Prevalence and determinants of comprehensive eye care in a group of patients with diabetes: a cross-sectional study in a sub-Saharan African setting

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Abstract

Objectives: We aimed to investigate the determinants of comprehensive eye examination in diabetes patients. We conducted a cross-sectional study at the eye department of the Douala General Hospital. Adult patients with diabetes were consecutively interviewed on the history of their diabetes. Main outcomes were a first ever comprehensive eye examination including fundoscopy, and diagnosis-to-fundoscopy time.

Results: 52 patients were included of whom 59.6% were males with a mean age of 55.9 ± 10.9 years. 51.9% have had counselling on the risk of visual impairment and blindness due to diabetes, and 61.5% [95% CI 47–74.7] have had a comprehensive eye examination. Of those with a first ever fundoscopy, only 21.9% had the test performed within 1 year of diagnosis. Thus, after an average of 10 years of the diagnosis of diabetes, 13.5% (7/52) of patients have had a comprehensive eye examination within 1 year of diagnosis. Only dose with duration of diabetes of more than 10 years were 7–24 times more likely to have a comprehensive eye examination. In summary, patients with diabetes in this low-income setting do not receive a comprehensive eye care as recommended. Most patients will get an eye examination at least 10 years after the diagnosis of diabetes.

Keywords: Diabetes, Eye, Fundoscopy, Sub-Saharan Africa

Introduction

Diabetes has reached epidemic proportions with the greatest burden on low-to-medium income settings [1], where it is under-diagnosed, under-investigated, and under-treated [2]. For instance, it affects about 6.5% of adults Cameroonian [3]. This high disease burden is associated with low availability of investigation tests and essential medicines for the management of diabetes [4]. This translates into high rates of vascular complications which occurs early in the course of the disease [5], and which carries a high morbidity and mortality. Thus, after 6 years of diagnosis of diabetes in low-income settings, about 40% of patients with type 2 diabetes have diabetic retinopathy, of whom 15–17% have sight threatening retinopathy [5, 6]. Prevention of diabetic retinopathy and diabetes related blindness requires strict control of risk factors, regular eye checks with timely laser therapy [7]. Most patients with diabetes in low-income settings are first cared for by primary care physicians. There is evidence of a gap in the diagnosis and management of diabetes in low-income settings [2]. However, evidence on the standard of care to prevent diabetes related blindness, as well as the determinants of standard care are lacking in low-income settings. We report on the prevalence and determinants of comprehensive eye care in a group of patients with diabetes in a sub-Saharan African (SSA) setting.
Main text

Study design and setting

This was a cross-sectional study in the eye department of the Douala General Hospital between August and September 2006. It is a tertiary centre in the economic capital of Cameroon (a low-income setting located in sub-Saharan Africa), with a catchment population of over three million inhabitants. The eye department of this hospital served as the reference centre for entire Country and the sub region in terms of retinal pathologies, and likely to receive patients from all walks of life.

Participants were adult patients aged ≥ 18 years, of both sex having diabetes (type 1 or 2), who gave their informed consent. Pregnant women were excluded.

Measurements

Before the comprehensive eye examination, each patient was interviewed using a standard questionnaire. The questionnaire used in this study was designed specifically for this study and was not pre-tested. Information registered are presented in Additional file 1. Patients then underwent a comprehensive eye examination. Outcome: The main outcome was a first ever comprehensive eye examination or at least a dilated fundus examination. The secondary outcome was having been counselled on the risk of visual impairment and blindness due to diabetes. Possible determinants of having an eye examination were age, sex, residence, duration of diabetes, health insurance, level of education, sector of activity, treating physician, counseled on diabetes complications, associated hypertension, difficulties to reach the eye clinic, low visual acuity.

Sample size and power

With an estimated catchment population of three million, an expected prevalence of diabetes to be 5.4 and 80% power, and an accepted error of 5%, the estimated number of participants needed for the descriptive study was 78.

Statistical analysis

Data were analyzed using Epi-Info version 7. Baseline characteristics are presented by sex. Continuous variables are presented as mean ± standard deviation (SD), and discrete variables as frequencies and percentages, with their 95% confidence intervals. To calculate potential determinants (unadjusted Odds) for the first ever comprehensive eye examination, all variables were categorized. Chi squared test or Fisher exact test was used where appropriated to test for statistical significance. A two-sided P < 0.05 was considered statistically significant.

Results

A total of 52 (67% of expected) patients were included in the study, of whom 31 (59.6%) were males. Their mean age was 55.9 ± 10.9 years, and ranged from 20 to 84 years. Baseline characteristics are summarized in Table 1. Most of the patients had type 2 diabetes (92.3%) that has been evolving for about 10 years. Most patients had secondary school level of education (38.5%) and lived in Douala (69.2%). Only nine (17.3%) had health insurance. The treating physician who referred the patient for eye examination was a diabetologist in 53.9% of cases. Most of the treating physicians also lived in Douala (73.1%).

The main outcome is summarized in Table 1. About half of the patients (51.9%) have had counseling on the risk of visual impairment and blindness due to diabetes, and 32 (61.5%) have had a comprehensive eye examination. Of those with a first ever fundoscopy, 7 (21.9%) had the test performed within 1 year, and 25 (78.1%) had the test performed after 1 year of diagnosis. Thus, after an average of 10 years of the diagnosis of diabetes, 13.5% (7/52) of patients have had a comprehensive eye examination within 1 year of diagnosis. All fundoscopy was performed by an ophthalmologist. The possible determinants of a comprehensive eye examination are summarized in Table 2. Only those with diabetes duration of more than 10 years were 7–24 times more likely to have a comprehensive eye examination. Those who admitted having no problem to seek comprehensive eye care were less likely to have a fundoscopy done. The main difficulties faced by patients in seeking eye care are summarized in Fig. 1. This is mostly due to the cost of healthcare, transportation, feeding and lodging. This was followed by lack of physical assistance (often a relative) to the Hospital.

Discussion

This study aimed to determine the prevalence and determinants of a comprehensive eye examination in a group of patients with diabetes in Cameroon. About 60% of the patients have had a comprehensive eye examination, and only about a fifth of these had an eye examination within the first year of diagnosis of diabetes. The duration of diabetes (more than 10 years) was associated with a 7–24 times more likely to have a comprehensive eye examination.

Most of the patients who presented for screening and/or treatment for sight threatening retinopathy were seen by internists/diabetologists. Similar findings of the likelihood of referral by internists were reported by several studies [8, 9]. Few general practitioners (who make up the
bulk of the primary care physicians) refer patients with diabetes for eye examination. Similar findings in several studies showed that a significant number of primary care physicians do not follow the recommended guidelines set forth for diabetic eye care [9–13]. The findings suggest that general practitioners in this low-income setting lack awareness on the natural history of diabetic retinopathy, and of the success of current treatment. A similar finding was reported by Edwards [12].

The rate of awareness of the ocular complications of diabetes is low in this group of patients (51.92%) compared to that reported by Tapp et al. [14] in Australia, who found that 90% of participants were aware that diabetes was associated with visual impairment and blindness. This could be due to the implementation of

|                | Overall (N = 52) | Male (n = 31) | Female (n = 21) | P value |
|----------------|------------------|---------------|-----------------|---------|
| Mean age (years) | 55.9 ± 10.9      | 54 ± 9.8      | 58.7 ± 12       | 0.128   |
| Type 2 diabetes, % | 92.3             | 96.8          | 85.7            | 0.144   |
| Mean duration of diabetes (years) | 9.5 ± 7.7        | 10.6 ± 8.6    | 7.8 ± 5.8       | 0.199   |
| Level of education, % |                  |               |                 |         |
| None            | 7.7              | 3.2           | 14.3            | 0.144   |
| Primary         | 30.8             | 25.8          | 38.1            | 0.350   |
| Secondary       | 38.5             | 41.9          | 33.3            | 0.536   |
| University      | 23.1             | 29            | 14.3            | 0.221   |
| Health insurance, yes, % |        |               |                 | 0.637   |
| Primary         | 44.2             | 22.6          | 76.2            | <0.001* |
| Secondary       | 11.6             | 19.4          | 0               | 0.034*  |
| Tertiary        | 44.2             | 58            | 23.8            | 0.016*  |
| Treating physician, % |              |               |                 |         |
| Diabetologist   | 53.9             | 45.2          | 66.7            | 0.131   |
| General practitioner | 28.9          | 41.9          | 9.5             | 0.012*  |
| Others          | 17.3             | 12.9          | 23.8            | 0.313   |
| Reference to eye clinic, % |          |               |                 |         |
| Treating physician | 53.9          | 41.9          | 71.2            | 0.040   |
| Ophthalmologist | 23.1             | 35.5          | 48              | 0.011*  |
| Advised to consult | 9.6            | 12.9          | 48              | 0.336   |
| Self-consultation | 13.5            | 9.7           | 19.1            | 0.335   |
| Eye care counselling (yes), % |        |               |                 | 0.542   |
| Dilated fundoscopy (yes), % | 61.5         | 67.7          | 52.4            | 0.271   |
| Number of fundoscopy, % |              |               |                 |         |
| None            | 38.5             | 32.3          | 47.6            | 0.271   |
| One             | 19.2             | 22.6          | 14.3            | 0.461   |
| Two             | 15.4             | 16.1          | 14.3            | 0.861   |
| More than two   | 26.9             | 29            | 23.8            | 0.681   |
| Referral time to actual consultation (weeks), % |          |               |                 |         |
| < 2             | 80.8             | 87.1          | 71.4            | 0.163   |
| > 2             | 11.5             | 9.7           | 14.3            | 0.614   |
| Unknown         | 7.7              | 3.2           | 14.3            | 0.144   |
| Reaction to risk of blindness, % |          |               |                 |         |
| Worried         | 36.5             | 38.7          | 33.3            | 0.694   |
| Indifferent     | 48.1             | 48.4          | 47.6            | 0.995   |
| Can’t tell      | 15.4             | 12.9          | 19.1            | 0.547   |
| Low visual acuity (VA < 3/10), % | 42.3           | 41.9          | 42.9            | 0.944   |

Data are mean ± standard deviation, level of significance set at p < 0.05
* Significant difference
education and awareness programs for diabetic retinopa-
thy, and developing the role of primary care providers in
screening for retinopathy in Australia [15]. This suggests
that existing education and awareness strategies be rein-
forced with primary care providers occupying key role in
our milieu.

A high proportion of patients (78.13%) had their first
dilated fundus examination > 2 years after the diagnosis
of diabetes, a rate far higher than that reported by Tapp
et al. [14], who found 23%. We recommend the education
of non-ophthalmologist to detect and to appropriately
refer patients who are at risk for vision loss, as suggested
by Awh et al. [16].

Health insurance status was not related to the patients’
ability to afford for quality health care.

In summary, patients with diabetes in this low-income
setting in SSA do not receive a comprehensive eye care as
recommended. Most patients will get an eye examination
at least 10 years after the diagnosis of diabetes. The cause
of this sub-optimal care is probably multifactorial, from
lack of awareness on the part of the primary care physi-
cians, to high cost of healthcare and associated ill-health
on the part of the patients. Findings of this study revealed
that most of diabetes patients have an important delay in
eye examination. Considering the prevalence of this dis-
order in our context and importance of eye examination
in detecting and diagnosis diabetes eye complications,
such delay is worrying and must addressed. This will first
required more studies with greater sample size which
can investigate both determinants and outcomes of com-
prehensive eye examinations in order to find if there is a
relation between this delay in eye examination and diabe-
tes eye complications in these patients even. Considering
the fact that diabetes eye examination can progress insid-
iously and given that eye examination is the only method
to detect or diagnose such condition, it seems obvious
that this delay in eye examination may influence develop-
ment of eye complication but this need to be assessed by
further studies. Also, measures must be taken to increase
awareness of general population, diabetes individuals and
general practitioners on the importance of having a com-
prehensive eye examination as soon as diagnosis is made
or at least within 1 year as recommend.

Limitations
Our findings should be interpreted in the light of the
limitations. The sample size was small (less than 80% of
expected), thus underpowered to detect statistically sig-
nificant risk for not having a comprehensive eye exami-
nation. Also, this study was a specialist hospital based,
and does not represent the general population of patients
with diabetes. Thus, the proportion of those with eye
examination reported could be overestimates. Despite

### Table 2 Determinants of a comprehensive eye examination

|                          | Unadjusted odds ratio | 95% confidence interval | P value |
|--------------------------|-----------------------|-------------------------|---------|
| Age (years)              |                       |                         |         |
| ≤ 50                     | 1                     | 1.00                    | 1.00    |
| 50–60                    | 2                     | 0.47–8.49               | 0.467   |
| > 60                     | 0.59                  | 0.14–2.42               | 0.502   |
| Sex                      |                       |                         |         |
| Female                   | 1                     | 1.00                    | 1.00    |
| Male                     | 1.91                  | 0.61–5.97               | 0.264   |
| Duration of diabetes (years) |                   |                         |         |
| 0–5                      | 1                     | 1.00                    | 1.00    |
| 5–10                     | 2                     | 0.45–8.9                | 0.458   |
| 10–15                    | 7                     | 1.1–44.6                | 0.046*  |
| > 15                     | 24                    | 2.5–230.7               | 0.004*  |
| Diabetologist physician  |                       |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 0.67                  | 0.23–2.07               | 0.250   |
| Counselling on risk of blindness |                 |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 1.13                  | 0.37–3.5                | 0.526   |
| Concerned about blindness |                       |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 1.6                   | 0.49–5.2                | 0.558   |
| Health insured           |                       |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 2.52                  | 0.47–13.58              | 0.239   |
| Level of education       |                       |                         |         |
| None                     | 1                     | 1.00                    | 1.00    |
| Primary                  | 1.29                  | 0.14–11.5               | 1.00    |
| Secondary                | 2.33                  | 0.26–20.7               | 0.578   |
| University               | 1.4                   | 0.08–13.6               | 1.00    |
| Douala resident          |                       |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 1.38                  | 0.41–4.57               | 0.412   |
| Sector of activity       |                       |                         |         |
| Primary                  | 1                     | 1.00                    | 1.00    |
| Secondary                | 3.85                  | 0.39–38.6               | 0.362   |
| Tertiary                 | 1.19                  | 0.37–3.9                | 1.00    |
| Low visual acuity (VA < 3/10) |             |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 2.33                  | 0.71–7.6                | 0.279   |
| Hypertension             |                       |                         |         |
| No                       | 1                     | 1.00                    | 1.00    |
| Yes                      | 1.11                  | 0.35–3.5                | 1.00    |
| Difficulties to consult at eye clinic |             |                         |         |
| Yes                      | 1                     | 1.00                    | 1.00    |
| No                       | 0.3                   | 0.09–0.97               | 0.050   |

Data are mean ± standard deviation, level of significance set at P < 0.05
* Significantly modified the risk of having comprehensive eye care examination
these shortcomings, we provide baseline data for future large scale and community research. Also, our data was derived from patients so as to reduce reporting bias with the physician approach. However, there is a high risk of recall bias with this approach.

**Additional file**

**Additional file 1.** Questionnaire.

**Abbreviations**

SSA: sub Saharan Africa; WHO: World Health Organization.

**Authors’ contributions**

Conception and design: CEM, AMJ. Data collection: CEM, AMJ. Data analysis and interpretation: AMJ, JRN, JJN, Nansseu JRN, Wang B, Kingue S, et al. Access to diagnostic tests and essential medicines for cardiovascular diseases and diabetes care: cost, availability and affordability in the West Region of Cameroon. BMC Endocr Disord. 2015;15:18.

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**Competing interests**

The authors declare that they have no competing interests.

**Availability of data and materials**

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Consent for publication**

Not applicable.

**Ethics approval and consent to participate**

This study was performed in accordance with the guidelines of the Helsinki Declaration and was approved by the Institutional Research Ethical Committee of the Faculty of Medicine and Biomedical Sciences of Yaoundé and by the institutional review board of the Yaoundé Central Hospital of Cameroon. All participants provided written informed consent.

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**Additional file**

**Additional file 1.** Questionnaire.