How to improve screening for diabetic retinopathy:
The Burgundy experience

C. Creuzot-Garcher a,*, L. Malvitte a, A.C. Sicard b, A. Guillaubey a, A. Charles a, J.N. Beiss b, A. Bron a

a Department of Ophthalmology, University Hospital, CHU Hopital-Général, 3, rue du Faubourg-Raines, 21000 Dijon, France
b Department of General Medicine, University of Dijon, Dijon, France

Received 24 September 2008; received in revised form 26 August 2009; accepted 2 September 2009
Available online 29 January 2010

Abstract

Objectives. – The aim of this study was to evaluate the impact of a mobile diabetic retinopathy (DR) screening programme on the overall ophthalmological follow-up of diabetics in Burgundy.

Methods. – The primary objective was to compare the rate of eye examinations, according to the information personnalisée aux professionnels de santé (IPPS; personalized information sent to health professionals) database, in diabetics before and after the screening campaign in selected zones. The secondary objectives were to compare the rate of eye examinations in diabetics before and after the screening programme in two different situations: with a mobile site; and with general practitioners (GPs) who teach in medical school. The impact of the different kinds of information on improving DR screening participation was also assessed.

Results. – The overall rate of ophthalmological visits did not change significantly before vs after the screening campaign (42.2% vs 41.8%; P = 0.73), nor did the rate of ophthalmological visits in screened areas (44% vs 43%; P = 0.58), compared with non-screened areas (41% vs 41%; P = 0.99) and the sectors with GPs as teachers (47% vs 49%). Patients referred to the screening programme were mainly informed of the screening by flyers provided by the National Health System.

Conclusion. – The DR screening campaign represents a major improvement in diabetic management, as around 80% of the screened patients with DR consulted an ophthalmologist after the screening campaign. However, the overall rate of diabetics having the recommended annual ophthalmological visit in the region of Burgundy remained unchanged.

© 2010 Elsevier Masson SAS. All rights reserved.

Keywords: Non-mydriatic camera; Diabetic retinopathy; Screening campaign; General practitioners

Résumé

Comment améliorer le dépistage de la rétinopathie diabétique ? L’expérience bourguignonne.

Buts. – Le but de cette étude était d’évaluer si une campagne de dépistage de la rétinopathie diabétique (RD) pouvait influencer le suivi ophthalmologique global des diabétiques en Bourgogne.

Méthodes. – L’objectif principal était de comparer le taux d’examen ophtalmologique annuel des diabétiques évalué par l’information personnalisée aux professionnels de santé (IPPS) avant et après la campagne dans les zones sélectionnées de la région. Les objectifs secondaires étaient de comparer le taux d’exams ophtalmologiques annuels pour les diabétiques dans différentes situations : dans les zones avec et sans dépistage mobile, dans les secteurs des médecins généralistes enseignants cliniciens ambulatoires. Enfin, nous avons spécifié l’origine de l’information ayant poussé les patients à participer au dépistage mobile.

Résultats. – Le taux des examens ophtalmologiques annuels n’a pas été modifié globalement après notre campagne de dépistage en Bourgogne (41,8 % versus 42,2 %, P =0.73). Le dépistage n’a pas eu d’influence sur la fréquence de l’examen ophtalmologique annuel que ce soit dans les zones dépistées ou dans les zones non dépistées, 43 % versus 44 % et 41 % versus 41 %, P =0.58 et P =0.99 respectivement. Pour les patients suivis par les médecins généralistes enseignants cliniciens ambulatoires, le pourcentage des visites annuelles chez l’ophtalmologiste n’a pas été modifié par la campagne de dépistage, 49 % versus 47 %, respectivement. La grande majorité des patients avaient été informés du dépistage grâce aux informations dispensées avec les relevés mensuels de l’assurance maladie délivrées par la Caisse primaire d’assurance maladie.

* Corresponding author.
E-mail address: Catherine.creuzot-garcher@chu-dijon.fr (C. Creuzot-Garcher).
1. Introduction

In the industrialized countries, diabetic retinopathy (DR) is the main cause of blindness among people aged less than 50 years [1] and the third most important cause among the elderly [2,3]. Diabetes mellitus (DM) is a common chronic disease, affecting more than two million individuals in France. The prevalence of DM was estimated to be 3%, with an incidence of 3.2%, between 1998 and 2000 in France, which works out to around 150,000 new cases of any type of DM each year [4]. In France, DR is the most common cause of irreversible blindness in those aged less than 50 years and the third most common cause in people aged more than 50 years, after age-related macular degeneration (ARMD) and glaucoma. DR blindness can usually be avoided when treatment is undertaken without delay [5–7]. Therefore, regular ophthalmological follow-up is strongly advised for DM sufferers. An annual fundus examination is recommended by official agencies such as ANAES and ALFEDIAM [8,9]. Also, non-mydriatic cameras are becoming more and more popular and have gained rapid acceptance for DR screening among eye-care professionals [10], as it allows photography of the fundus without pupil dilation by a nurse or technician who has been trained in the technique [11].

Burgundy is a region of France where DR screening rates are poor; in 2006, only 43.6% of diabetics had the recommended annual ophthalmological follow-up, according to Union régionale des caisses d’assurance maladie (URCAM; Regional Union for Health Insurance Funds). In Burgundy, the number of diabetics receiving oral antidiabetic drugs (OADs) is around 56,000, the number of general practitioners (GPs) is 2487 and the number of ophthalmologists in private practice is 96. For this reason, since 2004, a mobile DR screening programme has been implemented in the region to improve the follow-up of diabetics [12]. The main objective of the present study was to evaluate the impact of such a programme on improving the overall screening rate for DR in Burgundy. The secondary study objectives were, first, to compare the rates in the areas covered by the mobile unit and with the presence of GPs involved in teaching in medical schools and, second, to assess the role of different sources of information in improving patients’ awareness of the screening programme.

2. Patients and methods

2.1. Organization of the mobile screening site campaign

2.1.1. Determination of screening areas

Areas to be covered by the mobile screening site (MSS) programme were selected with the help of indicators such as the number of GPs per patient, distance from an ophthalmologist and whether or not it was a low-medicalized area, as defined by Regional Health Agency (Observatoire régional de la santé) criteria.

The first campaign using the MSS was undertaken from September 2004 to August 2005 in the areas thus selected. A second campaign ran from September 2005 to August 2006 in other, less rural, areas than those chosen for the first campaign and a third campaign, from September 2006 to August 2007, was carried out in the same areas as in the first campaign, but also included a regional information campaign aimed at both GPs and diabetic patients (using advertisements in regional newspapers and on regional television).

To compare the impact of mobile screening on the current ophthalmological follow-up of diabetics, areas that had access to the MSS campaign were paired with areas that did not. The selected areas also had similar numbers of available GPs.

2.1.2. Patients’ information

Before each MSS campaign, GPs were contacted by mail, while pharmacists and private-practice nurses had posters and brochures distributed to their premises. Lectures on DR were organized for GPs two weeks apart by the recruitment team and, two weeks before enrolment, a multimedia advertising campaign was undertaken, with regional coverage in newspapers and a dedicated toll-free phone number. Local and regional diabetes associations were closely involved in the project via answering the toll-free calls and the support of the major health insurance services was enlisted to disseminate flyers, which were sent directly to diabetic patients together with their reimbursement invoices from the National Health Service (NHS; Sécurité sociale; Social Security). Although only one health service was involved in 2005 (the Mutualité sociale agricole [MSA]), all of the health insurance services gave their support in 2006. Also, all patients participating in the MSS campaign had to complete a survey of their awareness of the campaign.

2.1.3. Screening for diabetic retinopathy by a mobile site

Patients were asked to fill out a questionnaire by representatives of the diabetes associations that welcomed them in the selected zones. A trained orthoptist accompanied the non-mydriatic camera installed in a truck as it visited the selected zones. The orthoptist took three photographs per patient: one nasal to the optic disc; and one temporal to the macula. The photographs were stored on a USB Flash Drive and interpreted by a certified ophthalmologist, based in the ophthalmology department of Dijon University Hospital, according to the ALFEDIAM classification [8]. Following
screening, all patients received a postal correspondence detailing the results. The letter also encouraged the patients to undergo regular ophthalmological follow-up. In addition, the patient’s referring GP was informed of the results and patients were given a list of ophthalmologists who had agreed to give them a rapid appointment if necessary.

2.1.4. Impact of continuing medical education and teaching involvement

In addition, sessions covering DR prevention and screening were directed towards GPs, offered by the orthoptist in charge of the MSS campaign and an ophthalmologist from the steering committee. The impact of such campaign-linked continuing medical education (CME) on ophthalmological follow-up of diabetic patients was also evaluated.

Teaching GPs (enseignant clinicien ambulatoire) refers to those GPs who volunteer to teach medical students in addition to their daily practice. To qualify for such a degree, GPs have to follow an initial programme of study and regularly participate in CME sessions. There are 107 teaching GPs in Burgundy and the impact of the MSS campaign on them and on the ophthalmological follow-up of diabetic patients was also evaluated.

2.2. Study objectives

The main objective of the present study was to evaluate the overall impact of mobile screening on the rate of annual eye examinations among diabetic patients before and after the campaign in selected zones (those with and without access to MSS). The secondary objectives were, first, to compare the rate of eye examinations among diabetics before and after the screening campaign, according to use of the mobile site, presence of teaching GPs in medical school and availability of CME sessions and, second, to evaluate the role of the information source on the participation of patients in the screening programme.

The main information source was the information personnalisée aux professionnels de santé (IPPS; personalized information sent to health professionals), a database created by URCAM in 2005–2006 to allow better evaluation of the follow-up of all diabetics who had received at least three prescriptions for OADs per year in Burgundy. The database also makes it possible to assess HbA1c, blood lipids, creatinine, microalbuminuria and blood sugar, as well as any prescriptions for an ophthalmological visit, dental consultation and electrocardiography.

### 3. Results

In 2005, 676 diabetic patients were screened at 39 sites and 63 (8.6%) cases of DR were found, of which five had already been diagnosed. Only 4.5% of the participants had gone for an ophthalmological visit during the year. Most of the patients had not had their eyes checked for at least 2 years, 12% for more than 5 years and 7% never.

In 2006, 1298 diabetics participated at 34 sites and 45 (3.5%) cases of DR were found. The percentage of patients who had visited an ophthalmologist during the past year was 16.4%, while 33% had gone for a visit during the past 1–2 years and 33% had made a visit during the past 2–5 years. The others had not visited an ophthalmologist for more than 5 years or had never made such a visit.

#### 3.1. Impact of the mobile screening site programme on overall ophthalmological follow-up

The overall rates of ophthalmological follow-up did not increase as a result of the campaign from 2005 to 2006 in selected areas (42.2% vs 41.8%, respectively; \( P = 0.73 \); Table 1). The GPs could not be strictly paired, as the number of GPs in the non-screened areas was greater than in the screened areas (152 vs 97, respectively). This, however, was not surprising, as the areas screened by MSS were selected because of their lower rates of GPs per population. However, as the number of diabetic patients increased in the non-screened areas, the ratio of diabetics to GPs was, in fact, similar (Table 2).

On looking only at the areas covered by mobile screening, the number of ophthalmological visits recorded in the IPPS database had decreased slightly from 2005 to 2006 (44.0% vs 43.0%, respectively; \( P = 0.58 \); Table 3). In the non-screened paired areas, the percentage was identical at 41% (\( P = 0.99 \); Table 4).

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigated via</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the IPPS (n)</td>
<td>8661</td>
<td>10.574</td>
<td></td>
</tr>
<tr>
<td>Diabetics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who visited an</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ophthalmologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 1 year (n)</td>
<td>3653</td>
<td>4419</td>
<td></td>
</tr>
<tr>
<td>Diabetics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who visited an</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ophthalmologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 1 year (%)</td>
<td>42.2</td>
<td>41.8</td>
<td>0.73</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Screened areas with mobile sites</th>
<th>Paired non-screened areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPs (n)</td>
<td>Diabetics (n)</td>
</tr>
<tr>
<td>Côte d’or</td>
<td>15</td>
</tr>
<tr>
<td>Nièvre</td>
<td>35</td>
</tr>
<tr>
<td>Saône-et-Loire</td>
<td>23</td>
</tr>
<tr>
<td>Yonne</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
</tr>
</tbody>
</table>
Table 3
Rate of annual ophthalmological visits among diabetics, according to the information personnalisée aux professionnels de santé (IPPS) database, in screened areas.

<table>
<thead>
<tr>
<th></th>
<th>Screened areas</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2006</td>
</tr>
<tr>
<td>Diabetics according to the IPPS (n)</td>
<td>3407</td>
<td>4226</td>
</tr>
<tr>
<td>Diabetics who visited an ophthalmologist within 1 year (n)</td>
<td>1499</td>
<td>1817</td>
</tr>
<tr>
<td>Diabetics who visited an ophthalmologist within 1 year (%)</td>
<td>44.0%</td>
<td>43.0%</td>
</tr>
</tbody>
</table>

Table 4
Rate of annual ophthalmological visits among diabetics, according to the information personnalisée aux professionnels de santé (IPPS) database, in non-screened areas.

<table>
<thead>
<tr>
<th></th>
<th>Paired non-screened areas</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2006</td>
</tr>
<tr>
<td>Diabetics according to the IPPS (n)</td>
<td>5254</td>
<td>6346</td>
</tr>
<tr>
<td>Diabetics who visited an ophthalmologist within 1 year (n)</td>
<td>2154</td>
<td>2602</td>
</tr>
<tr>
<td>Diabetics who visited an ophthalmologist within 1 year (%)</td>
<td>41.0%</td>
<td>41.0%</td>
</tr>
</tbody>
</table>

3.2. Patients’ awareness of the campaign

In 2005, the local newspapers were the most effective medium for informing patients of the mobile screening campaign (52.8%). At that time, GPs also played an active role (21.6%), whereas the flyers sent with the reimbursement invoices were mentioned by only 16.6% of patients (but bear in mind that, in 2005, only one health insurance service had agreed to participate in the advertising campaign). However, in 2006, the flyers were the most often reported information medium (65.8%), followed by newspapers and local radio stations (21.4%), GPs (11.3%) and pharmacists (2.5%).

3.3. Prescription profile for teaching general practitioners

The rates of prescriptions for ophthalmological visits in zones with teaching GPs were higher in both 2005 and 2006 (49% and 47%, respectively) than the rate (42%) observed in zones without teaching GPs, whether the areas were screened or not. However, the difference was not statistically significant.

3.4. Potential role of continuing medical education sessions

The number of ophthalmological visits, according to the IPPS database, did not appear to be influenced by CME sessions, but was highly dependent on site (Table 5). Indeed, at two sites (Paray le Monial and Louhans), the number of prescribed ophthalmological visits decreased in 2006 compared with 2005.

4. Discussion

DR remains a major complication of DM [2] and its prevalence is dependent on the duration of the disease [13]. A study conducted in England showed that, from a baseline level of 37%, after 12 years, the prevalence of DR was 70% among diabetic patients [14]. In 1999 and 2000, the Caisse nationale d’assurance maladie des travailleurs salariés (CNAMTS; National Health Insurance Fund for Salaried Workers) undertook two surveys to evaluate the management of type 2 diabetes and to assess how the recommendations of ANAES were being followed in clinical practice. In fact, they found that the management of type 2 diabetics was not optimal, as 59% of patients had no assessment of glycated haemoglobin, 61% had not undergone an eye examination and 89% had no microalbuminuria assessment. However, when the recommendations of the NHS were followed by GPs, prescriptions for HbA1c and microalbuminuria increased by 33% and 32%, respectively, while ophthalmological visits increased by 6% [15].

The Échantillon national témoin représentatif des personnes diabétiques (ENTRED) study also revealed the following: 32% of GPs were not aware of the retinal status of their patients; and only 43% of patients reported visiting an ophthalmologist within the year. As most diabetics (86% and 29% for diabetes type 2 and 1, respectively) are followed by their GPs with no referrals to an endocrinologist [16], the ideal target for improving patients’ follow-ups is their GP [17].

4.1. The mobile screening site campaign in Burgundy

The MSS programme was initially set up at the end of 2004 [12] and its feasibility has been carefully scrutinized. A survey was conducted among the 76 GPs working in rural areas and the 96 ophthalmologists in private practice in Burgundy. The response rates were 33% for GPs and 42% for ophthalmologists and their opinion of the campaign was good in 88% and 76% of the GPs and ophthalmologists, respectively. All responders volunteered to examine any diabetic patients presenting with an
eye disorder within 1 month, a benefit taken advantage of by 80% of patients after the MSS campaign.

A DR prevalence of 8.6% was found in the first campaign [12] and 3.5% in the second, although—due to better organization—we doubled the number of screened patients. The difference, however, could have been because we had specifically selected less medicalized areas in Burgundy for the first year of the campaign.

4.2. Impact of the mobile screening site campaign on ophthalmological follow-up in all diabetics in Burgundy

The observed impact of the MSS programme was disappointing overall, as there was no increase in the proportion of diabetics who went for an annual ophthalmological visit whether or not the zones had access to mobile screening, according to the IPPS. However, it would have been interesting to compare our rates of ophthalmological visits with those in a part of the country far from our region and with no media campaign for DR screening.

The information campaign linked to the MSS programme also had no influence on the results. However, we acknowledge that the IPPS was not the most appropriate database for evaluating the effect of mobile screening. In fact, only a small percentage of patients with DR, unreadable photographs and/or a previous ophthalmological visit more or equal to 2 years before DR screening were supposed to see an ophthalmologist urgently. In addition, it was impossible to accurately determine if the visit to the ophthalmologist was prescribed by the GP or prompted by the patient on his own. These biases may have underestimated the true rate of ophthalmological follow-up.

These results highlight the active role of GPs in 2005 in alerting their patients to the screening campaign. However, as the IPPS cannot determine how many ophthalmological visits were ordered by a GP, the true impact of education remains controversial. However, the present study did attempt, even with such an imperfect tool, to determine whether or not the annual ophthalmological follow-up might be improved by more education, although this was clearly not the case with CME sessions dedicated to DR. Nevertheless, the higher rate of prescribed visits to an ophthalmologist (albeit not statistically significant) among the teaching GPs is encouraging, although it remains impossible to precisely determine the original prompt of such visits.

Furthermore, it may be hypothesized that some patients considered mobile screening as a substitute for the annual recommended ophthalmological visit. To address this possibility, a letter was always sent to the screened patients to explain that the annual visit was mandatory in spite of screening. However, this bias could have reduced the rate of reported ophthalmological visits in the IPPS.

4.3. Why is the management of diabetic patients difficult?

At least initially, diabetes—and particularly its eye involvement—is an essentially symptom-free disease, which means that patients may not realize that an annual eye examination, even in the absence of any specific complaint, is mandatory [15]. Also, even when the GP requests that the patient sees an ophthalmologist, the long delay until such a visit is often responsible for the frequently missed appointments. This trend is likely to become worse in future, as it is estimated that, by 2020, the number of GPs will decrease by 14%, while the number of specialists will drop by 27%, including ophthalmologists, who have an anticipated decrease of 48% [18]. In addition, there is a growing increase in the prevalence of DM in the French population [19]. As there are now around two million diabetics and about 55,000 GPs, it can be estimated that, on average, one GP takes care of 22–36 diabetic patients. If we consider that these patients need four consultations per year, the number of such visits alone (90–150) represents only a small proportion of the annual number of consultations carried out by a GP, which ranges from three to 7000 per year. Diabetic consultations are ranked eleventh among GP consultations and represent only 1.6% of the GP’s routine activities.

Often, the ophthalmological follow-up of diabetics is incomplete and one of the aims of DR screening is to improve the quality of this follow-up [20]. Through advertisements in the media, we have attempted to give diabetic patients a better awareness of their disease and its complications; we have also facilitated their access to an ophthalmologist when necessary. However, based on the results of the present study, the impact of a screening campaign on the quality of ophthalmological follow-up among diabetics in the selected region was minimal and probably needs more time to be properly assessed.

4.4. How can screening for diabetic retinopathy be improved?

As for how well the official recommendations—published since 1990—have been followed, the results are disappointing as, 20 years later, the screening rate for DR remains barely 50%. The impact of the screening campaign on GP behaviour and prescriptions, as revealed in the present study, also appears to be disappointing, although the overall results are better among teaching GPs. The present results are also in agreement with those of the French NHS, obtained in 1999, 2000 and 2001, with rates of 39.6–40% for an annual ophthalmological visit. Indeed, it is also difficult to convince patients to attend regular ophthalmological follow-up visits when they already have to struggle with the many difficulties of daily life such as unemployment [16]. However, when national agencies become actively involved, the participation of patients appears to be higher, as was shown in the present study by the use of flyers sent with reimbursement invoices. This leads to speculation as to whether or not a more regulated system would yield a better screening rate, given the fact that a national programme undertaken in England, which involved an obligatory eye appointment led to an 80% overall screening rate [21].

The present study has several weaknesses that must be acknowledged. In addition to the already mentioned low precision of the IPPS database, it also fails to include non-treated diabetic patients or those treated with insulin and does not take into account diabetics followed-up in public institutions. In addition, all prescriptions (for drugs or HbA1c values) made during
hospitalization and the fundus examinations made during the screening campaign were not included in the results. A further point is the assumption that every visit to the ophthalmologist leads to a fundus examination, although this is not always the case.

Thus, to increase the rate of ophthalmological follow-up among diabetic patients, two main targets come to mind. The first is to improve the awareness of diabetic patients of the importance of regular ophthalmological follow-ups. The results of our study clearly show that the involvement of the NHS is crucial, as the majority (65.8%) of patients were informed of the screening programme through flyers sent by the NHS. The possible roles played by information disseminated through the national and local multimedia, as well as by advertisements linked to the MSS programme, probably need more time to make an impact. The second target is to encourage the involvement of GPs in the ophthalmological follow-up of their patients. Recommendations from national agencies and teaching programmes organized during the various screening campaigns, led to an anecdotal increase in the rate of ophthalmological follow-up of our diabetic patients. This suggests an urgent need for strongly encouraged—if not mandatory—ophthalmological follow-up of all diabetic patients and the involvement of the NHS, to achieve a higher rate of annual DR screening.

5. Conclusion

Screening for diabetic eye complications cannot be a substitute for regular visits to an ophthalmologist. To reach the ideal 100% rate of screening for DR, all of the available tools need to be used. Screening (whether mobile or not) and information linked to such campaigns can improve the current rate, but is likely to take some time to be effective. The participation of the NHS in advertising such a screening campaign, as well as the organization of a regulated annual screening programme, are also pivotal key issues.

Conflict of interest

The authors have no proprietary or financial interest in the products mentioned in this study.

Acknowledgments

The authors wish to thank the following organizations for their help in the present study: the Federation of Diabetic Associations of Burgundy (Fédération des associations de diabétiques de Bourgogne), available at http://bourgogne-diabete.com; the Regional Union of Health Insurance Funds (Union régionale des caisses d’assurance maladie), available at http://www.bourgogne.assurance-maladie.fr/bourgogne.0.html; and the Regional Union of Private Physicians of Burgundy (Union régionale des médecins libéraux de Bourgogne), available at http://www.urmlbourgogne.org.

References