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Original article

Development of public health program for type 1 diabetes in a university community: preliminary evaluation of behavioural change wheel

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Summary. *Background:* Diabetes mellitus, including type 1 is a global public health problem among the young persons. While public health campaign and screening program is a potential strategy, but communication skills, knowledge and opinion of the healthcare personnel are indicated as variables that can impact patient's education, which will lead to better outcome of care. Thus, in designing or planning a program for public health, workforce development considers opinion and behavioural change wheel of prospective personnel. *Objective:* The purpose of this preliminary study was to evaluate if a university academic department has the behavioural change wheel to function as workforce infrastructure for an envisioned program. *Method:* Survey of knowledge, attitude and practice (KAP) of a university community regarding diabetes type 1 was performed. The KAP were translated into behavioural change wheel comprising capacity, motivation and opportunity (CMO). *Results:* There are baseline indications of the behavioural change wheel potential of the public health department to run a T1D screening program. The number of participants who knew someone with T1D was significantly higher than the subgroup with no such knowledge ($p<0.0004$) and this improved when age factor is considered ($p<0.00005$). *Conclusion:* While the public health department of a university community has the behavioural change wheel or CMO to develop a workforce infrastructure for T1D screening program, the experience that comes with age of lecturers will be an important factor to enable such program to succeed. (www.actabiomedica.it)

Key words: public health screening, type 1 diabetes, workforce development

Introduction

Type 1 diabetes (T1D) is as a result of e.g. autoimmune-mediated destruction of beta cells or idiopathic destruction or failure of beta cells to produce insulin (1). That is, assuming it is not caused by viral infections, chronic alcohol, or chemicals such as alloxan and streptozotocin. T1D accounts for 5-10% of cases of diabetes worldwide, and it is the most common type of diabetes in children and adolescents, although type 2 diabetes is now increasingly diagnosed in youth (2, 3). The increasing incidence of T1D is marked in young children (4, 5). The incidence rate decreases after puberty, and attains stability in 15-29 year olds (3-6); though data from Europe showed that incident rates of T1D peaked in the age group (0-9 years) (7). Data from sub-Saharan Africa indicates incidence of T1D less than 0.002% (8), but there is no indication of peak age.

Persons with prediabetes are at risk of developing CVD in addition to developing diabetes (9-11) and it is also reported that CVD risk is higher in prediabe-

tes, perhaps due to an ongoing, yet unmanaged 'metabolic syndrome' (12, 13); when compared to diabetes individuals. Hence, there is need to improve detection of prediabetes, in order to initiate early intervention against macrovascular complications (14, 15).

One of the strategies of improving detection is to avail prediabetes screening for early identification and intervention of the disease. However, it is acknowledged that undiagnosed diabetes remains prevalent probably because the effectiveness and efficiency of screening are low, especially in testing people from the low socioeconomic status (16). While the need for public health screening is valid, there is also the need to improve the efficiency of screening programs and/or explore new strategies. Yet, there is lack of measure of knowledge regarding how different variables relate to outcomes. For instance, communication skills, knowledge and opinion of the healthcare personnel are indicated as variables that can impact patient's education, which lead to better outcome (17).

Screening of diseases is used in management of health and leads to favourable prognosis, if treatment is initiated prior to severe clinical manifestation (18). Case finding, counselling, screening, surveillance and testing are public health paradigms and six basic characteristics that constitute principles of public health screening are: goals, knowledge of the disease, cost, acceptability of the procedure, sensitivity and specificity of the method and post-screening plan (19, 20). That is, the public healthcare personnel performing the screening need to have knowledge of the disease as well as an opinion regarding goal of the exercise among others.

Behavioural change wheel is guide for designing intervention programs, and it is predicated on capacity, motivation and opportunity (CMO) (21). Apparently, the importance of behavioural change wheel in successful implementation of a screening program is not arguable (21), but it is unknown if an academic public health department has the necessary CMO.

T1D is a growing public health concern in developing countries, as it has been for a long time in most developed countries (8). This is because in developing countries infectious diseases seems relatively under control and non-communicable diseases (NCD) are now accounting for more deaths (22). T1D is a silent killer, with many victims becoming aware of the disease when the disease manifests symptoms and complications (23). There is poor awareness about the extent of the problem among the public and people are not sufficiently aware of interventions for preventing the disease and managing complications' outcomes (24). It has been acknowledged that "the true burden of this disease is not known, but a difference in the pattern and outcome of T1DM in the sub-Saharan Africa compared to the western World seems to be present. Moreover, much of the data is not population-based and is of limited value for making generalizations about diabetes in children of Sub-Saharan Africa" (25). There is also sparse literature on the public health screening of NCDs including T1D in most Nigerian rural communities (26), which means dearth of information vital for the development of a screening program for control and prevention of the disease.

Thus, T1D and its complications remain a challenge (27) and a way to tackle this problem is assessment of grass-root knowledge of the disease to allow introduction of effective intervention and education programs. Increased awareness of the disorder had been recommended (28), therefore, there is need to assess the extent to which the advice has been implemented; especially in an academic setting since in the African context academics are respected and therefore can educate communities.

Objective

The purpose of the study was to investigate the knowledge, attitude and practice (KAP) as well as the behavioural change wheel in an academic institution. This is for the prospect of developing public health educational program on T1D in the low-mid income communities served by Novena University and Catholic Hospital Abbi.

Methods

Study design and setting

This study was part of the prediabetes and cardiovascular complications study (PACCS), international

research collaboration with the department of Public and Community Health of Novena University (29). The study was designed to be a descriptive survey as defined in health research methodology (30). It followed purposive sampling procedure in a questionnaire-based survey that includes a quasi filter (Fig. 1).

Diabetes and heart disease knowledge, attitude & practice
1 page questionnaire

Theme	Question	Yes	No	Don't know	
Have you ever performed:	Clinical test of your blood sugar level?				1
	Clinical test of your blood cholesterol/lipid level?				2
	Assessment of your BMI; or are obesity status?				3
	Others (specify):_____				4
Have you ever been diagnosed with or investigated for:	Diabetes				5
	High blood pressure				6
	Abnormal cholesterol level				7
	Obesity				8
	Kidney disease				9
	Heart disease				10
	Liver disease				11
	Cancer				12
	Others (specify):_____				13
Has any member of your immediate family or other relatives been diagnosed with:	Diabetes				14
	High blood pressure				15
	Abnormal cholesterol level				16
	Obesity				17
	Kidney disease				18
	Heart disease				19
	Liver disease				20
	Cancer				21
	Others (specify):_____				22
Diabetes mellitus	Do you know anybody suffering diabetes type 1?				23
	Do you know anybody suffering diabetes type 2?				24
Do you know the signs & symptoms of:	Diabetes				25
	Heart disease				26
	Obesity				27
Health check up	Do you have regular health check up				28

Name of participant:	**Date:**
Address:	
Telephone no:	**Date of birth (or approx age):**
Sex: Female ☐ Male ☐	

Figure 1. Questionnaire used in survey

Based on the university population of about 3500, N=134 was initially determined as the appropriate minimum number of participants on two basis. Firstly, sample size calculation was determined to be 100, assuming 10% margin of error. Secondly, it was also determined to be 134, assuming 5% margin of error, 95% confidence interval and 90% response rate, (31). Random sampling was used to select participants one hundred and forty-eight (N=148) participants took part.

Exclusion and inclusion criteria

Only consenting staff and students in the University were included and participants consented by completing the questionnaire after being given adequate information concerning the purpose of the study during a public lecture on diabetes and cardiovascular disease complications. Individuals who attended the public lecture, but declined to accept/complete the questionnaire were excluded.

Method of Data Analysis

Data generated from the questionnaire were analysed using MicroSoft Excel Data Analysis ToolPak 2010. All responses were given numerical values of 1 for [yes], 2 for [no] and 3 [don't know]. Paired t-test analyses were performed twice. First was the paired *t-test* to compare the [yes] and [no] groups of those who know somebody suffering T1D. Given that sample sizes were unequal, values for responses to each question were initially calculated as a percentage for either group to avoid bias. This analysis was performed to determine KAP that may be translated into behavioural change wheel vis-à-vis CMO necessary for public health screening of T1D (Table 1). Second paired t-test analysis was to compare age differences, whether older subgroup representing is more knowledgeable and of better attitude, which can be translated into greater capacity and motivation, respectively.

Assumption

In this study, it has been assumed that knowledge is capacity for effective action. Attitude is a reflection of self-motivation and practice embodied by demonstration of experience reflects past opportunity.

Results

In the context of population-based study, analysis was performed to determine potential differences between genders. No statistical significant difference was found in the KAP of males versus females of the studied population (p=0.71). Of the participants it was observed that:

Table 1. KAP matching with behavioural change wheel towards T1D screening

	Questions	KAP component	CMO to practice†
1	Have you performed your own test for DM?	Attitude	Motivation
5	Have you been diagnosed or investigated for DM?	Knowledge & practice	Capacity, Motivation & Opportunity
14	Member of family diagnosed or investigated for DM?		Capacity, opportunity
23	Know someone suffering T1DM?	Knowledge	Motivation & Opportunity
25	Do you know signs & symptoms of T1DM?		Capacity
28	Do you have regular health check up?	Practice	Opportunity

CMO: capacity, motivation & opportunity for behavioural change
KAP: knowledge, attitude & practice
†Practice: public health screening of T1D
Assumption: In this study, it has been assumed that
• Knowledge is capacity for effective action
• Attitude is a reflection of self-motivation
• Practice embodied by demonstration of experience reflects past opportunity

- 47% had performed own test for blood sugar
- 6% had been diagnosed or investigated for diabetes mellitus
- 24% have a family member who has been diagnosed or investigated for diabetes mellitus
- 14% knew someone suffering T1D
- 44% knew about T1D
- 29% have medical regular check up

Discussion

While there has been enormous improvement in the knowledge, epidemiology and management of T1D in developed countries, there has been little or no improvement in sub-Saharan Africa (25, 32). The prevalence of T1D is not clearly established, but there are sketchy reports from various endocrine centres in Nigeria (33). Thus, T1D and its complications remain a challenge (27) and a way to tackle this problem is assessment of grass-root knowledge of the disease to allow introduction of effective intervention and education programs.

This report indicates that more respondents in the younger subgroup remember carrying out their blood sugar test, but the reverse is the case on other questions. In particular, the younger age group (represented by 1st quartile), did not know someone suffering diabetes type 1 or type 2 as shown in Figure 1. This observation may be attributed to the fact that participants that fell into the 1st quartile are young who are generally in good health; considering that the prevalence of

Table 2. % of subgroups that responded 'yes' to the various questions (N=148)

	Yes: Knows somebody	No: Knows nobody	4th Quartile	1st Quartile
1	65	46	48	61
2	30	17	26	9
3	35	13	26	0
4	*	*	*	*
5	10	3.8	13	0
6	40	10	48	0
7	5	1	4	0
8	0	0	0	0
9	5	2.9	9	0
10	0	2.9	9	0
11	0	1.9	9	0
12	0	1	0	4
13	*	*	*	*
14	45	19	22	13
15	65	23	39	9
16	5	2.9	4	4
17	5	1.9	9	0
18	5	5.7	17	0
19	0	3.8	9	0
20	5	1	4	0
21	10	6.7	13	4
22	*	*	*	*
23		Independent variable		
24	11	4.5	26	0
25	75	40	78	26
26	70	26	57	13
27	70	28	61	13
28	45	29	35	22
Mean	24	12	23	7.1
P value	<0.0004		<0.00001	

*Quasi questions – excluded in analysis

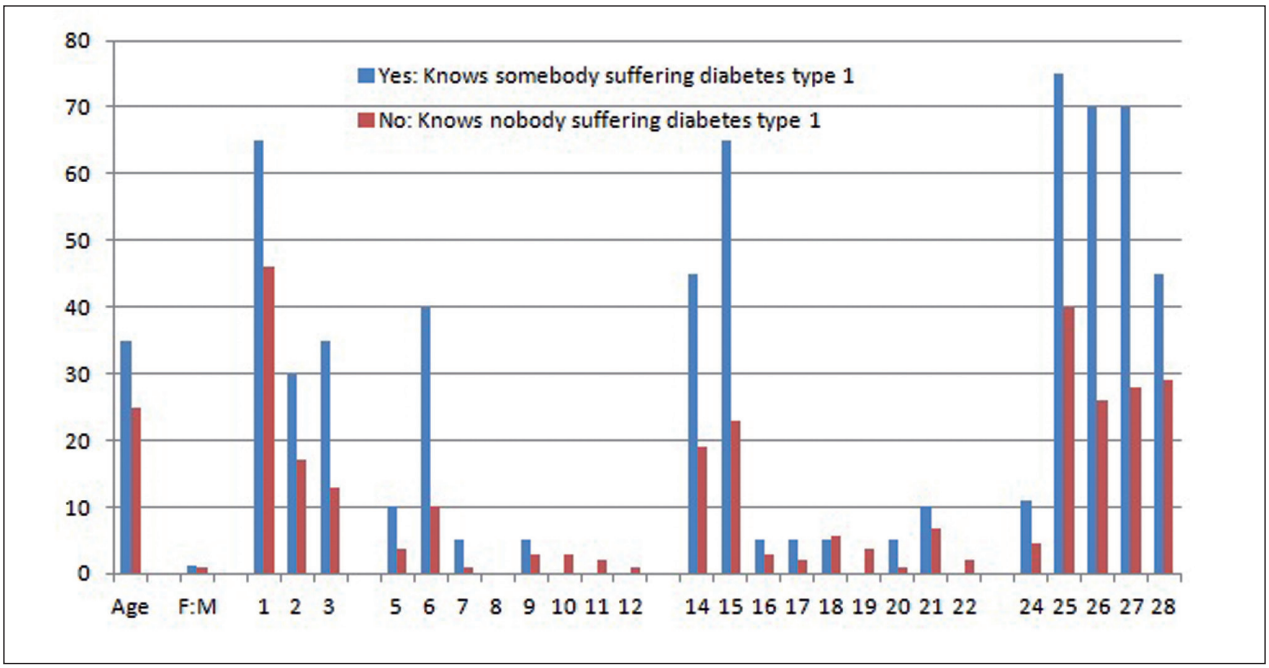

Figure 2. Outcome of analysis of 'Yes' vs. 'No' knowledge of anybody suffering T1D (N=136)
P<0.00005 – statistical significant difference increases when age is considered

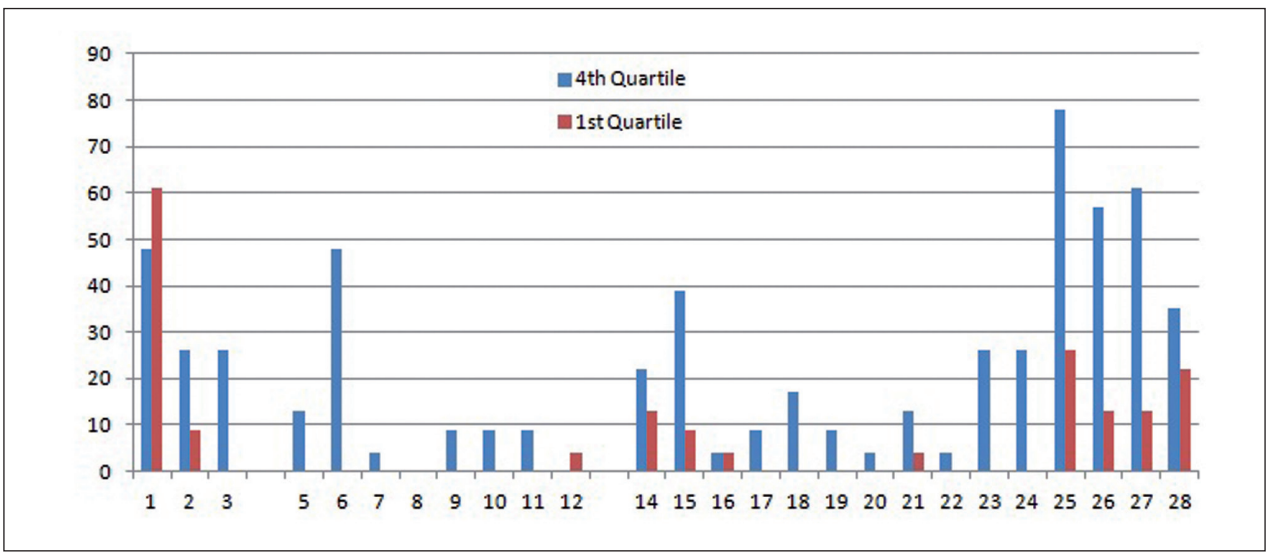

Figure 3. Outcome of analysis of 1st & 4th quartile age groups (N=92).
Statistically significant: p < 0.000001

DM goes up with age. However, the observation also indicates that those who knew someone suffering diabetes type 1 were older participants. The implication is possibly that while the young who are predominantly students may have little knowledge, there has been no opportunity as well as lack of capacity and motivation for these students to carry out public health education on T1D. Literature has indicated that counselling is one of five paradigms and knowledge (of the disease) is one of the six basic principles of public health screening (19, 20). Therefore, it is inferred that students lack capacity to independently counsel a T1D client, or

motivation to drive screening for early identification of the disease.

On the other hand, the older subgroup (represented by 4th quartile) is more knowledgeable about T1D. This study was done in a university community and it is possible that the older group are e.g. academics thus more educated. For instance, in the older group, 78% knew the signs and symptoms of diabetes, 57% had knowledge of heart disease and 61% knew about obesity. Therefore, there is sufficient capacity in the university to develop and implement the program for T1D screening.

When reviewing the study cohort in the context of university population-base, it was observed that 47% had performed own test for blood sugar, which is a good indication of attitude that may translate into motivation; 24% had a family member who has been diagnosed or investigated for diabetes. This indicates that a moderate fraction of people with experience that may have elicited opportunity – in the terms of behavioural change wheel. However, 44% had knowledge of T1D, and this is a good indication of capacity to practice. It was observed that 29% of the subjects had regular check-up, implying a moderate number of people with opportunity. Considering that most of the study participants may not be health students/lecturers, the foregoing constitute baseline indications of the behavioural change wheel potential of the public health department to run a T1D screening program.

Further, Table 2 indicates that the subgroup that knew someone suffering T1D was significantly higher than the subgroup with no knowledge ($p<0.0004$), while Figure 1 shows an improved higher significance when age factor is considered ($p<0.00005$). Thus, it can be inferred that while the university community has the behavioural change wheel or CMO to develop and implement a T1D screening program, the experience that comes with age of e.g. lecturers will be an important factor.

Conclusion

Developing a public health screening program requires planning based on existing KAP and this includes development of policy and workforce infrastructure, amongst others. This study is a preliminary simple evaluation of whether public health department of a university has the behavioural change wheel to constitute the workforce infrastructure for T1D screening program. The findings of the study are promising and further studies on T1D screening workforce need to be carried out as part of the ongoing planning phase.

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