DIABETICMedicine

DOI: 10.1111/j.1464-5491.2012.03760.x

Short Report: Health Economics

Diabetes self-risk assessment questionnaires coupled with a multimedia health promotion campaign are cheap and effective tools to increase public awareness of diabetes in a large Chinese population

Y. L. Zhang[1], W. G. Gao[1], Z. C. Pang[2], J. P. Sun[2], S. J. Wang[2], F. Ning[1], X. Song[1], A. Kapur[3] and Q. Qiao[1]

[1]Department of Public Health, Hjelt Institute, University of Helsinki, Helsinki, Finland, [2]Department of Non-Communicable Disease Prevention, Qingdao Municipal Centre for Disease Control and Prevention, Qingdao, China and [3]World Diabetes Foundation, Gentoft, Denmark

Accepted 18 July 2012

Abstract

Aims To evaluate costs and effectiveness of implementing a diabetes self-risk assessment (Diabetes Risk Score) questionnaire coupled with a multimedia health promotion campaign on changes in diabetes awareness in a large diabetes prevention programme.

Methods Between 2007 and 2010, a multimedia health promotion campaign was conducted targeting the 1.94 million population of Qingdao, China, using newspapers, radio programmes, distribution of free booklets and Diabetes Risk Score flyers. Diabetes awareness questionnaires filled out by people first interviewed in 2006 (survey A), before the initiation of the campaign, were compared with those first interviewed between 2007 and 2010 during the campaign period (survey B). The rates of diabetes awareness in both surveys were studied amongst adults aged 35–74 years without a prior history of diabetes, but with a Diabetes Risk Score of ≥ 14.

Results In survey B, 85, 82 and 76% of the urban participants correctly recognized obesity, family history of diabetes and physical inactivity, respectively, as important risk factors for diabetes; while the awareness rates were 43, 46 and 25%, respectively, in survey A ($P < 0.001$). The corresponding figures among rural participants were 65, 63 and 53% in survey B and 29, 22 and 11% in survey A ($P < 0.001$). To cover 1000 individuals, the programme spent €5.4 on the use of the Diabetes Risk Score flyer, €31.3 on the education booklet, €7.7 on the newspaper campaign and €37.5 on radio programmes.

Conclusions The combination of a Diabetes Risk Score questionnaire with a multimedia health promotion campaign is a cheap and effective health promotion tool to raise public awareness of diabetes.

Diabet. Med. 29, e425–e429 (2012)

Introduction

The prevalence of Type 2 diabetes is increasing rapidly in mainland China. Education and lifestyle intervention has been considered to be the most cost-effective way to fight the epidemic of Type 2 diabetes and obesity [1,2].

To increase public awareness of diabetes and address health promotion and prevention, a population-based health promotion campaign using multimedia and identification of high-risk individuals by a simple Chinese Diabetes Risk Score has been carried out in Qingdao under the framework of a lifestyle intervention programme for diabetes—the Qingdao Diabetes Prevention Program—between 2006 and 2010 [3]. The aim of the current study is to evaluate changes in diabetes awareness and performance of different education strategies in terms of the total costs, efficiency (cost per individual exposure to education strategy) and effectiveness (changes in diabetes awareness).

Correspondence to: Zhang Yanlei. E-mail: yanlei.zhang@helsinki.fi

Patients and methods

Study population

As shown in the Supporting Information (Fig. S1), survey A is a random population-based cross-sectional survey for diabe-

tes, which has been described in detail in our previous publication [4]; survey B is a part of a lifestyle intervention programme for diabetes [3]. A Chinese Diabetes Risk Score [5] was applied to both surveys and individuals aged 35–74 years without a prior history of diabetes but with a Diabetes Risk Score ≥ 14 are included in the current data analysis. Diabetes awareness was measured during the first interview by questionnaires containing diabetes risk factors such as obesity, family history of diabetes and physical inactivity.

Under the Qingdao Diabetes Prevention Program framework, we published 34 educational articles in *Qingdao Morning*, a local newspaper, and broadcast a 30-min radio programme about healthy lifestyle and prevention of diabetes every Monday at 12.00 h between September 2006 and 2009. In addition, we distributed 724 130 educational booklets (57 pages) containing information about diabetes diagnosis, prevalence, risk factors, complications, prevention strategies, healthy diets, physical activity, etc., to each family. The booklet also contained the Diabetes Risk Score sheet. Another 535 870 single Diabetes Risk Score flyers were distributed to citizens through primary care doctors and nurses, schoolchildren, volunteers and during public events, including walks to mark World Diabetes Day.

Main outcome measures

The main outcome measures were the changes in public awareness of diabetes before and after the health promotion campaign, the total costs of each education tool, and the number of individuals covered by each education tool in relation to the whole population covered by the Qingdao Diabetes Prevention Program.

Changes in diabetes awareness were measured based on answers recorded in the diabetes awareness questionnaire in both surveys. Obesity, family history of diabetes and physical inactivity as major risk factors were included in both questionnaires and were counted and compared in this study as markers of change in diabetes awareness.

The direct costs of each education tool were collected from the actual expenditures in the project. The costing has two elements: (1) quantities of resources used and (2) unit price.

To estimate the number of individuals exposed to different education strategies, we interviewed 90 randomly selected adults from a suburban area in Jiaonan district in July 2011. They were asked whether their families subscribed to the *Qingdao Morning* newspaper during the period of 2007–2010, or whether they had ever listened to a radio programme on lifestyle and diabetes, or had ever received a booklet on diabetes or a Diabetes Risk Score flyer.

Statistical analysis

The *t*-test was used to compare differences in means and the χ^2-test for differences in proportions. All statistics were performed using Predictive Analytics SoftWare (PASW) statistics (version 18.0.2; SPSS Inc., Chicago, IL, USA), with statistical significance defined as a two-tailed $P < 0.05$.

Results

Compared with the participants in survey A, those in survey B were older, had a lower waist circumference and fewer reported incidences of a positive family history of diabetes (see also Supporting Information, Table S1).

Changes in diabetes awareness

Overall, in survey B, 85, 82 and 76% of the urban participants correctly recognized obesity, family history of diabetes and physical inactivity, respectively, as important risk factors for diabetes; while the awareness rates were 43, 46 and 25%, respectively, in survey A ($P < 0.001$). The corresponding figures among rural participants were 65, 63 and 53% in survey B and 29, 22 and 11% in survey A ($P < 0.001$). The rates of awareness were higher in survey B than in survey A, irrespective of age, gender and place of residence (urban/rural) (see also Supporting Information, Table S2). Although the levels of diabetes awareness were higher in 2010 (survey B) than in 2007 (survey A) (Fig. 1), there was no significantly increasing trend noted between 2007 and 2010. A slump was observed in 2009 and was more noticeable in the rural population (Fig. 1). The change in awareness level is indeed impressive given the fact that a significantly higher number of people in survey A compared with survey B had a known family history of diabetes and thus were more likely to be expected to be aware of diabetes and its risk factors (see also Supporting Information, Table S1).

Costs and coverage of different education strategies

The total direct costs of media education and printed materials were €60 262 and €29 100, respectively. Based on the results of the interview to assess the reach of each tool used in the project, the exposure rate to the newspaper in the suburban area was 34%, to the radio programme was 33%, the booklet 83% and the single Diabetes Risk Score flyer 56%. To cover 1000 individuals, the cheapest way was to distribute Diabetes Risk Score flyers, followed by the newspaper, booklets and the radio programme (Table 1).

Discussion

Creating awareness and providing knowledge about the risk factors, prevention of and care for diabetes are very important tools and fundamental building blocks to address the diabetes epidemic. Many approaches can be used to achieve these objectives, but it is important to assess their relevance and cost-effectiveness in the settings in which they are applied. We evaluated the costs and performance of the various multi-

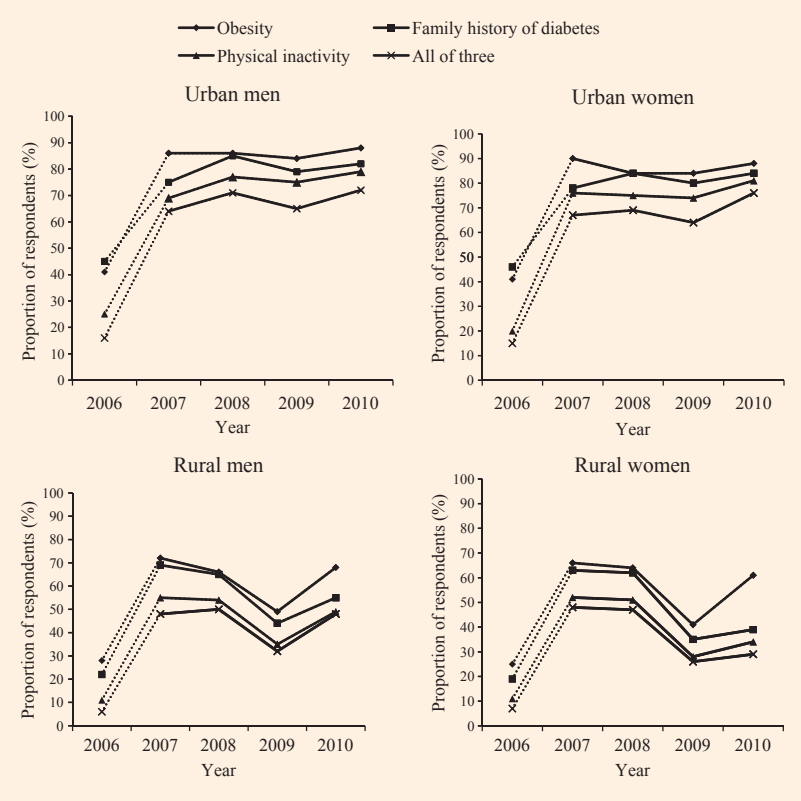

FIGURE 1 Awareness (%) of major diabetes risk factors according to years of first interview.

media tools being used in the Qingdao Diabetes Prevention Program in sensitizing and raising public awareness. A significant improvement in public awareness on obesity, physical inactivity and family history of diabetes, which have a major bearing on Diabetes Risk Score, has been achieved since the start of the Qingdao Diabetes Prevention Program amongst citizens living in both the urban and rural areas covered by the project. Per thousand people reached, the diabetes self-risk assessment questionnaire incurred the lowest costs.

Many different strategies have been used to improve public knowledge and awareness of diabetes, such as online education [6], group education [7], etc. Although these education strategies were effective, they are relatively expensive and require substantially more human resources for implementing a large-

Table 1 Coverage and expenditures of different education means among the 1.94 million population under the Qingdao Diabetes Prevention Program framework

Educational means	Unit cost (€*)	No. of delivery	Total costs	Coverage‡ (%)	Estimated no. of individual exposure	Expenditure (€) per 1000 individuals
Diabetes Risk Score	3/1000 sheets	1 260 000	3780	56	705 600	5.4
Booklet	78/per 1000 booklets	724 130	56 482	83	1 803 084†	31.3
Newspaper	150/per article	34	5100	34	659 600	7.7
Radio	200/time	120	24 000	33	640 200	37.5

*1 euro (€) = 10 renminbi (RMB) (¥).
†Estimated that one booklet can cover *c.* 3 family members, which is the average family size in Qingdao based on the Sixth National Census in 2010.
‡Assumed as the mean value for the whole area.

scale population-based approach. For a large-scale public health promotion project such as the Qingdao Diabetes Prevention Program, an earlier study [8] showed that a mass media campaign is effective in increasing public awareness and knowledge of diabetes, but no study has assessed the relevance or compared the cost-effectiveness of different strategies.

From 2007 to 2010, the Qingdao Diabetes Prevention Program conducted additional multimedia education programmes (print, radio and Internet) specifically directed at diabetes, on the top of the regular mass-media health-education programmes organized by local health authorities. The multimedia programme has the capability of fast dispersion, but unfortunately reached only a small number—approximately one third of the target population, as shown by our study. In contrast, the distribution of the printed material is slow. It took *c.* 3 years for the booklets to reach all target families (n = 724 130) or for distribution of 1.26 million Diabetes Risk Score flyers to citizens. However, the material is specific, targeted and likely to have better recall. The booklet served a larger educational purpose and could be referred to again when needed; but it has the drawback that it can be used widely only in populations with high literacy rates. In order to attract individuals at high risk to enter into the intervention programme, from 2007 to 2010 we provided a free capillary blood glucose test for people who had a Diabetes Risk Score ≥ 14 when first visiting a community clinic. Therefore, the cohort recruited between 2007 and 2010 should have all read the Diabetes Risk Score flyer. Considering the high exposure of the printed material, the low coverage of multimedia and the consistency in diabetes awareness between 2007 and 2010 in spite of the accumulation in media programmes introduced, we would like to assume that the rise in diabetes awareness after the Qingdao Diabetes Prevention Program can be mainly attributed to the exposure to the booklets and the Diabetes Risk Score flyers.

It is difficult to directly compare our expenditure results with data from other studies, as the unit cost, frequency and mode of the education delivery varied widely across different programmes and different countries. To estimate the costs of each education tool, we have only considered the incremental direct costs from the project payer's point of view. The Diabetes Risk Score appears to be an efficient and cheap sensitization tool to bring attention to the risk factors in our mass health promotion project, but this may not be the case in other societies where the population size, culture, economic development and health policy are different. The major channels to distribute the Diabetes Risk Score flyers and booklets in our project were through community clinics, schoolchildren, volunteers or during awareness days. This was organized in close collaboration with local government and health authorities, and costs related to the distribution were not incurred by the Qingdao Diabetes Prevention Program project; therefore the substantial human capital costs involved with the distribution chain were not counted in the current data analysis. If the costs ascribed to this are added, the total costs for applying the Diabetes Risk Score strategy will rise substantially. However, if one takes into account that most countries have existing public health systems that are increasingly interested in addressing prevention and improving care for non-communicable diseases, the additional costs to implement such a strategy are likely to be small.

The relevance of an efficient and supportive public health channel must not be underestimated, as becomes evident from the slump in awareness levels in 2009, particularly in rural areas. The exact reason for this slump is not clear. It may be related to constraints in managing diversion of the attention of local health workers to other acute issues such as outbreaks of foot-and-mouth disease and H1N1 flu in 2009, or because of changes in local leadership.

To minimize the discrepancies in study design, in the data analysis we had included only individuals without diabetes with a Diabetes Risk Score ≥ 14, and counted the awareness questions that are available for both surveys. The input of the paper records into digital records is random and still ongoing. The goal is to put all paper records into digital form. The digital records can serve as a random sample of the high-risk population identified so far. The increase in diabetes awareness was observed irrespective of age, gender and place of residence (urban/rural), indicating that the study is less likely to be biased by the study design and the incomplete input of the high-risk records. Considering that the participants in survey A were young and reported a higher rate of family history of diabetes, an increased awareness would be expected, and the difference between the two surveys might have been attenuated rather than enlarged. This supports a true rise in diabetes awareness following the introduction of the prevention programme.

In conclusion, a simple non-invasive Diabetes Risk Score can be distributed widely and is a cheap and effective sensitization tool to raise public awareness of diabetes as seen in Qingdao, China. Using the Diabetes Risk Score to identify the high-risk population and to increase public awareness might serve as a framework for large-scale diabetes prevention, or a similar strategy could be used for other chronic disease prevention programmes.

Funding sources

None.

Competing interests

Nothing to declare.

Acknowledgments

The Qingdao Diabetes Prevention Project has been financially supported by the World Diabetes Foundation (WDF05-108 and WDF07-308). The Qingdao Municipal Health Bureau and Qingdao Centre for Disease Control (CDC) have provided working spaces, facilities and staff.

References

1 Boren SA, Fitzner KA, Panhalkar PS, Specker JE. Costs and benefits associated with diabetes education: a review of the literature. *Diabetes Educ* 2009; **35**: 72–96.

2 Li R, Zhang P, Barker LE, Chowdhury FM, Zhang X. Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review. *Diabetes Care* 2010; **33**: 1872–1894.

3 Qiao Q, Pang Z, Gao W, Wang S, Dong Y, Zhang L *et al.* A large-scale diabetes prevention program in real-life settings in Qingdao of China (2006–2012). *Prim Care Diabetes* 2010; **4**: 99–103.

4 Gao WG, Dong YH, Pang ZC, Nan HR, Zhang L, Wang SJ *et al.*; Qingdao 2006 Diabetes Survey Group Increasing trend in the prevalence of Type 2 diabetes and pre-diabetes in the Chinese rural and urban population in Qingdao, China. *Diabet Med* 2009; **26**: 1220–1227.

5 Gao WG, Dong YH, Pang ZC, Nan HR, Wang SJ, Ren J *et al.* A simple Chinese risk score for undiagnosed diabetes. *Diabet Med* 2010; **27**: 274–281.

6 Heinrich E, de Nooijer J, Schaper NC, Schoonus-Spit MH, Janssen MA, de Vries NK. Evaluation of the web-based diabetes interactive education programme (DIEP) for patients with type 2 diabetes. *Patient Educ Couns* 2011; **86**: 172–178.

7 Ooi GS, Rodrigo C, Cheong WK, Mehta RL, Bowen G, Shearman CP. An evaluation of the value of group education in recently diagnosed diabetes mellitus. *Int J Low Extrem Wounds* 2007; **6**: 28–33.

8 Penn ND, Stevenson C, McMahon C, Bodansky HJ. The effect of a city-wide mass media campaign on the public awareness of diabetes. *Diabet Med* 1992; **9**: 756–758.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Figure S1. A flow chart of sampling procedures and participating rates.

Table S1. Baseline characteristics of the men and women who did not have a prior history of diabetes, but had a diabetes risk score ≥ 14 in two surveys.

Table S2. Awareness (%) of major diabetic risk factors before/after the health promotion programme.

Please note: Wiley-Blackwell are not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than for missing material) should be directed to the corresponding author for the article.