Original article

RETIDIAB®: Assessment of a continuing medical education website for the improvement of diabetic retinopathy management

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Abstract

Aim. – The aim of this study was to evaluate the efficacy of a continuing medical education (CME) website to improve ophthalmological management of diabetic retinopathy (DR).

Methods. – A worldwide website called RETIDIAB® was created in which, to log on for first time, users had to take a preliminary test to evaluate their baseline level of knowledge. This allowed them free access to the entire website at any time with no time obligation. The website comprised a course of theoretical concepts and different types of training, including multiple-choice questionnaires (MCQ) focused on the course content, interpretation of diabetic fundus photographs and case reports. After perusing the entire RETIDIAB® website, users could take a second assessment test. Finally, they were asked to fill in a questionnaire evaluating the entire programme.

Results. – A total of 137 users were registered and, of these, 109 took only the preliminary test, while 28 took the second test and evaluated the entire website; of the latter, 75% were residents and 25% were practising physicians, and 15 were male and 13 were female, ranging in age from 26 to 42 (30.2 ± 3) years. Statistically significant progress was seen between the first and second evaluations (37.3 ± 14% correct answers *vs* 64 ± 10%, respectively), and the average time interval between the first and second evaluations was 40 ± 20 days. In addition, users expressed a high level of overall satisfaction with the site.

Conclusion. – This pilot study demonstrated the value and effectiveness of RETIDIAB®, a new CME website exclusively devoted to DR management.

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Keywords: E-learning; Continuing medical education; Diabetes mellitus; Diabetic retinopathy; Fundus photography; Screening

Résumé

RETIDIAB® : un site internet de formation continue pour l'amélioration de la prise en charge de la rétinopathie diabétique.

But. – Le but ce cette étude était d'évaluer l'efficacité d'un site internet de formation continue pour améliorer auprès des ophtalmologistes les connaissances portant sur la prise en charge de la rétinopathie diabétique.

Méthodes. – Un site Internet appelé RETIDIAB® a été créé. À leur première connexion, les utilisateurs devaient évaluer leurs connaissances de départ. Ils avaient ensuite un libre accès au site quand ils le désiraient. Le site comportait un cours théorique avec des questions à choix multiples (QCM), une interprétation de photographies du fond d'œil de patients diabétiques et des cas cliniques. Après une fréquentation libre en temps du site, une seconde évaluation des connaissances était réalisée. Enfin les utilisateurs étaient interrogés sur leur degré de satisfaction du site.

Résultats. – Nous avons enregistré 137 participants parmi lesquels 109 ont effectué la première évaluation, et 28 ont testé le site complètement. Les trois quarts étaient des internes ou des assistants et un quart correspondait à des ophtalmologistes installés. Cette population comprenait 15 hommes et 13 femmes, pour un âge moyen de 30,2 ± 3 ans (26–42). Nous avons observé une amélioration statistiquement significative entre la première et la seconde évaluation, 37,3 ± 14 % de réponses correctes contre 64 ± 10 %, *P* < 0,001. Le temps moyen entre ces deux évaluations était de 40 ± 20 jours. De plus les utilisateurs ont exprimé un taux élevé de satisfaction.

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Conclusion. – Cette étude préliminaire a démontré l'intérêt du site RETIDIAB®, nouveau site de formation médicale continue dédié à la prise en charge de la rétinopathie diabétique.

1. Introduction

In industrialized countries, diabetic retinopathy (DR) has become the leading cause of irreversible blindness in working-age individuals [1], and the third-ranked cause of vision loss in the elderly [2]. However, a number of studies show that timely treatment can prevent vision loss due to DR [3] and macular oedema [4]. For this reason, DR screening with a non-mydriatic camera has become more and more popular, as it provides a reliable method that is both specific and sensitive in detecting DR while using cost-effective modalities [5]. Furthermore, fundus photography is now the recognized preferred method for DR screening, according to the Liverpool declaration on screening for diabetic retinopathy in Europe [6]. However, the need for standardized training for diabetic fundus interpretation was particularly emphasized by the declaration, which was signed by 29 European countries in 2005.

The French National Authority for Health (*Haute Autorité de santé*, HAS) stipulates that DR screening requires specific initial and continuing training, as well as certification for readers and medical photographers. It also suggests that the training may be accomplished by different modalities, including workshops, short-term training dispensed by recognized centres and followed by validation through practical evaluation, and Internet training with self-evaluation [7]. In ophthalmology, as with any speciality, massive changes have swept through the field because of the ever-accelerating expansion of medical knowledge [8]. It is now apparent that one-off certification of knowledge and skills is no longer adequate. Indeed, in spite of the rapid development of different types of DR screening methods [9,10], there remains a persistent gap between DR management guidelines and ophthalmological clinical practices [11]. It is now mandatory to standardize the management of DR screening and to update the knowledge of ophthalmologists on this topic. For this reason, the French Society of Ophthalmology (*Société Française d'ophtalmologie*, SFO) [12] and the HAS [7] have published guidelines covering these activities. However, in spite of such efforts to improve the quality of DR screening, the lack of a method to disseminate good practices remains a key issue.

Although numerous questions regarding formal continuing medical education (CME) have persisted [13], the potential of the Internet as an instructional tool was quickly recognized [14]. Internet-based education allows learners to participate at a time and place convenient to them; it facilitates instructional methods that might be difficult in other formats and has the potential to tailor instruction to the individual learners' needs [15]. Contrary to the simple reading of a traditional document, e-learning seeks to be interactive, allowing dynamic exchanges. Moreover, DR screening appears to be particularly well suited to this type of training, as the era of numeric photography and non-mydriatic

cameras has made numeric archiving accessible by computers, rendering a vast number of photographs immediately available at the stroke of a key.

In response to this situation, the Department of Diabetes Health Network Paris-Nord (*Réseau santé Paris-Nord*), the department of Ophthalmology at the Lariboisière university-hospital in Paris and the department of Ophthalmology at the Dijon university-hospital came together to create an e-learning website on DR screening. This interactive website, dubbed RETIDIAB®, was developed on the Internet. The intention was to create a CME programme strictly for ophthalmologists (residents or those in private practice) for CME credits. Creation of the website also fulfils the HAS recommendation for evaluation of professional practices (*évaluation des pratiques professionnelles*, EPP). The aim of the present study was to assess the effectiveness of the RETIDIAB® website in improving ophthalmologists' performances in DR screening and to assess user satisfaction with the programme.

2. Methods

2.1. Creation of the website

RETIDIAB® was developed in two phases. The first was in 2006, when the Department of Diabetes Health Network Paris-Nord initially set up an e-learning website focused on DR screening. This website was accessible to any user, but did not offer CME credits. Also, the data had not been updated since its initiation.

Then, in 2008, prompted by HAS recommendations, it was decided to create a new website along the lines of that of 2006. The new website was based on the most recent data from the literature on DR and specifically tailored to ophthalmologists, and gave users CME credit. Financing was provided by both public (fund to aid the quality of city care; *fond d'aide à la qualité des soins de ville* [FAQSV]) and private funds (companies involved in the technical aspects of eye care). The software was developed by a private company (MGLab®) for a total cost of €9947. Educational material was collected and designed by two of the authors (J.B., A.B.M.), and the entire website contents were validated by the other authors.

2.2. Design of the website

RETIDIAB® had three main parts — a theoretical course (*cours*); training (*entraînements*); and evaluation (*évaluation*) — all of which were accessible from the website home page. The course was based on recent data from the literature, and users could print them out as PDFs. The information was focused on DR epidemiology, pathophysiology and symptoma-

Table 1
Diabetic retinopathy (DR) and maculopathy grading system[a] used for screening.

Screening grading for DR	
Stage 0: no DR	
Stage 1: mild DR	Isolated cottonwool spots or isolated retinal haemorrhage without microaneurysm
	Microaneurysm only
Stage 2: moderate DR	> stage 1, but < stage 3
Stage 3: severe DR	Retinal haemorrhage and/or microaneurysm of severity ≥ ETDRS standard photographs 2A, at least in nasal field
	And/or IRMA ≥ ETDRS standard photographs 8A
	And/or venous beading
Stage 4: proliferative DR	Pre-retinal neovascularization ± fibrosis
	And/or proliferative DR complications (vitreous haemorrhage, pre-retinal haemorrhage)
Grading for maculopathy	
Stage 0: no macular oedema	No exudate
Stage 1: mild maculopathy	Few and small hard exudates located at > 1 optic-disk diameter from centre of macula
Stage 2: severe maculopathy	Circular exudates > 1 optic-disk in diameter located at > 1 optic-disk diameter from centre of macula
	Hard exudates located at < 1 optic-disk diameter from centre of macula

ETDRS: Early Treatment Diabetic Retinopathy Study; IRMA: Intraretinal Microvascular Abnormalities.
[a] Lecleire-Collet et al. [16].

tology, and was extensively illustrated. A substantial part of the course was devoted to DR screening guidelines, and each part contained the main literature references on the topic. Training consisted of 70 MCQs (multiple-choice questionnaires) on the course content, 250 pairs of fundus photographs and 25 case reports (each containing three to five MCQs). Each exercise was based on an MCQ model, and each answer was in the form of a commentary. Users could stop and repeat the training whenever they wished. As meticulous attention was initially paid to the quality of the photographs, the images were sufficiently large and could be displayed quickly on the computer screen at high resolution. A magnifying tool was also available, and the contrast and brightness were adjustable.

User evaluation was based on 30 pairs of fundus photographs from diabetic patients randomly extracted from a database of 250 pairs of photographs. Each photograph was classified beforehand according to level of difficulty (easy, moderate, difficult) and, for the tests, each user was shown the same proportions of each type of fundus photographs (60% easy, 30% moderate, 10% difficult). The grading system used to classify retinopathy and maculopathy was that recommended by the SFO screening guidelines (Table 1) [12].

From the website home page, other information was also available, such as "How does it work?" (*Comment ça marche?*), "useful information" (*info utiles*), "actors" (*acteurs*) and "my account" (*mon compte*). From the "useful information" screen,

users could access a bibliography and various links on DR, while "My account" allowed users to check their results and progress, and to contribute to the website by sending in new fundus photographs. These items all served to provide greater interactivity.

2.3. Evaluation of the website

2.3.1. Participants
Only ophthalmologists in private practice or residencies were allowed to participate, and were considered study users as soon as they logged on to the website. Recruitment was carried out during initial training meetings and CME meetings, when the website was described through oral presentations, and interested users could register at the end of the meeting by leaving their e-mail addresses. Subsequently, users received an e-mail inviting them to connect to the website from their own premises. Another recruitment source was spontaneous access via Google.

2.3.2. Interventions
At the time of their initial logging on to RETIDIAB®, users filled out an online questionnaire (for personal data such as age, gender, resident/physician in training). They then were immediately directed to a preliminary evaluation, comprising 30 pairs of diabetic fundus photographs. For each pair of photographs (one centered on the macula and one centered on the optic-disk), the physician had to grade both the retinopathy and maculopathy in accordance with the SFO's screening classifications [16]. The answers had to be correct for both maculopathy and retinopathy grades to obtain one point. After completing this first test, users were then given access to the entire contents of the website at any time.

After working on the course and doing each type of exercise (but not necessarily all of them), users were allowed to take a second test based on 30 pairs of fundus images. The time intervals between each log-on, and between the first and second evaluations, were left entirely up to the users' discretion.

2.3.3. Objectives
The primary objective of the present study was to compare the users' responses in each of the two tests to assess their improvement in knowledge of DR. The secondary objective was to evaluate their improvement, and collect their opinion of the website and its contents.

2.3.4. Statistical tests
The McNemar test was used to compare the ophthalmologists' levels of performance in the first and second evaluations. The tests were two-tailed, and the significance threshold was set at $P < 0.05$. Responses to the questionnaire items were expressed as the percentage of users who selected each of the various options. The response frequencies of the users who took only the first evaluation and those who took both evaluations were compared by the non-parametric chi-square test.

3. Results

3.1. User characteristics

Over a period of about 6 months (from 25 June to 31 December 2009), the site was visited 1244 times by users from 11 different countries (France: $n = 1111$; Canada: $n = 50$; Morocco: $n = 18$; others: $n = 65$), and 4937 pages were viewed with a mean duration of approximately 7 min per visit (data from Google analyses). Also, during this time, 137 ophthalmologists registered, 109 took only the first evaluation, while 28 took the two evaluations and participated in the assessment of the entire website.

The 137 registered ophthalmologists were aged 24–80 (35.7 ± 10) years and, for the most part, were French. The male-to-female ratio was 1.13, and 55.5% were residents and 44.5% were practitioners; 80.3% had a hospital-based practice and 19.7% were in private practice. The majority of users were located in urban areas. Only 16% had ever received specific training on DR screening, and 29.9% had already participated in DR screening.

Users who participated in the evaluation of the entire website were aged 26–42 (30.2 ± 3) years, and included 15 men (53.5%) and 13 women (46.4%). The resident/private practice physician ratio was 3. Their subspecialities were 78.5% general ophthalmology, 7.1% retinal surgeons, 7.1% medical retina specialists, 3.5% palpebral surgeons and 3.5% neuro-ophthalmologists. All were practising in urban areas, and 39.3% had already participated in a DR screening campaign, but only 14.3% had received specific DR screening training.

Also recorded was the time spent on the site by each participant during the evaluation. Those who only took the first evaluation spent 14 ± 5 min ($n = 109$), while those who participated in both the first and second evaluations spent 13 ± 3 min ($n = 28$; $P = 0.40$).

3.2. Assessment of website efficiency

The mean time interval between the first and second evaluations was 40 ± 20 days. The mean rate of correct answers for the first evaluation was $37.3 \pm 14\%$ and, for the second, $64 \pm 10\%$ ($P < 0.001$). The mean time spent working on the theoretical part of the course was 1.5 ± 0.9 h. In the training part, users who completed both evaluations answered, on average, 55.3 ± 39 MCQs with a mean rate of correct answers of $49 \pm 0.2\%$, viewed 23.5 ± 29 case reports with a $40 \pm 0.2\%$ rate of correct responses and interpreted 92.7 ± 89 fundus photographs with a $46 \pm 0.1\%$ rate of correct answers.

3.3. Users' perception of the website

Table 2 summarizes the overall user satisfaction with RETIDIAB®, as well as their assessment of the course, training and evaluations. In general, most users were satisfied with the website.

Table 2

Results of the survey taken by visitors to the RETIDIAB® website and their evaluation of the site. All data are presented as percentages.

	Zero	Poor	Good	Excellent
Overall				
Satisfaction	0	7	36	57
Navigational speed	0	6	63	31
Ease of use	0	0	42	58
Design	0	6	31	63
Intention of regular visits	0	27	68	5
Do you think this website could count as an EPP?	10	0	0	90
Courses				
Global interest	0	0	43	57
Quality of content	0	0	43	57
Quality of images	0	0	47	53
Could it count as an EPP module?	0	11	73	16
Training				
Quality of content	0	0	53	47
Quality of images	0	6	47	47
Value of MCQs	0	0	64	36
Quality of case reports	0	0	43	57
Evaluation				
Quality of content	0	0	69	31
Quantity of content	0	6	52	42
Overall value	0	0	57	43
Do you think that it reflects your level?	27	0	0	73

MCQs: multiple-choice questionnaires.

4. Discussion

Implementation of the RETIDIAB® website was motivated by the discrepancy between ophthalmologists' practices and the current DR screening recommendations [11]. Indeed, this observation was evidently valid, as the mean percentage of correct answers was low for the initial baseline evaluation ($37.3 \pm 14\%$). There are many advantages in accessing Internet-based CME programmes; however, evaluation of such Internet-based CME activities has not kept up with their development [17]. For this reason, it was important to evaluate the RETIDIAB® website for both its quality and effectiveness while it was being used. Indeed, despite the short test period, the website appeared to be highly useful for both residents and private practitioners. Furthermore, the fact that there were users from other countries, albeit limited in number, suggests international interest in the topic.

Users who completed the entire website evaluation spent 1.5 ± 0.9 h working on the course. The participation rate in the training segment was high, with an average of 55.3 ± 39 MCQs, 23.5 ± 29 case reports and 92.7 ± 89 fundus interpretations completed by each user. In addition, the significantly increased rate of correct answers between the first and second tests demonstrated the effectiveness of the website as a learning tool. Moreover, user satisfaction was high. Nearly every participant rated each item on the website as "good to excellent" and in accordance with the literature, indicating that distance-learning courses can compare favourably with classroom instruction, and that online participants do come away highly satisfied with their

results [18]. According to Harris et al. [19], younger physicians appear to be adopting online CME more rapidly than others ($P < 0.001$). The vast majority of users who completed the whole of the present evaluation were residents. On the other hand, there was no difference in user gender in our present study ($P = 0.50$).

Although research into CME is poorly developed, with relatively few published studies, CME has become increasingly important around the world. In 2009, the American College of Chest Physicians (ACCP) [20] published guidelines designed to optimize CME effectiveness. In France, a national CME system became mandatory by law in 1996 [21], and was completed in 2002 by another law [22]. In practice, however, CME is voluntary, as no incentives or disincentives are applied [23]. CME in France has two goals: improvement of knowledge (IK; CME, *formation médicale continue*); and evaluation of professional practices (EPP) [24]. In the future, the distinction between EPP and IK will probably disappear. Indeed, the recently passed bill "Hospital, Patients, Health, Territories" (*hôpital, patients, santé, territoires*, HPST) [25] amalgamates the two entities into what is now called "continuing professional development", a term that is already in use in many countries. The objectives of EPP are to observe one's own practice, to keep up with the recommendations and guidelines pertaining to one's field, and to find ways to improve and to observe, a few months later, whether physician practices have evolved. A number of countries have installed some form of EPP or an equivalent — in the UK as 'clinical audits', in the USA as "performance improvement", and in Australia as "external accreditation and quality improvement" — although it is difficult to evaluate their effectiveness.

The number of comparative or qualitative studies of Internet-based learning has increased from two articles in 1996, to 16 reports in 2001 and 56 in 2006 [26]. In May 2009, 300 websites, offering more than 13,000 courses and more than 22,000 h of CME credits, were referenced [27], suggesting the growing interest in these types of CME. In 2008 in the USA, Internet CME garnered the greatest number of participants — 3,721,419 — compared with 2,303,578 for regularly scheduled courses [28]. Indeed, recording and posting online e-learning software has become considerably easier and less expensive than before. In France, several e-learning websites have recently been developed [29,30] by universities or by private companies. Yet, there are no data on their CME activity [31], thus prompting the present evaluation of RETIDIAB®.

Both internationally [32,33] and in France [34], there are already many courses of CME for DR, but few are focused on DR screening and even fewer offer e-learning opportunities. The UK's programme for certification in DR screening allowed all staff involved in the identification of sight-threatening DR in the English national screening programme for diabetic retinopathy to obtain accreditation to the minimum level of competence required [35]. Although that website has not been assessed, its main differences compared with the RETIDIAB® website are that it does not measure continuing competence, and it is aimed at ophthalmologists, optometrists and nurses. In 2004, the Canadian team of Belair et al. also developed training software to formally develop trained readers of digital images and to encourage the establishment of mass screening programmes for DR [36]. However, their software was not designed specifically for ophthalmologists, and its efficacy was tested on only five individuals; nevertheless, the results, assessed by readers' levels, were considered good to excellent after using the software.

However, our present study has some weaknesses. As with other similar studies [37,38], a large number of participants were lost as the study progressed (137 subscribers *vs* 28 users who completed the entire evaluation). This may be due to the fact that CME requires a substantial personal investment of practitioners' time. Also, during the study, CME credits were not awarded and no financial encouragement was proffered. This limitation is a well-recognized problem [39], and the consequent loss of participants may have introduced an unmeasured bias. The mean time interval between the first and second evaluations was also long (40 ± 20 days), creating problems for recruiting more participants. Regardless, it was relatively low compared with studies that conducted tests at 4–12 months after the intervention [37,40]. In addition, it has been shown that most CME courses fail to change physicians' practices [13,40]. As in other studies [41], the present evaluation was focused mainly on participant satisfaction and increases in knowledge, with no evaluation of changes (or not) in participants' practices. Indeed, even if ophthalmologists' knowledge is statistically improved at the end of our study, any changes in their behaviour have to be measured by independent methods, such as chart audits or referral rates. Moreover, as opined by Short et al. [37], whether behavioural modifications persisted for any meaningful length of time after the training should also be measured.

The present pilot study showed that further modifications are needed in the answer-marking system, as it was noted that the answers could be different depending on the group of items. The current system uses an all-or-nothing approach to evaluate responses, which led to a poor rate of correct answers overall (from $37 \pm 14\%$ to $64 \pm 10\%$). Therefore, users may have the impression that the site does not truly reflect their level (27% of the questions aimed to poll participants on their satisfaction with the site). Thus, the system of marking responses will be modified in the next version of the website: instead of awarding either 0 or 10 points, a variable number of points within this range could be given according to the relevance of the response, even if it is not completely correct. Moreover, as only 27% are not likely to visit the site regularly, the plan is also to insert new materials and to upgrade the site more frequently to make it consistently more attractive.

5. Conclusion

The growing number of DR screening campaigns and recent changes in guidelines have made DR a subject of choice for an interactive online CME. Indeed, the present study has demonstrated the value and effectiveness of RETIDIAB®, a new e-learning website exclusively dedicated to DR management. However, the evaluation presented here is only a pilot study, and will be further developed in an ongoing study. Nevertheless, in designing this type of CME, it may be possible to increase knowledge and change professional habits to produce the best outcomes for patients.

Conflict of interest statement

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