

A Case Study: Risks & Challenges for Training Nurses in Diabetes Problems

Jozef B. Lewoc¹, Slawomir Skowronski², Peter Kopacek³, Antoni Izworski⁴,
Antonina Kieleczawa⁵, Nicolae Bulz⁶

¹Design, Research and Translation Agency Leader Wroclaw, Poland

²Informatics and Management Faculty Wroclaw University of Technology Wroclaw, Poland

³Institute for Handling Devices and Robotics Vienna University of Technology Vienna, Austria

⁴Institute of Automation and Robotics Wroclaw University of Technology Wroclaw, Poland

⁵Institute for Power System Automation (IASE) Wroclaw, Poland

⁶Victoria University Centre for Strategic Economic Studies, Melbourne, Victoria, Australia National Defence College Bucharest, Romania World Economy Institute/ (NERI)/ Romanian Academy Bucharest, Romania Interdisciplinary Research Group / Romanian Academy Bucharest Romania

Abstract: - The primary health care nurses have a very important role to play in prophylaxis and treatment of diabetes. But this need rather fast training of ca. 20000 nurses in diabetes problems in Poland. This, in fact, implies application of the distant learning methods on the scale of the overall country. Prior initiating a project of a ubiquitous system of such a complexity, social importance and of a severely limited prior experience, its challenges and risks should be predicted and analysed. The paper presents shortly the proposed technical solution of the problem, specifies the challenges and the basic measures needed to meet them, enumerates the basic possible risks and specifies the counteractions planned to avoid the risks. The challenges and risks disclosed during the earlier history of the project are also discussed.

Keywords: -system; ubiquttous; nurse; diabetes; e-training

I. INTRODUCTION

Diabetes is recognised as a major social problem of the XXI Century. Community, family and school hygienists/nurses (called, in general, the PHC (Primary Health Care) or community nurses) have a very important role to play in the diabetes prevention and treatment processes. But the knowledge of diabetes, especially in its epidemiological sense, is changing rather fast nowadays. Therefore, the PHC nurses need serious training in their new duties and they need it fast. Traditional classroom lessons can not be successful because the high amount of the eligible learners (e.g. ca. 20,000 community nurses in the case study country of Poland). A team of the designers/researchers (the Team) developed a technical proposal for solving this problem with use of a ubiquitous system employing the Distant Learning (DL) and e-training methods [1-3]. This solution including the ICT system and the infrastructure needed to train community nurses has been called e-Train-Diabetes .

The e-Train-Diabetes is an example of an emerging ubiquitous system of a possibly high social significance. Therefore, the Team had to consider seriously not only the ICT but also medical and social aspects of this project. The present paper is devoted to these issues. Some examples of the basic challenges and risks that should be considered by the e-Train-

Diabetes research and design Team are specified below.

Ex definitione,

for an emerging ubiquitous system of serious possible social impacts, enough earlier experience and know-how necessary for the decisive circles to undertake a well justified decision concerning possible establishing a design and development project are missing. Considering it, the Team decided to work out the concept of e-Train-Diabetes and to submit it for validation to specialists ranked on the very top of the world ICT technology and science, and nursing. The aim was to improve possibly the concept worked out and to acquire as much credible evidence, as possible, for the correctness and the quality of the solutions proposed, as possible to facilitate for the competent authorities of the case study country and/or other interested countries to undertake adequately justified administrative and financial decisions.

This approach worked unexpectedly well: no individual person or organisation connected with science or technology, asked for help by the Team, refused it. An outstanding example may be the Second Summer School by IFIP [4]. They helped the Team even before the School (basing on extended abstracts, the Organizers

appointed "The nurses" for a contribution of the utmost importance and very interesting, and announced it even during the get-together party. During the whole School the presentation, the participants and the Organisers were apt to help the representative of the Team and The nurses were the only presentation mentioned by the School Chairman during the closing session. This helpful attitude was continued after the School finished, when conference papers/reports were produced and long, long after that.

This paper is based primarily on experience gained from the Second Summer School [2,4] and is a proposal of an emerging ubiquitous system of the utmost medical and social importance.

II. GENERAL IDEA OF E-TRAIN-DIABETES

A. Introductory Remarks

The solution proposed is based on the prior experience in teaching nurses on the PHC Faculty of the Wroclaw Medical Academy [5] and on the available experience in design and development of Polish pioneering computer systems and networks [6], and is based on the Distant Learning system e-Train-Diabetes proposed by the team.

B. The e-training Program

At present, rather wide experience is available in training nursery students in the diabetes problems on various Polish Medical Academies, e.g. that in Wroclaw [5]. The diabetes training program (Diabetes) addresses to the current problems of the diabetic epidemiology and makes use of the latest achievements of science people and practitioners involved in the domain of diabetes prevention, prophylaxis, detection and medical treatment. Therefore, it seems very worthwhile that all community nurses are provided effectively with the e-training in accordance with the analogous program e-Diabetes presented in Table 1.

This e-training program may be Website-based or CD ROM-based. The basic advantage of the Website-based solution is the possibility of automatic on-line recording of the feedback from the learners. For the project intended for the scale of the overall country, such feedback may be very useful for the PHC

TABLE 1. E-TRAINING PROGRAM E- DIABETES

No.	Module of program e-Diabetes
1.	Rough epidemiological conditions concerning diabetes
2.	Diabetes risk factors and disease indices
3.	The tasks of the primary health care in diabetes prophylaxis
4.	The tasks of community nurses in the primary health care
5.	Participation of PHC nurses in prophylaxis and early detection of diabetes
6.	The role of PHC nurses in prophylaxis and early detection of diabetes
7.	Salubrious education in diabetes prevention
8.	The outfit of PHC nurses in diabetes prophylaxis
9.	The tasks of PHC nurses in educational actions among diabetic patients
10.	The tasks of PHC nurses in care on chronic patients and their families
11.	Evaluation of the medical treatment effects and the living comfort for diabetic patients

authorities to monitor and control the e-training progress and the level of training of the subordinated nurses but also to develop the knowledge of diabetes on the scale of the country or even wider.

The basic flowchart of the system e-Train-Diabetes is presented in Fig. 1 and is described in some more detail in the paper [1] that presents the technical problems of both medical and computer science domains. However, because of the importance of the diabetes issues for the all population, the problem of PHC nurse training in diabetes is of rather high significance for the whole country though the financial outlays needed to

solve it will be, hopefully, rather low. In addition, e-Train-Diabetes , if implemented successfully, would be the very first application of Distant Learning at so big scale in the case-study country.

C. General remarks

Just when any designer develops an idea of her or his solution to an emerging ICT problem, it is a good time for her or him to think in some more general way: what more can they get from their design and what are the possible dangers? This may be expressed in other words as: What are the challenges and the risks of the project involved for the network society?

The latter question was asked by the Scientific Committee of the IFIP Summer School on the Risks and Challenges of the Network Society [7]; the Team of e-Train-Diabetes designers decided to verify their ideas there, in Karlstad. This paper is, therefore, devoted to the risks and challenges to be thought about when designing and developing the Distant Learning system called e-Train-Diabetes , intended to train community nurses in diabetes problems. The risks and challenges recognised are discussed in the following sections.

The e-Train-Diabetes system and educational infrastructure are being developed in order to solve, first of all, the problem of training community nurses in the case study country. However, the authors do not know of another similar project developed or being under development in another country and the feedback received for this and other papers (e.g. [1-3]) are applicable to any country,

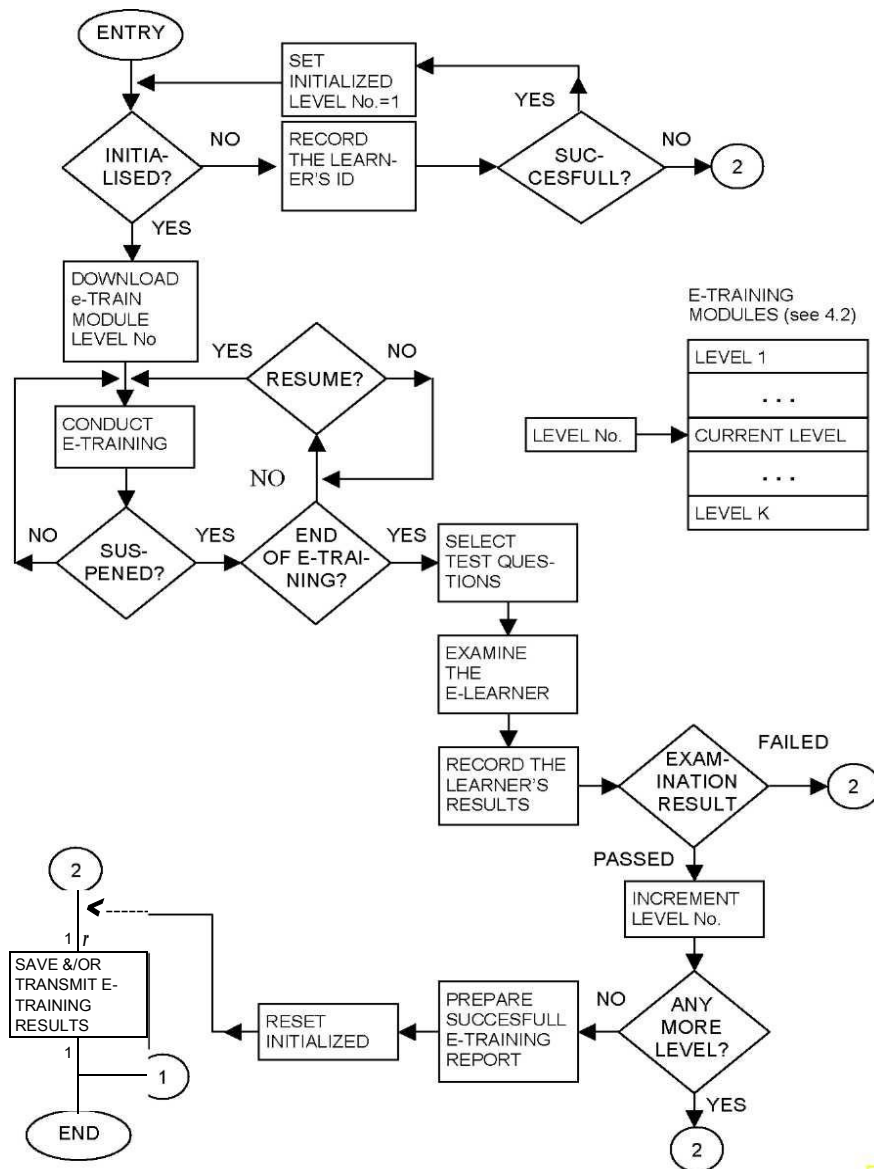


Figure 1. Basic flow diagram of e-Train-Diabetes

III. CHALLENGES

A. *Introductory remarks*

In the present sections, the challenges recognized for the e-Train-Diabetes problem are discussed. At the beginning, there are mentioned the challenges recognised by the e-Train-Diabetes designers themselves. However, presentation of the problems during the Summer School in Karlstad resulted in a considerable feedback from the participants who indicated other challenges. The latter are discussed at the end of this section.

B. *e-training scope*

At least in theory, one community nurse is to be employed on the full-time basis per each 2500 inhabitants in the case-study country. In addition, at least one school hygienist or nurse should be employed by each school. Therefore, the fundamental challenge for the e-Train-Diabetes design and implementation team is to provide, effectively, the knowledge on diabetes prophylaxis, treatment and care result evaluation to the army of ca. 20,000 community nurses. This challenge means not only the development of the ICT system for e-Train-Diabetes, but also of the e-training infrastructure needed to deliver the knowledge to the learners and to acquire the feedback from the latter and to monitor the distant learning progress.

The infrastructure needed covers, first of all, modern computers provided with Internet interfaces for all community nurses participating in the e-Training-Diabetes courses. This does not mean that it is assumed to buy a computer for each nurse involved. However, the organisers of the e-training courses have to arrange for free-of-charge access to computers of adequate characteristics for all community nurses attending the e-Diabetes course.

There is also needed that adequate services are available in the e-Train-Diabetes organiser (most probably, the Education and Medical Staff Department of the Ministry of Health and Social Care) to operate the e-Train-Diabetes system, to control and evaluate the e-training progress and to grant due benefits to the community nurses who have passed remote or face-to-face examinations.

C. *Distant learner benefits*

Another challenge for the e-Train-Diabetes team is to ensure that the distant learners who pass successfully the e-training course in e-Diabetes (the e-training program in diabetes) are granted the due benefits (increased wages, professional promotion, etc. assumed at the very beginning of the project). Surely, the Team will not be able to provide financing or certification required. However, it should be realised that the distant learners will look at the team as the primary representatives of the projects, responsible also for care on their financial and professional interests connected with the distant learning project.

The design and implementation team must realize that fact and arrange for adequate warranties from the Employer (the Ministry of Health and Social Care) to ensure credible meeting of the promises given to the community nurses who want to pass the e-Training-Diabetes course.

D. *Feedback from distant learners*

Another real challenge for the e-Train-Diabetes team is emerging when the practical provision for the feedback from the distant learners is considered. This feedback is necessary for evaluation of the distant learning process and of the individual community nurse results. Most probably, face-to-face examinations will not be feasible because of the huge number of the distant learners. Therefore, the feedback should be automated in some way. For instance, community nurses may transmit their feedback to the e-Train-Diabetes control and monitoring centre via dynamic Web pages. Another possibility is to use e-mail messages for this purpose. In any case, an easy and reliable system to transmit medical data is to be devised and implemented. The ICT solution enabling transmission of data must be supported by a staff needed to analyse this data and to draw conclusions.

If implemented and validated successfully, such ICT system (complete with the analytical and inferring staff) can and should be used, in the future, for transfer of local descriptions of the diabetes conditions, worked out by PHC nurses. The challenge for the e-Train-Diabetes design and development team is, therefore, to provide for a system that would use the evaluations to accumulate and even create the knowledge on diabetes, especially in its epidemiological aspects, which is, potentially, very valuable though very hardly available now. Thus, it is an important challenge concerning the knowledge engineering practice and, perhaps, theory.

E. *Possible applications in other domains*

F. The e-Train-Diabetes project gives rise to another challenge: the challenge of successful development on novel educational tools to be used in various professional domains on the scale of the whole country. Possible success of e-Train-Diabetes will surely open the route towards new educational methods. But the design and implementation team is conscious of the great caution needed here: many ICT projects failed because they were planned in a too general way at the beginning. on the contrary, project designed safely, assuming limited

purposes at the beginning, often resulted in a fast success that could be used to acquire experience needed to gain more general goals. *Possible applications for other diseases*

This question was raised during the Summer School on the Risks and Challenges of the Network Society [7]. Will it be possible to employ e-Train-Diabetes for training nurses or other medical professional groups in problems related to other major diseases, e.g. heart and coronary artery diseases? It is a challenge for the e-Train-Diabetes design and implementation team to answer yes; however, the honest answer must be "yes, but ...".

The basic reason for such answer is that the thing needed most in order that the e-Train-Diabetes project is successful is the actual experience in exactly that project. The experience is needed in medical problems, especially in diabetes, in ICT problems related with e-training on such scale, in organisation of the nurse e-training process and monitoring of the latter, etc. The design and implementation staff must acquire the experience as soon as possible. To enable it, it is assumed even to limit the project objectives to some subset of the community nurses at the beginning so that the project is controllable for a single leading designer. Thus, it was planned to organise so called first thread of the project, i.e. as small as possible set of hardware and software needed to implement the basic functionality of this emerging ubiquitous system and to validate the e-Train-Diabetes solutions on this thread. Only after the project solutions are validated positively, the full-scale e-training process may be initiated.

Forcing the design and implementation staff to consider actually (i.e. in some needed detail) the problems related with other diseases and/or medical professional groups would be harmful for the progress of the e-Train-Diabetes project realisation and could result in a total failure. In addition, one should realise that, in spite of several years of the research and design work, the knowledge of the design and implementation team is now much, much poorer than it will be, hopefully, after completion of this emerging ubiquitous project. So it is rather dangerous and unreasonable to make important decision of a generalised character now. And, of course, the necessity of considering of circumstances related with other diseases would need a considerable time and the e-Train-Diabetes progress would unnecessarily be retarded.

The last two paragraphs constitute the "but . ." part of the answer. The "yes" part seems to be more optimistic.

Possible success of e-Train-Diabetes will result in a huge amount of experience on large-scale e-training in a serious and responsible way. The staff experienced will be able to start to cope with other similar problems. Usually, it works fast and enables to disseminate large-scale systems rather rapidly [8,9].

The basic thing needed in order that the process of development of new and new applications for e-Train-Diabetes -based systems is that the design and implementation team realised the fact that such expansion will be needed and applied design methods and tricks (usually simple and straightforward) to facilitate future modifications. And the Team is conscious of the fact.

G. Possible applications of e-Train-Diabetes outside the case-study country

The question raised during the Summer School on the Risks and Challenges of the Network Society [10] constitutes an important challenge for the design and implementation team.

Like in the preceding section, the answer is "yes, but . .".

The "but . ." part is very similar to that of section F. In addition, however, one should remember of possible generic differences (e.g. cultural differences or differences in the standard of living, etc.) which are related with, in particular, the e-training control and monitoring process.

In any case, the design and implementation team is working so that a possible localisation process is easy (e.g. all descriptive texts are entered via external tables to enable easy changes).

H. Detection of diabetes

Another question raised during the Summer School on the Risks and Challenges of the Network Society [11] generated a new challenge for the design and implementation team. The author of the question gave an example of symptoms of diabetes visible on the diabetic faces and proposed to use films showing such faces to teach community nurses how to detect diabetes.

The design and implementation team has started to recognise the problem. The basic compendium on diabetes does not mention any possibility to detect diabetes on the basis of such symptoms [11]. The well-known classroom-based Diabetes training program does not include teaching diabetes recognition basing on face symptoms [5]. But e-Train-Diabetes will provide community nurses with much more modern and better electronic media than those available from classroom-based teaching. Therefore, the problem is being recognised by competent diabetes specialists and, provided that their opinion is positive, such films will be included in the e-Diabetes program.

IV. RISKS

A. Hackers

The basic risk in any website-based DL system is the danger of hackers breaking into the system and, possibly, destroying it or, even worse, impair its operation. This problem must be analysed very seriously and adequate protective measures must be applied to ensure the highest possible credibility of e-Train-Diabetes .

B. Violation of distant learner authorities

Another risk in the e-Train-Diabetes project is connected with possible violation of the distant learners authorisations. To minimise this risk, it will be necessary to organise an authorisation checking system not only in e-Train-Diabetes but also in the infrastructure of the Ministry of Health and Social Care that will operate the system. This risk will be even more important for the future stage of acquiring knowledge on diabetes on the epidemiological scale since such violation may result in erroneous knowledge created by the community nurses.

C. False data being entered

Still another risk to be considered is that of false data entered by some distant learners (to falsify the actual results of distant learning, to save their efforts needed for finding the true data, etc.). This issue needs a careful approach to design of data validation procedures (both automated and manual) and of some supervisory data monitoring system.

D. General risk

There is a major risk that the distant learning methods may be used by some third parties for purposes that may be inconsistent with the interests and goals of the e-Train-Diabetes project. To avoid it, some measures should be undertaken in order that the overall project is under effective control of the distant learner community, perhaps represented by some democratically elected authorities. This control should also cover the basic design and implementation team itself.

E. Possible opposition of doctors

This question was raised during the Summer School on the Risks and Challenges of the Network Society [12]. The author of the question asked if the design and implementation team realised that doctors may create an opposition against development and use of e-Train-Diabetes because to their negative attitude with respect to nurses.

In theory, there is no risk of that type. Provided that the e-Train-Diabetes project is realised, it will be run under auspices of the Health and Social Care Ministry that possesses enough power to make any person of the Health Care circles to obey the orders and guidelines needed to run the system effectively. In addition, the problem is so important that there is no room for that an attitude of any individual may make harm to it.

However, the design and implementation team is conscious of the fact that there are doctors who make light of nurses and may oppose transferring of some of their responsibility range to community nurses. The possible authorities of community nurses, mentioned in section D above and the responsible body of the Ministry of Health and Social Care, supported by the design and implementation team, should protect distant learners in such, hopefully, rare cases.

F. Examinations

During the Summer School, a question of examinations was raised [13]. For the e-training courses run by the Karlstad University, all examinations were carried out face-to-face and they considered remote examinations as a risk to their projects. The design and implementation team does consider remote examinations as some risk to the e-Train-Diabetes project. However, they are a must. The project is planned for ca. 20,000 remote listeners and in order that any examination session takes no longer than 5 days, some 200 examiners would be needed. In additions, nurse travel cost and accommodation problems would be very severe. Therefore, the general idea of e-Train-Diabetes has been designed from the very beginning so that remote examinations are feasible (see Fig. 1).

G. Geographical considerations

This question was raised during the Summer School on the Risks and Challenges of the Network Society [14]. The author of it was interested if the design and development team has taken into consideration the fact that diabetes incidence ratio may be different in various regions of any country.

The popular references on the diabetes pathogenesis (e.g. [11]) do not provide definite proofs for influence of the local environment on the incidence rate of diabetes mellitus so some work in this domain is in progress. In opinion of the design and implementation team, possible region-related causes of diabetes do not produce any significant risk for the e-Train-Diabetes program. on the contrary, it is some challenge for the program to use

possible feedback from the distant learners, mentioned in section 3.4 above to discover and analyse such possible relations.

V. FINAL REMARKS

The paper presents the challenges and risks recognized during the progress of the design work and during the Summer school in Karlstad. The repair and/or protective measures planned by the e-Train-Diabetes team are also described. Any response from other specialists on possible risks and challenges of the Network Society may be fruitful for the project and will be welcome.

Basing on the work of the Team, validated and improved by the IFIP Summer School Participants and organizers and by numerous experts in nursing and ICT, a proposal was submitted to competent authorities. The answer was: it is wonderful. Please develop the system and we will test it. It was the end of possible discussion: for any emerging ubiquitous system, relevant authorities must be co-designers from the very beginning. In other case, what can the leading designer tell to the community nurses. May be that: Dear Ladies, you are brave, ready to sacrifice, overworked and severely underpaid. I've devised a beautiful system for you due to which you will have to work even more and will get even less money.

But many experts claim that the e-Train-Diabetes is severely needed. The authors present this paper to encourage other teams to try to develop such emerging ubiquitous system. In such case, the Team offers any possible help.

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