

Awareness of Diabetes-Related Complications in a Community Survey

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Purpose: This study assessed awareness of diabetes related complications among adults residing in Eastern Washington State.

Methods: A 17-question telephone survey instrument administered to 800 randomly selected households in Eastern Washington State.

Results: The most common diabetes-related complication identified was eye problem/blindness. Respondents with diabetes, gestational diabetes or pre-diabetes were more likely to identify eye problems/blindness, cardiovascular and kidney problems as being diabetes-related complications compared to persons without diabetes. In a multivariate model, persons with diabetes, gestational diabetes or pre-diabetes, females; college graduates, respondents 35 years of age and older, and those who received health information from print materials were more likely to identify diabetes-related complications.

Conclusions: Awareness of diabetes-related complications was very low among randomly sampled adults in this study. Increasing awareness of diabetes-related complications is central to achieving Washington State's goal of activating and empowering individuals to prevent and manage diabetes.

Introduction

One of the most prevalent and costly chronic health conditions is diabetes mellitus. In 2007 the number of people in the U.S. diagnosed with diabetes was estimated at 23.6 million or 7.8% of the U.S. population (CDC, 2007) and the direct and indirect costs of care were conservatively calculated at \$174 billion annually (American Diabetes Association, 2008). Nearly half the total costs and the majority of the acute care costs associated with diabetes are related to treating comorbid complications (American Diabetes Association, 2008; Selby, Thomas, Zhang & Colby, 1997; Roman & Chassin, 2000). Thus, the cost of treating diabetes and its related complications is a significant economic burden.

The personal impact of diabetes is equally devastating. The diagnosis of diabetes has been clinically correlated as the equivalent of aging 15 years (Booth, Kapral, Fung & Tu, 2006). The risk of death for someone with diabetes is twice that of a person without diabetes (Tierney, Geiss, Englegau, Thompson, Schaubert & Shireley, 2001). Diabetes is the seventh leading cause of death in the United States (CDC, 2007). Common diabetes-related complications include microvascular conditions such as neuropathy, retinopathy, and nephropathy and macrovascular disease resulting in an increased incidence of stroke and heart disease. These complications further contribute to reduced quality of life (Huang, Foley, Brown, Meltzer & Ewingman, 2007).

The incidence and outcomes of diabetes-related complications are staggering. Nearly 70% of patients with diabetes die from cardiovascular disease (CDC, 2007). Adults with diabetes are two to four times more likely to have heart disease or stroke than adults without diabetes (Haffner, Lehto, Ronemaa, Pyorala & Laasko, 1998). Diabetes is the underlying condition in more than 60% of non-traumatic limb amputations (CDC, 2007). In addition, diabetes is the leading cause of kidney failure and blindness in the United States (CDC, 2007). Thus, both macrovascular conditions such as heart attack and stroke and microvascular co-morbid conditions such as retinopathy, nephropathy, and neuropathy are commonly associated with diabetes and contribute greatly to the significance of diabetes as a public health problem.

Available evidence indicates complications can be prevented or significantly delayed with improved diabetes management (DCCT Research Group, 1993). A popular model to guide research and practice improvements for diabetes management is the Chronic Care Model (Bodenheimer, Wagner & Grumbach, 2002; Wagner, Austin, Davis, Hindmash, Schaefer & Bonomi, 2001). One of the main components of the Chronic Care Model (CCM) is an "Activated Informed Patient." Foundational to becoming an 'activated informed patient' is the need to be aware that a problem or potential problem may exist. Recognizing public knowledge and awareness of diabetes risk factors and management strategies as a potential area for improvement, the Washington State Diabetes Plan (2005, p. 5) includes the following as one of ten goals: "A comprehensive, coordinated, and measurable strategy is conducted to increase awareness of risk factors for diabetes and to empower individuals to take action to prevent diabetes, get screened, diagnosed, and receive treatment to manage their diabetes." Internationally, one of twenty top policy and research priorities identified for chronic non-communicable diseases such as diabetes was

"Package compelling and valid information to foster widespread, sustained and accurate media coverage and thereby improve awareness of economic, social and public health impacts" (Daar, et al., 2007, p. 495). Despite such assertions, evidence related to public awareness of diabetes related complications is virtually non-existent.

The purpose of the current study was to assess awareness of diabetes related complications among adult residents of Eastern Washington State. This study sought to answer the following research questions:

1. What are the rates of awareness of diabetes-related complications for persons with and without diabetes?
2. What demographic and health information factors are associated with awareness of diabetes-related complications?
3. What demographic and health information factors predict awareness of diabetes-related complications?

Methods

Design and Sample

A telephone survey with 800 completed interviews was conducted in March 2007 by a regional research organization. Households from ten Eastern Washington counties were randomly selected using random digit dialing. Interviews were completed with adults aged 18 years or older. Selection of respondents was conducted so that sample gender-by-age proportions closely matched each county's population characteristics. In addition, respondents were sampled proportionate to county population size. Most interviews were conducted between 4:00 p.m. and 9:00 p.m. on weekdays and between 10:00 a.m. and 5:00 p.m. on weekends. Computer-aided workstations were used by interviewers to allow randomization and rotation of question order. A minimum of four call attempts were completed for each targeted telephone number. Based on the

Exemption Determination Application submitted for the study, the WSU Institutional Review Board determined that the study satisfied the criteria for Exempt Research.

Survey Instrument

A 17-question survey instrument was created for this study. The six demographic questions included questions on age, gender, and race, number of persons living in the household, education and health insurance. There were six response-aided questions, in which participants were asked to choose one of the response options as an answer. The response-aided questions were general health rating, having a primary provider, having a diagnosis of diabetes, recalling-public health message about diabetes, being aware of the Eastern Washington Diabetes Network, and being aware of diabetes-related community events. A total of five open-ended questions, which required un-aided respondent generated answers, included questions on identification of diabetes related complications; sources of health information; sponsors of public health messages about diabetes; recall of details related to public health messages; and actions taken as a result of public health messages. On average, each interview took five minutes to administer.

Statistical Analysis

Independent sample t-tests were used to compare means for continuous variables and Pearson chi-square analysis was used to examine relationships among categorical variables. Bi-variate associations were examined using Pearson chi-square analysis. A multi-variate model to determine odds ratios for successful recall of a diabetes-related complication was completed using binary logistic regression. A manual method of factor entry was used. Statistical significance of $\alpha = 0.05$ was established a priori for all tests.

Results

A total of 796 interviews were completed in which the respondent answered the question, "Have you ever been told by a doctor that you have diabetes?" Two cohorts were created for analysis. A total of 96 respondents (12.1%) indicated they had diabetes, gestational diabetes or pre-diabetes (hereafter referred to as the diabetes cohort). The remaining 700 respondents (87.9%) indicated they did not have diabetes, gestational diabetes or pre-diabetes (hereafter referred to as the non-diabetes cohort).

Survey respondent characteristics differed depending on their self-report of diabetes status (Table 1). Respondents in the diabetes cohort were older compared to the non-diabetes cohort. A greater percentage of respondents in the diabetes cohort lived alone (28.1%) compared to respondents in the non-diabetes cohort (17.4%, $p=.01$). The diabetes cohort reported poorer health compared to the non-diabetes cohort. While 37.9% of respondents in the diabetes cohort indicated their health status at-risk (a response of fair or poor), 16.8% of respondents in the non-diabetes cohort indicated their health status at-risk ($p<.001$). Respondents in the diabetes cohort were more likely to have a person they think of as their personal doctor or primary care provider. Only 4.2% of respondents in the diabetes cohort reported they did not have a personal doctor or primary care provider compared to 24.6% of respondents in the non-diabetes cohort ($p<.001$). The two cohorts did not differ by gender, race, education or health insurance status.

Respondents in the diabetes cohort were more likely to identify diabetes-related complications compared to respondents in the non-diabetes cohort (Table 2). In both cohorts, the "health problem that can happen to someone with diabetes" most frequently cited was eye problem/blindness. Over 58% of respondents in the diabetes cohort mentioned this health problem

Table 1. Community Survey Respondent Characteristics by Diabetes/Pre-Diabetes Status

Self-Report Demographic Variable	Self-Report Pre-Diabetes	Diabetes or (n=96)	Self-Report No Diabetes or Pre-Diabetes (n=700)	p-value
Mean Age	59.96 (1.692)		48.65 (.676)	< .001
Percent Age 65+	47.9%		20.1%	< .001
Percent Age Under 35	12.5%		26.4%	.003
Percent Female	57.3%		54.0%	.54
Percent Not Caucasian/ White	13.5%		8.2%	.09
Percent Living Alone	28.1%		17.4%	.01
Percent College Graduate	33.0%		33.6%	.90
Percent No Health Insurance	9.4%		16.3%	.08
Percent At-Risk Health Status	37.9%		16.8%	< .001
Percent No Primary Provider	4.2%		24.6%	< .001

Table 2. Community Survey Respondent Rates of Diabetes-Related Complication Awareness by Diabetes/Pre-Diabetes Status

Mention of Diabetes-Related Disease	Self-Report Pre-Diabetes	Diabetes or (n=96)	Self-Report No Diabetes or Pre-Diabetes (n=700)	p-value
Cardiovascular Related	32.3%		19.1%	.003
Stroke Related	6.2%		9.1%	.35
Kidney Related	30.2%		12.7%	< .001
Eye Problem/Blindness	58.3%		40.4%	.001
Feet/Lower Limb/Amputation	46.9%		36.3%	.05
Any of above 5	82.3%		64.0%	< .001

compared to 40.4% of respondents in the non-diabetes cohort ($p=.001$). Respondents in the diabetes cohort were also more likely to identify cardiovascular (32.3%) and nephrology (30.2%) diseases compared to respondents in the non-diabetes cohort (19.1% and 12.7% respectively). No statistical differences were observed in the two cohorts' rates of responses identifying stroke or feet/lower limb/amputation related complications.

Respondent characteristics associated with identifying at least one diabetes-related complication was examined (Table 3). Respondents were asked the following unaided, open-ended question, "What are the health problems that can happen to someone with diabetes?" A categorical variable was created to measure whether respondents mentioned at least one of five common diabetes-related complications (eye/blindness; feet/lower limb/amputation; cardiovascular; kidney related; or stroke). Respondents over the age of 35 years

were more likely to mention at least one diabetes-related complication ($X^2 = 19.49$; $df=1$, $p<.001$). Females ($X^2 = 12.32$; $df=1$, $p<.001$), college graduates ($X^2 = 9.09$; $df=1$, $p=.003$), respondents with health insurance ($X^2 = 6.64$; $df=1$, $p=.01$) and those with a primary care provider ($X^2 = 10.74$; $df=1$, $p=.001$) demonstrated a greater proportion of knowledge of diabetes-related complications. Respondents were also asked unaided, "Where do you get your health information for your or a family member?" Responses including the internet ($X^2 = 4.53$; $df=1$, $p=.03$), print materials excluding newspaper ($X^2 = 18.24$; $df=1$, $p<.001$) and television ($X^2 = 10.50$; $df=1$, $p=.001$) were significantly associated with the respondent's mention of a diabetes-related complication. Finally, having diabetes, gestational diabetes or pre-diabetes was significantly associated with

mention of a diabetes-related complication ($X^2 = 12.63$; $df=1$, $p<.001$).

To predict respondents' knowledge of diabetes-related complications, a multivariate model with the dichotomous dependent variable related to mention of any of the five common diabetes-related complications was constructed (Table 4). A total of five factors had significant effects when controlling for other variables in the model. Having diabetes, gestational diabetes or pre-diabetes status (OR 2.605; $df=1$, $p=001$), being female (OR 1.584, $df=1$, $p=003$), being a college graduate (OR 1.606; $df=1$, $p=006$) and being 35 years of age or older (OR 1.754; $df=1$, $p=.001$) increased the likelihood of mentioning a diabetes-related complication (eye/blindness; feet/lower limb/amputation; cardiovascular; stroke; or kidney related). Finally, in a multivariate model to

Table 3. Bi-Variate Factors Associated with Mention of At Least One Diabetes-Related Complication

Non-Significant Associations		Result
Race Non-White vs. White		$X^2 = 2.07$; $df=1$, $p=.15$
Live Alone vs. Not Live Alone		$X^2 = .80$; $df=1$, $p=.37$
Health Status At Risk vs. Not At Risk		$X^2 = .53$; $df=1$, $p=.47$
Mention vs. Not Healthcare System Source of Health Information		$X^2 = 1.60$; $df=1$, $p=.21$
Mention vs. Not Friends Source of Health Information		$X^2 = .244$; $df=1$, $p=.62$
Mention vs. Not Newspaper Source of Health Information		$X^2 = 1.77$; $df=1$, $p=.18$
Recall vs. Not Public Health Message about Diabetes		$X^2 = 3.87$; $df=1$, $p=.05$
Geography Urban vs. Rural County of Residence		$X^2 = 1.89$; $df=1$, $p=.17$
Significant Associations		
Greater Proportion of Knowledge of Diabetes-Related Complication	Lesser Proportion of Knowledge of Diabetes-Related Complication	Result
Age 35+	Age 18-34	$X^2 = 19.49$; $df=1$, $p<.001$
Female	Male	$X^2 = 12.32$; $df=1$, $p<.001$
College Graduate	Not College Graduate	$X^2 = 9.09$; $df=1$, $p=.003$
Health Insurance	No Health Insurance	$X^2 = 6.64$; $df=1$, $p=.01$
Primary Care Provider	No Primary Care Provider	$X^2 = 10.74$; $df=1$, $p=.001$
Mention Internet Source of Health Information	No Mention Internet Source of Health Information	$X^2 = 4.53$; $df=1$, $p=.03$
Mention Print Source of Health Information	No Mention Print Source of Health Information	$X^2 = 18.24$; $df=1$, $p<.001$
Mention TV Source of Health Information	No Mention TV Source of Health Information	$X^2 = 10.50$; $df=1$, $p=.001$
Self Report Diabetes	Self Report No Diabetes	$X^2 = 12.63$; $df=1$, $p<.001$

Table 4. Multivariate Model with Dependent Variable Mention of At Least One Diabetes-Related Complication

Factor	Result
Gender Female	OR 1.584, df=1, p=.003
College Graduate	OR 1.606; df=1, p=.006
Age 35+	OR 1.754; df=1, p=.001
Mention Health Information - Print	OR 2.232; df=1, p=.001
Diabetes or Pre-Diabetes	OR 2.605; df=1, p=.001
Nagelkerke R-Square = .105	

determine the influence of sources of health information on knowledge of diabetes-related complication, print materials (OR 2.232; df=1, p=.001), was the only significant independent predictive factor in the multivariate model.

Discussion

This study investigated public awareness of diabetes-related complications among adult residents of Eastern Washington State. The rates of awareness of diabetes-related complications for those with and without diabetes, and respondent characteristics associated with knowledge of at least one common diabetes-related complication were explored.

This study found the most common diabetes-related complication identified in a public survey was eye problem/blindness. The diabetes cohort was more likely to identify eye/blindness, cardiovascular and kidney problems as being diabetes-related complications compared to the non-diabetes cohort. In a multivariate model, persons with diabetes, gestational diabetes or pre-diabetes; females; college graduates; respondents 35 years of age and older; and those who receive health information from print materials were more likely to identify diabetes-related complications.

Low awareness of diabetes-related complications identified in this sample from Eastern Washington state mirror those reported by Merz and colleagues (2002) who conducted telephone

interviews with a national sample of over 2000 people with diabetes. As in the current study, respondents in Merz et al.'s sample were much more likely to report awareness of blindness (65%) or amputation (36%) compared to heart disease (17%) or stroke (5%). While diabetes is the leading cause of both blindness and non-traumatic amputation in the United States, only about 1.0% and 3.5% of people with diabetes have these respective outcomes annually (National Diabetes Information Clearinghouse, 2005). In contrast, the majority of people with diabetes have heart disease and nearly 70% eventually die from heart disease or stroke. The dissonance between the awareness of diabetes co-morbid cardiac disease and other diabetes co-morbid diseases which are significantly less common may be related to the prevalence and visible presentation of these complications in the general population. Cardiac disease is the most common chronic disease in the United States and the most common cause of death. However, in most people there are no overtly visible disabilities associated with heart disease. In contrast, for persons without diabetes, amputation and blindness are very rare and blindness and lower limb amputations are complications that are clearly visible.

Despite decades of research demonstrating the risks of cardiac disease for people with diabetes, many people with diabetes do not recognize cardiovascular disease as a complication. In a seven-year study involving 3000 patients, people with diabetes who had not had a previous

myocardial infarction (MI) had the same risk of an MI as the people without diabetes who had already had an MI (Haffner et al., 1998). Only 18% of people with diabetes recognized they were at a higher risk of cardiovascular disease as compared to someone without diabetes (Hagar, 2001). More than 65% of people with diabetes did not identify cardiovascular disease as a concern for themselves (Merz, Buse, Tincer & Twillman, 2002). Thus, the low number of people in the current study who identified cardiac disease (19.1% in the non-diabetes cohort and 32.3% in the diabetes cohort) as a diabetes-related complication is not surprising, but presents a critical public health problem.

Findings from this study may be generalized to residents of ten counties in the eastern part of the State of Washington and are not representative of the State of Washington or the entire U.S. population. The Eastern Washington geographic area is less ethnically diverse and more rural than the rest of the State of Washington. Rural residents were over-sampled in this study to allow for urban versus rural comparisons. No urban versus rural differences in awareness of diabetes-related complications was detected. Further, diabetes and health status was based on unaided, self-report responses, not by clinical evaluation. Respondents who indicated having diabetes, gestational diabetes or pre-diabetes were assigned to the diabetes cohort. Accordingly, the percentage of respondents in the diabetes cohort was higher than the U.S. adult prevalence rate for 'diabetes'. Finally, unsolicited and unprompted questions in a telephone survey related to

awareness of diabetes-related complications may under report respondent's actual knowledge of such conditions.

These study results suggest that public awareness of diabetes-related complications is very low. Increasing awareness of diabetes-related complications is central to developing activated informed patients, a key component of the Chronic Care Model. Washington State has adopted the Chronic Care Model to organize its efforts against diabetes. The Washington Plan for Diabetes (2005) established a goal to "create a comprehensive, coordinated and measurable strategy to increase awareness of risk factors for diabetes and to empower individuals to take action to prevent diabetes, get screened, diagnosed and receive treatment to manage diabetes" (Washington State Diabetes Plan, 2005). Increasing awareness of diabetes-related complications is central to achieving Washington State's goal of activating and empowering individuals to prevent and manage diabetes.

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