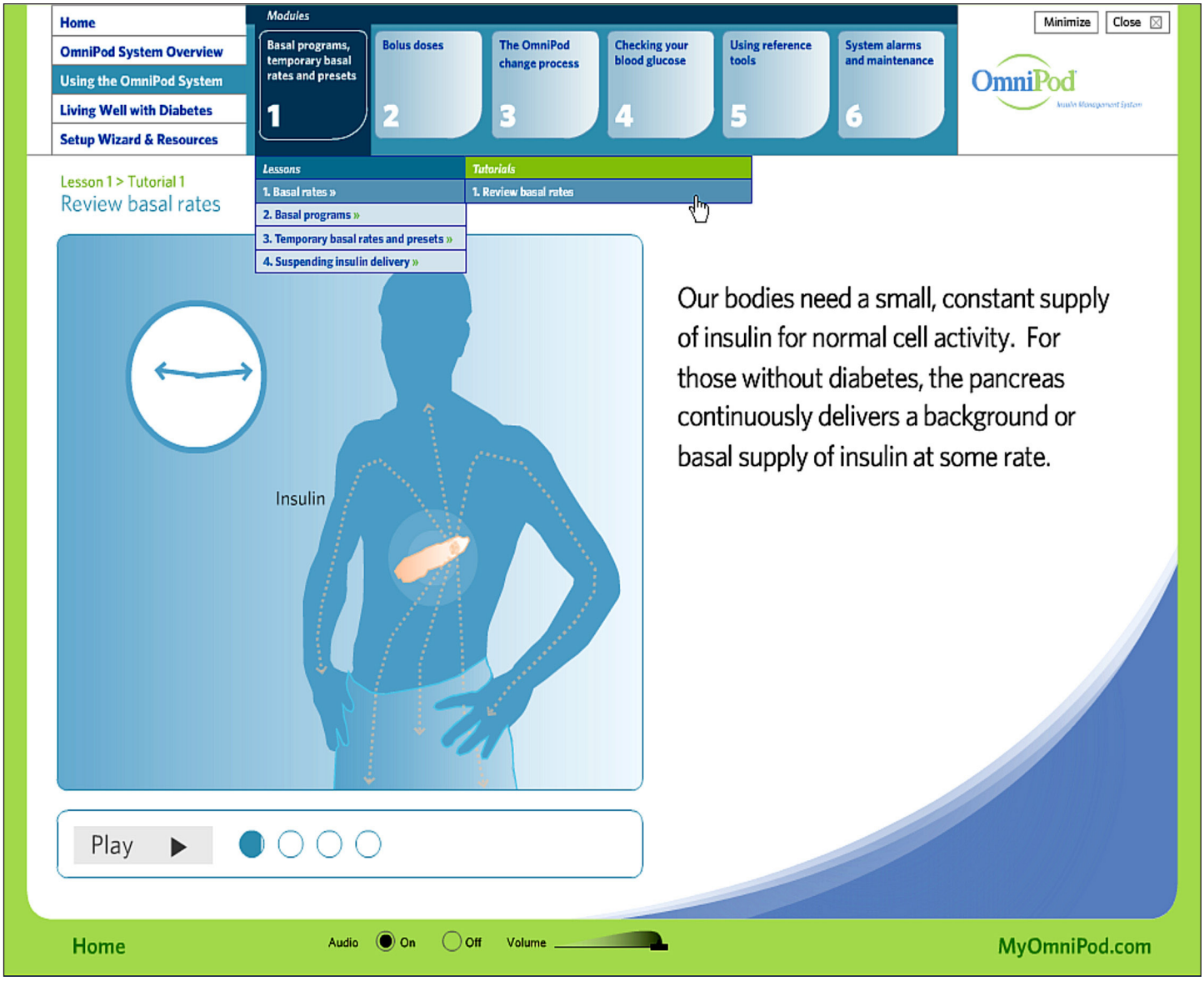

Figure 1. The user interface of the OmniPod training CD.

material was appropriately structured for new and advanced pump users in standardized learning tracks.

In summary, the training CD features the following unique elements:

- advanced self-management concepts (such as basal rates and programs, bolus doses and presets, and insulin correction and adjustment) are presented in brief reviews alongside the OmniPod features;
- multimedia tutorials provide step-by-step illustrations on how to use the OmniPod System features;
- split-screen presentations reinforce step-by-step instructions with guidance on the virtual Personal Diabetes Manager (PDM) screen;
- "Try It Now" interactive tutorials allow patients to practice diabetes management scenarios;
- a "Living Well with Diabetes" section presents basic information about nutrition and exercise, avoiding low and high blood glucose levels, and handling special occasions such as illness or travel, and
- a safe environment for patients to practice their OmniPod skills in a standardized format.

Survey Study

Measures

After reviewing results from a pilot online survey, we designed a 59-item questionnaire that covered

- participants' experience in diabetes education and pump training;
- their familiarity with the training CD, Web-based training, or both;
- satisfaction with content;
- efficacy of the educational material; and
- impact of the training CD on the training process.

Participants

Instructions for the online survey were sent via email to 1381 health care professionals involved with patients' pump education and registered with Insulet Corporation. Ten days were given to respond to the survey, with no incentives and no follow-up. From the pool of potential participants, 126 completed the survey. In addition, 36 participants who responded to fewer than five survey questions were eliminated from the final analysis.

Statistical Methods

Simple frequency analysis was used to examine respondents' experience and expertise in training with various brands of pumps. Group *t*-tests were used to compare continuous variables.

Results

Characteristics of the 126 respondents are shown in **Table 1**. Ninety-six percent are involved with training patients to use their pumps. In addition, 94% are certified on the OmniPod brand, 84% on the Medtronic MiniMed®, 72% on Animas®, 39% on Accu-Chek®, and 6% on Nipro®. Over the three-month period, the respondents trained 1244 patients.

Both those who already use the training CD and non-users leaned toward agreement (on a scale of –2 = strongly disagree to +2 = strongly agree; mean ratings = 0.7, standard deviation = 1.1) that the OmniPod System features lead to increased recommendation or utilization of pump therapy (**Table 2**). Notably, those already using the training CD more strongly agreed that ease of training, ease of use, and ease of learning increase pump therapy utilization. Training CD users' elevated agreement about the impact of the OmniPod System design, probability of patient compliance, and simplification of insulin pump therapy did not statistically differ from that of the training CD non-users. The training CD users were satisfied with overall content, quality, organization, and ease of use. Regarding helpfulness of specific application features, the majority of respondents rated each feature as "helpful" or "very helpful." Overall, 80% of pump trainers reported their approval of the teaching methods used in the training CD (**Table 3**).

Regarding efficiency of training, 81% of the trainers confirmed that their pump training is more efficient when a patient views the training CD before beginning training with them (data not tabulated). Moreover, the pump trainers were unanimous in recognizing the value and appropriateness of the training CD for patients new to insulin pump therapy. They all agreed that the training CD helped patients new to insulin pump therapy gain a positive attitude toward it.

Limitations

This study included a response rate lower than typical email-requested participation.[8] Respondents in this study were the pump trainers, not the patients. Although data

provided by trainers reflect their experience with other devices and training programs—something that is not available from patient surveys—future studies will need to focus on patient perspective and outcomes. Finally, it is not clear how many medical devices would benefit from this educational approach. However, the device in question was particularly well suited to computer-based training.

Table 1.
Characteristics of OmniPod Trainers

	All Trainers (n = 126)		Training CD			
			Non-users (n = 79)		Users (n = 47)	
Amount of job involved in training	n	%	n	%	n	%[a]
Rarely involved	5	4.0	4	5.1	1	2.1
Sometimes involved	24	19.0	16	20.3	8	17.0
Regularly involved	43	34.1	32	40.5	11	23.4
One of primary responsibilities	50	39.7	26	32.9	24	51.1
Lead responsibility	4	3.2	1	1.3	3	6.4
Other device certifications (categories may overlap)	n	%	n	%	n	%
Accu-Chek	49	38.9	28	35.4	21	44.7
Animas	91	72.2	57	72.2	34	72.3
Medtronic MiniMed	106	84.1	67	84.8	39	83.0
Nipro	7	5.6	3	3.8	4	8.5
OmniPod	119	94.4	72	91.1	47	100
Time needed to train on the OmniPod System	n	%	n	%	n	%
1 h	11	8.7	6	7.6	5	10.6
1.5 h	29	23.0	14	17.7	15	31.9
2 h	33	26.2	24	30.4	9	19.1
2.5 h	18	14.3	8	10.1	10	21.3
3+ h	15	11.9	11	13.9	4	8.5
Satisfaction with the current OmniPod training process	n	%	n	%	n	%
Very dissatisfied	4	3.2	4	5.1	0	0.0
Dissatisfied	2	1.6	1	1.3	1	2.1
Satisfied	64	50.8	40	50.6	24	51.1
Very satisfied	51	40.5	30	38.0	21	44.7
Years of experience in diabetes education (mean ± standard deviation)	12.7 ± 8.0		13.1 ± 7.9		12.0 ± 8.1	
Hours/week providing pump or pod training (mean ± standard deviation)	4.4 ± 5.3		4.1 ± 4.6		5.1 ± 6.5	
Number of patients trained in past three months	(mean ± standard deviation)					
Accu-Chek	0.6 ± 3.1		0.4 ± 2.0		1.0 ± 4.5	
Animas	2.1 ± 3.0		1.9 ± 2.8		2.3 ± 3.4	
Medtronic MiniMed	6.0 ± 8.8		5.2 ± 8.7		7.5 ± 8.9	
Nipro	0.0 ± 0.0		0.0 ± 0.0		0.0 ± 0.0	
OmniPod	2.5 ± 5.0		2.3 ± 4.3		2.7 ± 6.0	

[a] $p < .05$ comparing trainers who use the training CD versus those who do not.

Table 2. Extent of Agreement[a] with Statements Regarding the OmniPod System

Item	Mean (± standard deviation) Training CD	
	Non-users (n = 79)	Users (n = 47)
Ease of training motivates to recommend pump therapy to more patients	0.5 ± 1.1	1.0 ± 1.1[b]
Ease of use motivates to recommend pump therapy to more patients	0.7 ± 1.0	1.2 ± 0.8[c]
Ease of learning enables more patients to use pump therapy	0.7 ± 0.8	1.1 ± 0.9[b]
Wireless, tube-free design motivates more patients to use pump therapy	1.2 ± 0.7	1.3 ± 0.7
Patients are more likely to be more compliant with their pump therapy	0.3 ± 0.8	0.7 ± 1.0
The OmniPod simplifies insulin pump therapy	1.0 ± 0.7	1.2 ± 0.8

[a] Ratings were on a five-point scale centered on zero (–2 = strongly disagree, …, +2 = strongly agree).
[b] $p < 0.05$
[c] $p < 0.01$

Table 3. User Ratings of the Training CD Features (n = 47)[a]

Training CD features	Rating			
	Very helpful	Helpful	Somewhat helpful	Not helpful
Overview of advanced self-management concepts	62%	26%	0%	0%
Step-by-step illustration of how to use the OmniPod System functions	62%	23%	0%	0%
Guided interactions on the virtual PDM screen	55%	28%	2%	0%
Virtual practice of diabetes management scenarios	62%	19%	0%	4%
Information about basic diabetes management areas	43%	40%	4%	0%
Safe environment to practice the OmniPod skills	62%	19%	2%	0%

[a] Due to missing responses, percentages do not add up to 100%.

Conclusion

OmniPod trainers who use the training CD associate it with positive attitude toward insulin pump therapy among patients as well as an increase in the efficiency of training. The training CD users did not report spending less time in patient training, but they did more strongly agree that ease of use, training, and learning contribute to increased acceptance of the therapy. Health care professionals who use the training CD with their patients are very satisfied with the overall training process. Such interactive training tools facilitate the efficient and cost-effective introduction of new technology for patients with diabetes.

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Disclosures:

Sergey V. Sirotinin is a full-time employee of dbaza inc. and holds shares of Insulet Corporation. Charles J. George is a full-time employee of the University of Pittsburgh Medical Center.

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