

# Differences Between Patients With Type 2 Diabetes Mellitus Interested and Uninterested in the Use of a Patient Platform (e-VitaDM-2/ZODIAC-4I)

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## Abstract

**Background:** The prevalence of type 2 diabetes mellitus (T2DM) is rising in the Netherlands, and health care's workload will increase. e-Health applications may increase patients' participation in their care and could help reducing workload. To explore potential users, differences in patients interested and uninterested in e-Health are characterized.

**Methods:** A prospective cohort study was initiated in the Drenthe region of the Netherlands. This study included inviting T2DM patients to use e-Health (the e-Vita platform). Patients were offered access to clinical data, laboratory results, educational modules, and a self-management support program. Data were obtained from health record systems of general practices and questionnaires.

**Results:** Out of 2674 patients, 1378 (51.5%) participated in the study. Of the 1378 patients, 974 (70.7%) were interested in e-Health. Of 974, 405 (41.6%) were registered for e-Health. Interested patients were more often male, were younger, had shorter T2DM duration, and were higher educated. Of 405, 110 (27.2%) used the e-Health. No differences were found between users and nonusers of e-Health.

**Discussion:** Patients interested in e-Health were more often male, were younger, had shorter T2DM duration, and were more often higher educated. However, even in this interested group, the actual participation rate remained low. Together with characteristics and attitudes of caregivers and T2DM patients, the look and content of the e-Health platform strategies that increase interest and participation need to be developed.

## Keywords

patient web portal, type 2 diabetes mellitus, self-management, users

## Background

The prevalence of diabetes mellitus is increasing dramatically worldwide. The prevalence of diabetes in the Netherlands is estimated to increase from 740 000 in 2007 to over 1 300 000 in 2025.<sup>1</sup> More than 90% of this population will have type 2 diabetes mellitus (T2DM).<sup>2,3</sup> In this time frame there will be no proportional increase in care providers. This eventually will result in a decreased amount of time per person available to deliver care. Furthermore, constraints on growth of health care costs will further restrict the possibilities to spend adequate time per patient.<sup>4</sup>

Lifestyle changes and taking responsibility for one's own health are essential to prevent and manage T2DM. Part of this can be reached through promoting self-management skills to promote patient empowerment and to improve perceived quality of life. An online platform that provides insight in

DM-related health outcomes and educational tools may help to increase participation in their own care<sup>5</sup> and alleviate factors like health illiteracy and promote lifestyle change. Increasing self-management skills and promoting self care in

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T2DM could also result in a reduction of workload for health care professionals. E-Health solutions like teleconsultation, web portals, and online platforms have been and are used for a considerable time already. Systematic reviews reported variable effects on quality of life, degree of self-care, perceived stress levels, and costs.<sup>6,7</sup> Implementation in regular health care systems has proven to be difficult and actual proof of a major impact of the use of e-Health technologies on health, quality outcomes, and costs has been limited up to now.<sup>8,9</sup>

Web portals and patient platforms are considerable as a possible solution, but are also subject to implementation problems, a low participation rate, and nonadherence.<sup>10-16</sup> A mismatch between e-Health applications and users will contribute to this nonadherence.<sup>17</sup>

The online care platform e-Vita, which was developed in the Netherlands, was designed to offer T2DM patients insight in their DM-related health data as well as provide education and information regarding diabetes. In addition, patients can improve their health by setting goals and actions and monitoring their metabolic values. The platform was designed with emphasis on making it suitable and available for all T2DM patients.<sup>18</sup> From the start, special focus groups of caregivers and caretakers were actively involved in designing and testing of this platform.

The development of a platform is and will always be a continuing process. In this descriptive phase after the initial developments, patients who are interested and uninterested in the use of a platform are identified, as well as actual users and nonusers. The obtained data are used to further define and improve this platform.

### Objective

We performed a cross-sectional analysis of baseline data of patients, aimed to characterize patient groups who were interested or uninterested in the use of the online platform e-Vita. In the further stepwise approach we identified the characteristics of actual users and nonusers of the e-Vita platform.

### Methods

Detailed information about the methods and the study design can be found in the study protocol.<sup>18</sup>

### Study Design

A cross-sectional analysis of baseline data of patients interested and uninterested in use of an online patient platform within a large prospective observational cohort study was performed. Data collected concerned clinical information, perceived quality of care, and health-related quality of life (HRQoL).

### Study Population and Setting

A total of 46 general practices in the Drenthe region of the Netherlands agreed to participate in the cohort study

concerning quality of care and HRQoL in T2DM patients. All patients received information about the study and were asked to participate during a regular checkup by their practice nurse (PN). Assenting and included patients had to sign informed consent and filled out questionnaires at different time-points during the first year of follow-up. They were invited to start using the online platform e-Vita in addition to their usual care. Patients who expressed interest in using the platform had to be registered by their PN and received a user ID and information regarding the login procedure. In this ongoing study, participants were recruited from May 2012 onward.<sup>18</sup> The presented analysis includes patients recruited from May 2012 until August 2013.

### Description of Platform

The use of the online platform e-Vita was offered as part of a larger program, the e-Vita research program. The e-Vita research program aims to study the effects of an online platform for various chronic illnesses (T2DM, chronic obstructive pulmonary disease and chronic heart failure). Furthermore, the implementation process and cost-effectiveness of platform use have been investigated. The study presented in this article included T2DM patients only.

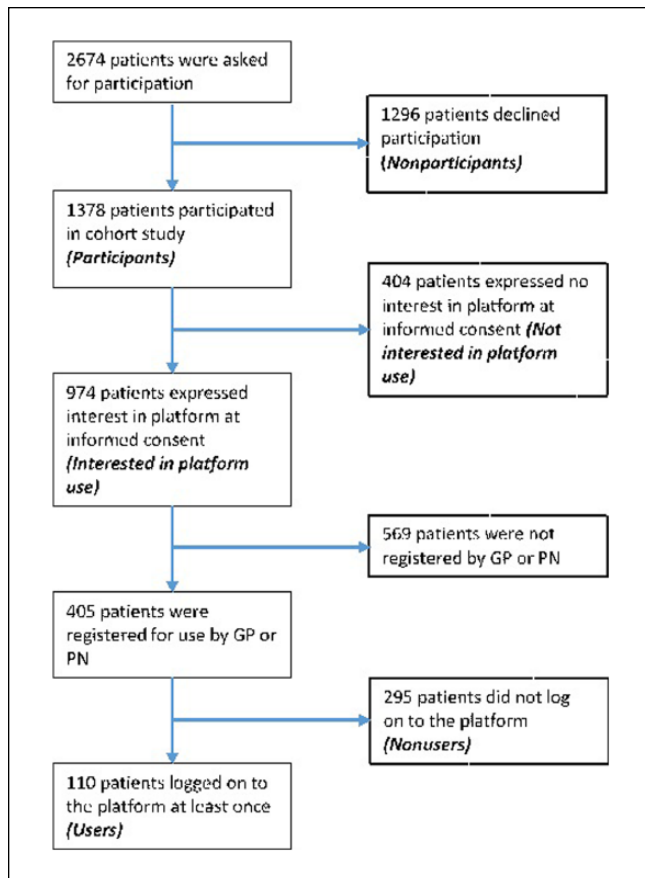
The platform (accessible through the login button on [www.e-vita.nl](http://www.e-vita.nl)) covers the following items:

- At the **home page** messages from e-Vita can be checked and graphics of monitored metabolic values are shown.
- At **insight in health data** patients can see the outcomes of their annual checkups from 2009 onward. Every outcome is accompanied by an explanation.
- At **improve health** patients can set goals and actions to reach their own health-related wishes.
- At **monitoring metabolic values** patients can register the values they measured themselves for weight, BMI, blood pressure, and waist circumference.
- At **increase knowledge** education presented in text as well as movies can be followed. A part of the education is patient-specific, based on the health data.
- At **extra information** patients are directed to a website ([www.e-vita.nl](http://www.e-vita.nl)) with reliable information on T2DM in general.

The development and theoretical background of the self-management module in e-Vita ("Improve Health") is based on the health action process approach (HAPA) model of behavior change and the proactive interdisciplinary self-management (PRISMA) course.<sup>19</sup>

### Data Sources

Demographic and clinical data were obtained from the health record systems of the general practices to identify the overall



**Figure 1.** Flowchart of patients and definitions.

characteristics of patients and the similarities and differences between the defined groups (Figure 1).

As part of the routine assessment of quality of delivered care, general practitioners in the Drenthe region receive benchmark information from the Diabetes Centre in Zwolle, the Netherlands. For this purpose, data of all primary care treated patients with T2DM are gathered on a yearly basis. The content of the data collection is based on a core data set of T2DM related information as advised by the Dutch general practitioner (GP) association.<sup>18</sup> Furthermore, data on educational background and employment were obtained by questionnaires specifically used for this study. Questionnaires included the WHO-5,<sup>20</sup> EQ5D,<sup>21</sup> PAID-5,<sup>22</sup> SDSCA,<sup>23</sup> Europep,<sup>24</sup> and additional questions (eg, about employment and education level). Various lists were filled out at various time points (Figure 2). Login data were collected from the application software, and log files were used to identify the users.

### Variables

For assessment, patients were divided into several groups. Figure 1 shows the flowchart of patients and clear definitions of the several groups.

Variables used to characterize the various categories in the present analysis were gender, age, BMI, diabetes duration, smoking status, and HbA1C level. In addition, for participants who already filled out the second questionnaire, employment, and education level were given. The same variables were used to identify the characteristics of patients who expressed interest or not in using the platform, to identify the actual users and nonusers of the platform.

### Statistical Analysis

Statistical analyses were performed using SPSS version 20 (IBM, Somers, NY, USA). Quantitative variables (age, BMI, T2DM duration, and Hb1Ac levels) are described as means and standard deviations when normally distributed and as medians and interquartile ranges in case of a skewed distribution. Gender, smoking habits, and, if available, employment and education level are described in percentages.

To identify statistically significant differences between several groups, 1-way ANOVA was used for normally distributed quantitative variables or nonparametric tests for skewed variables. Fisher's exact test was used for categorical data. If applicable, logistic regression was used.

### Ethics

This study was approved by the Medical Ethical Committee of Isala, Zwolle, the Netherlands, and was registered under Clinictrials.gov number NCT01570140.

### Results

In the period from May 2012 to August 2013, 2674 patients were invited to participate in the cohort study and were invited to start using the e-Vita platform (see Figure 1).

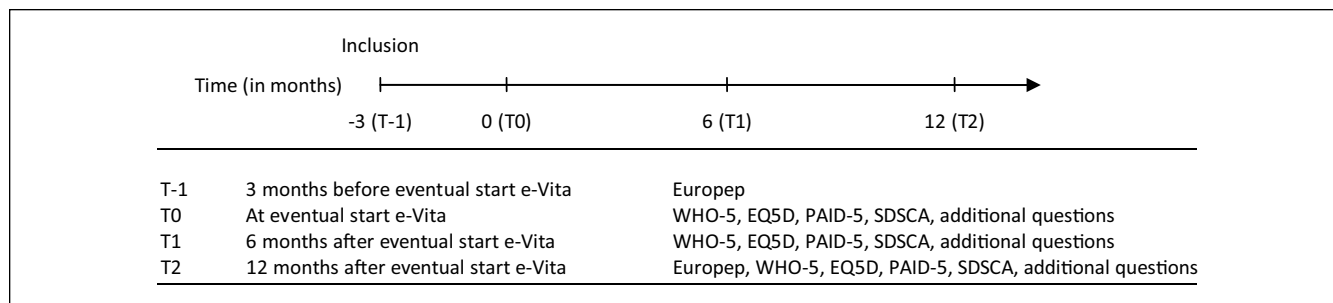
#### Participants Versus Nonparticipants (Table 1)

A total of 1378 patients (51.5%) agreed to participate, and 1296 (48.5%) declined participation. More men than women participated (54.2%). On average, participants were 6.6 years younger, had a 0.6 kg/m<sup>2</sup> higher BMI, had 0.9 years lower T2DM duration, smoked more often, and had a 2.8 mmol/mol lower HbA1c.

Information about employment and education level was available for 894 participants. More than half of the participants (51.0%) were retired. Almost half of the participants (43.3%) completed education at a lower level.

#### Expressed Interest Versus Uninterest to Use the Platform (Tables 2 and 3)

From the results of the univariate analyses shown in Table 2, it can be seen that of the 1378 participating patients, 974 patients (70.7%) expressed interest in using the e-Vita



**Figure 2.** Individual timeline.

**Table 1.** Characteristics of Participants and Nonparticipants in the Prospective Observational Cohort Study.

	Participants (n = 1378)	Nonparticipants (n = 1296)	P
Number of men (%)	747 (54.2)	554 (42.7)	<.001*
Age in years, mean (SD)	64.1 (10.1)	70.7 (10.5)	<.001#
BMI, mean (SD)	29.9 (5.1)	29.3 (5.1)	.004#
T2DM duration in years, mean (SD)	6.5 (7.0)	7.4 (7.0)	.001#
Smoking, n (%)	Yes	167 (13.3)	<.001*
	Before	343 (27.4)	
	No	744 (59.3)	
HbA1c in mmol/mol, mean (SD)	49.5 (9.4)	50.7 (9.3)	.001#
Employment (%)	Full-time working	n/a	
	Part-time working	n/a	
	Retired	n/a	
	Unemployed	n/a	
	Full-time housekeeper	n/a	
	Incapacitated	n/a	
Education level (%)	None	n/a	
	Primary school	n/a	
	Low	n/a	
	Intermediate	n/a	
	High	n/a	

n/a, not available.

\*Fisher's exact test.

#1-way ANOVA.

platform. More men (56.6%) than women were interested in the e-Vita platform; patients were on average 6.1 years younger and had a known 2.2 years shorter diabetes duration. No differences were found in BMI, smoking habits, or HbA1C level. Among the interested, more patients were working full-time or part-time (32.3% vs 11.6% among the uninterested) and fewer patients were retired (45.7% vs 71.4% among the uninterested).

Among the interested, more patients completed education at a high level (18.8% vs 4.8% among the uninterested) and fewer patients had completed primary school only (8.1% vs 27.1% among the uninterested).

Education level and degree of employment were correlated, and each was correlated with sex, age, BMI, and duration of diabetes. Therefore, we explored the relationship of all variables with showing an interest in using the platform in a multivariate analysis using logistic regression.

All variables were complete for 681 (69.9%) patients. No relevant differences between the patients with complete data and those with missing data were found, and missing data were regarded as missing at random. The results of the analysis are shown in Table 3. From the table it can be seen that age, duration of diabetes, and education level were independently related to expressing an interest in using the platform. Employment and sex were no longer significantly related to expressing an interest. The higher the level of education the more patients expressed an interest.

#### Users Versus Nonusers of the Platform (Table 4)

Of the 974 patients who expressed their interest in the platform, 405 (41.6%) were actually registered by their GP or PN for use of the e-Vita platform. Of these 405 patients, 110 (27.2%) logged on to the platform. No differences were

**Table 2.** Characteristics of Patients Interested and Uninterested to Use the Platform.

	Interested (n = 974)	Uninterested (n = 404)	Univariate P value
Number of men (%)	551 (56.6)	196 (48.5)	.006*
Age in years, mean (SD)	62.3 (9.7)	68.4 (9.7)	<.001#
BMI, mean (SD)	29.8 (5.0)	30.2 (5.5)	.143#
T2DM duration in years, mean (SD)	5.9 (5.6)	8.1 (9.5)	<.001#
Smoking, n (%)			
Yes	146 (15.4)	59 (15.1)	.576*
Before	339 (35.9)	152 (38.9)	
No	460 (48.7)	180 (46.0)	
HbA1c in mmol/mol, mean (SD)	49.5 (9.5)	49.6 (9.2)	.826#
Employment (%)			<.001*
Full-time working	135 (18.7)	11 (5.8)	
Part-time working	98 (13.6)	11 (5.8)	
Retired	330 (45.7)	135 (71.4)	
Unemployed	33 (4.6)	3 (1.6)	
Full-time housekeeper	87 (12.0)	26 (13.8)	
Incapacitated	39 (5.4)	3 (1.6)	
Education level (%)			<.001*
None	8 (1.1)	2 (1.1)	
Primary school	58 (8.1)	51 (27.1)	
Low	311 (43.3)	81 (43.1)	
Intermediate	206 (28.7)	45 (23.9)	
High	135 (18.8)	9 (4.8)	

\*Fisher's exact test.

#1-way ANOVA.

**Table 3.** Results of the Multivariate Analysis (Binary Logistic Regression; N = 681).

	P value	Odds ratio	95% confidence interval for odds ratio	
			Lower	Upper
Sex <sup>a</sup>	.751	0.929	0.587	1.468
Age in years	<.005	0.923	0.895	0.952
T2DM duration in years	.023	0.969	0.942	0.996
BMI	.070	0.962	0.923	1.003
HbA1c in mmol/mol	.151	1.018	0.993	1.044
Smoking <sup>b</sup>	.408			
No	.183	1.507	0.824	2.757
Before	.378	1.324	0.709	2.472
Employment <sup>c</sup>	.889			
Part-time working	.670	0.800	0.286	2.239
Retired	.628	0.807	0.338	1.923
Unemployed	.906	1.103	0.214	5.683
Full-time housekeeper	.777	0.866	0.320	2.342
Incapacitated	.381	2.081	0.404	10.713
Education level <sup>d</sup>	<.005			
Low	.007	2.061	1.216	3.496
Intermediate	.005	2.367	1.289	4.349
High	<.005	8.892	3.548	22.290
Constant	<.005	467.733		

<sup>a</sup>Male is the reference category.<sup>b</sup>Current smoking is the reference category.<sup>c</sup>Full-time working is the reference category.<sup>d</sup>None or primary school is the reference category.

**Table 4.** Characteristics of Users and Nonusers of the Platform.

		Users (n = 110)	Nonusers (n = 295)	Univariate P value
Number of men (%)		65 (59.1)	175 (59.3)	.966*
Age in years, mean (SD)		60.1 (8.2)	61.7 (9.8)	.263 <sup>#</sup>
BMI, mean (SD)		29.0 (4.9)	29.6 (4.7)	.267 <sup>#</sup>
T2DM duration in years, mean (SD)		5.1 (3.9)	5.6 (4.4)	.289 <sup>#</sup>
Smoking, n (%)	Yes	13 (12.3)	46 (15.9)	.634*
	Before	40 (37.7)	100 (34.6)	
	No	53 (50.0)	143 (49.5)	
HbA1c in mmol/mol, mean (SD)		48.2 (8.2)	50.0 (12.0)	.160 <sup>#</sup>
Employment (%)	Full-time working	29 (27.1)	53 (19.8)	.171*
	Part-time working	10 (9.3)	42 (15.9)	
	Retired	49 (45.8)	122 (45.5)	
	Unemployed	2 (1.9)	15 (5.6)	
	Full-time housekeeper	9 (8.4)	24 (9.0)	
	Incapacitated	8 (7.5)	12 (4.5)	
	None	1 (0.9)	1 (0.4)	
Education level (%)	Primary school	8 (7.5)	20 (7.5)	.766*
	Low	35 (32.7)	104 (39.1)	
	Intermediate	37 (34.6)	80 (30.1)	
	High	26 (24.3)	61 (22.9)	

\*Fisher's exact test.

<sup>#</sup>1-way ANOVA.

found in gender, age, BMI, T2DM duration, smoking habits, HbA1c level, employment, and education level between users and nonusers (Table 4). Among the users, more men than women logged on to the platform (59.1%). Of 110 patients who actually logged on to the platform, 25 (22.7%) logged on once, 42 (38.2%) logged on twice and 43 (39.1%) logged on more often.

## Discussion

Interest in the use of a type 2 diabetes e-Health platform was expressed more often by patients who were men, were younger, had shorter T2DM duration, were working, and in general completed education at a higher level compared to uninterested patients. Multivariate analyses revealed that a younger age, a shorter duration of diabetes, and higher education level were independently related to being interested. No differences were seen in the comparison between users and nonusers of the platform.

Only a few studies focused on the differences between interested and uninterested patients with regard to the use of online platforms and differences between actual users and nonusers. In agreement with the current study, Ronda et al<sup>25</sup> showed that patients who were interested in a web portal were more often men, were younger, and completed education at a high level. However, in contrast to our study, they showed that interested patients did have a longer T2DM duration. It should be noted that Ronda et al also included type 1 diabetes patients, whereas we included exclusively patients with T2DM. In addition, they showed

that uninterested patients experienced more diabetes related stress and more hyper- or hypoglycemia.

Some of the results found in our study might be influenced by patient selection. Among participants the average age is about 64 years. In comparison, the average age of patients with T2DM in primary care is about 68 years.<sup>26</sup> The more elderly patients may be lacking skills to use modern technologies like computers and mobile phones.

The current study has limitations. The inclusion rate was substantially different between participating practices; this might reflect differences not only in patients' attitudes but also in caregivers' attitudes toward participation, online platforms, and aspects of e-Health in general. Whether such a variable eventually leads to an inclusion of patients with different characteristics in different practices in the study is not known.

Training based on the PRISMA course to better motivate patients will be offered to the PNs in the near future, and effects will be investigated.

Furthermore, the steps to gain access to the platform were rather complicated at the beginning of the project, which posed a considerable hurdle for the less interested and those less able to handle computer technology and programs.

In April 2013, log-on steps were simplified. Further development of the platform is ongoing, also integrating the experiences gained up to the present study. Furthermore, at this moment, information to the patient is a 1-way direction. In the future, communication between health care providers and the patient on the platform may very well increase the effective use of the platform and at the same time change attitudes of the caregivers.



Another challenge will be to reach more women, the elderly, and lower educated T2DM patients with a longer duration of diabetes with comparable techniques, and assessing results in those categories. Intertwined with the implementation of e-Health technologies is the development. This is 1 of the key principles of the holistic framework, the ceH-Res Roadmap, designed by the Center of eHealth research.<sup>27-29</sup> This framework states that persuasive technology design, human-centeredness, and business modeling should be central in developing e-Health technologies. This framework should be taken into account by further development of the e-Vita platform.

Although interested patients and users are younger in a relative sense, their average age is still 60 years. Most of them are raised and educated without ICT facilities. It can be expected that with the present generations very much acquainted with ICT facilities, but also growing older and developing chronic disease, the use of e-Health facilities will grow as well.

## Conclusion

At present, interested patients of the e-Vita portal are more often male, are younger, have a shorter diabetes duration, and are more often higher educated. Consequences of this findings are—among others—the need to acknowledge that at present the target group reached is quite restricted. In addition, based on patient characteristics in interested subjects, it cannot be predicted who among the interested will actually start to use the platform. Furthermore, there is a need to develop tactics and systems focused on the elderly, on women, and on the lower educated population.

Another important aspect is influencing and changing the attitude of caregivers toward active patient participation, online platforms, and aspects of e-Health in general where needed. Measures and incentives to reach that goal will be variable, with attention needed for attitude in general, but also to factors like financial reimbursement, promotion of easy-to-use and standardized ICT systems, and legal aspects.

From a patient/user point of view, a different structure of the platform will be needed to address patients with more differentiated characteristics. At present, developments in those directions are already ongoing, for example, an adapted education flow to provide education appropriate to the patient's education background.

## Abbreviations

BMI, body mass index; CGD, Care Group Drenthe; EQ-5D, EuroQol-5 dimensions; GP, general practitioner; HAPA, health action process approach; HRQoL, health-related quality of life; PAID-5, Problem Areas in Diabetes-5 questions; PN, practice nurse; PRISMA, proactive interdisciplinary self-management; SDSCA, summary of diabetes self-care activities; T2DM, type 2 diabetes mellitus; WHO-5, WHO-Five Item Measure of Well Being.

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