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Demographic Differences of Adults with Diabetes Mellitus- cross-sectional study

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INTRODUCTION

Diabetes mellitus affects 20.8 million people in the United States,[1] and this number will increase to 22 million by 2025.[2,3] The disease has significant complications (retinopathies, nephropathies, neuropathies, coronary artery disease, cerebral vascular disease, and peripheral vascular disease) and is associated with individuals' personal and environmental factors**,** such as genetics, age, race/ethnicity, gender, education level, obesity, co-morbidity, and lifestyle.[1,3-5]

Research suggests that behavior modification to increase diabetes self-care activities is necessary to minimize the effect of these factors in the development and management of diabetes.[6-8]Individuals who have confidence in their capability for self-care care (self-efficacy) and actually have the capability for self-care (self-care agency) are more likely to perform self care activities**,** such as diet and exercise adherence, blood glucose monitoring, and medication administration (oral hypoglycemic and/or insulin) and to manage appropriately their disease and maintain better glycemic control.[9-14]

Demographic characteristics of individuals with diabetes may influence self-efficacy, self-care agency, and self-care activities, though only few studies have examined the influence of these variables. Researchers have reported that older individuals are more likely to engage in self--care management[15-17] and have better glycemic control[18] than younger individuals, and that women have a higher level of self-care than males.[19] Shorter duration of illness has also been related to greater self-care agency[20] and better self-care.[21] And, individuals with type 1 diabetes have greater self-efficacy than those with type 2 diabetes.[22] However, no studies have examined the effect of a full range of demographics on self-

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-efficacy, self-care agency, self-care activities, and glycemic control. In addition the effects of demographics on diabetes knowledge and social support are not known.

Therefore, using the Enhance-Behavior Performance Model (E-BPM)[12] as a conceptual framework**,** this study examined differences in scores on diabetes knowledge, social support, self-efficacy, self-care agency, self-care management, and glycemic control of individuals were males or females, younger or older, with less or more education, with type 1 or type 2 diabetes, and with a shorter or longer duration of diabetes. The E-BPM proposes that personal factors, which include demographic variables, may affect an individual's performance of self--care activities to achieve a specific outcome. This model was developed from Orem's[23] Theory of Self-Care, Bandura's[24] Self-Efficacy Theory, and published empirical studies of the relationships among these theories' concepts and related variables.[12,13]

METHODS

Design and Sample

A descriptive, comparative, cross-sectional design was used in the study, which was a secondary analysis of data from a larger study that have been reported elsewhere.[12,13] An institutional review board approved the parent study from which the data was taken. Subjects received all necessary information about the study, signed a consent form for participation and to gave permission to researchers review their medical record. Privacy and assurance of confidentiality were provided to each subject. All data were collected in a private office, each subject received a code number, and only researchers had access to the data.

The sample for this analysis included 141 insulin-requiring adults attending an outpatient diabetes care center in the Southern United States. Race/ethnicity was not included in the analysis because the groups of whites and non-whites were dissimilar and the size of one group was 1.5 times greater than the size of the other group, which would lead to reporting erroneous results.[25] Also, the Post Hoc power analysis for the t-test was very low, less than .60 considering a medium effect size d = .50 and a two tailed alpha level of .05.[25,26] Therefore, the demographic variables were gender, age, education level, type of diabetes, and duration of diabetes. The study looked at their effect on diabetes knowledge, social support, self-efficacy, self-care agency, self-care activities, and glycemic control.

Research Instruments

The instruments used in the study were all paper-based and had established psychometric properties, with alpha coefficients greater than .70, as recommended by Nunnally and Bernstein.[27] The development and psychometric properties of each instrument has been fully described elsewhere.[12,13] Fitzgerald et.al.'s[28] Demographic Questions from the Diabetes Care Profile (DCP) were used to measure individuals demographic characteristics .Subjects self-reported age, gender, educational level, type of diabetes, duration of diabetes, and so on. Certain characteristics (e.g. type of diabetes, duration of diabetes) were also verified as documented in the individual's medical record.

Fitzgerald et al.'s[29] Diabetes Knowledge Test (DKT), from the Michigan Diabetes Research and Training Center, was used to measure diabetes knowledge. The DKT is a 23-question-multiple-choice test with scores from 0 to 23, and higher scores indicating more knowled-

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ge. Content validity of the DKT has been established by experts in diabetes from different disciplines,[29] and its internal consistency, alphas ranged from .71 to .75.[13,29]

Evers, Isenberg, Phillipsen, Brouns, and Smeets's[30] Appraisal of Self-Care Agency Scale (ASAS) was used to measure self-care agency or capability for self-care. This scale contains 24 items scored on a 5-point Likert-type scale ranging from totally disagree to totally agree. Scores range from 24 to 120 points, with higher scores indicating more capability. Content validity of the ASAS has been established by an expert panel of nurses.[30] The ASAS internal consistency, alphas ranged from .77 to .85.[13,30-32]

Hurley's[33] Insulin Management Self-Efficacy Scale (IMDSES) was used to measure self--efficacy or believe in capability for self-care. The scale consists of 28 items, 6-point Likert-type scale from strongly agrees to strongly disagree. Positive items are reverse scored. Scores range from 28 to 168 points, with higher scores indicating greater self-efficacy. Content validity of the scale has been established by a expert panel of nurses.[33] The IMDSES's internal consistency, alphas ranged from .82 to .89.[13,19,33,34]

Hurley's[33] Insulin Management Diabetes Self-Care Scale (IMDSCS) was used to measure diabetes self-care management. This scale has 28 items scored on a 6-point Likert-type scale from strongly agree to strongly disagree. All items are reverse scored. Scores range from 28 to 168 points, with higher scores indicating performance of more self-care activities. Content validity of the scale has been established by a expert panel of nurses.[33] The IMDSCS's internal consistency, alphas ranged from .89 to .96.[13,19,33]

Glycosylated hemoglobin (HbA1c) was used to measure diabetes control. This test is the gold standard to evaluate an individual's glycemic control.[35] A laboratory certified by the National Glycohemoglobin Standardized Program (NGSP) performed all tests using the same method.

Data Analysis

The Statistical Package for Social Sciences (SPSS) version 11.0 was used to conduct t-tests. Initially, sample size was determined by Cohen & Cohen's[36] power analysis for correlation and regression (in the parent study [Sousa[12]]) to have 80 percent power with a medium effect size of $f^2 = .15$, and alpha level of .05. In addition, using Cochran's technique, sample representation was determined by analysis of percentages and average variability.[37] In this secondary analysis study, a Post Hoc Power Analysis was performed for each t-test considering a medium effect size d = .50 and a two tailed alpha level of .05.[25,26] The power analysis was reported after each t-test result.

The variables whose types were nominal and ordinal were recoded as dummy variables. Variables with more than two categories**,** such as education was coded as less than high school and with high school and above, and self-rated health was coded as poor or fair and good or excellent. Continuous variables, such as age and duration of diabetes were dichotomized as younger and older and with shorter duration of diabetes and longer duration of diabetes, respectively, using the median split technique (the median for age was 48 years old and the median for duration of diabetes was 172 months). Finally, diabetes type was already dichotomized as type 1 or type 2 diabetes.

RESULTS

A sample of 74 females and 67 males, all of whom used insulin to manage their diabetes, was included in the analysis. The great majority was Caucasian (74.5%) and most of others were Afri-

can-American (20.6%). The majority was married (59.6%), had some college education (65.3%), was employed outside the home (52.4%), was working more than 31 hours per week (52.4%), and had health insurance covering medication and supplies for diabetes care (87.9%). Subjects were on average 48.38 years of age, had had diabetes management classes to learn about disease management and development of psychomotor skills for self-care (64.5%), and reported having between two and five people who could help them as needed (62.4%). Finally, subjects' glycosylated hemoglobin levels were on average 8%.

As shown in Table 1, there were no statistically significant differences in mean scores on the major study variables between individuals who were male (n = 67) or female (n = 74). The power analysis of this test was between .80 and.83, and was based on a medium effect size d = .50 and a two tailed alpha level of .05.[25,26]

Table 1 - Major study variables mean score differences by gender

	Male (n=37)		Female (n=74)			
Major Variables	**M**	**SD**	**M**	**SD**	**T**	**P**
Diabetes Knowlege	18,37	3,07	18,22	3,36	-.289	ns
Social Support	74,36	18,81	72,85	16,86	-.499	ns
Self-Care Angency	92,87	9,89	92,01	11,90	-.464	ns
Self-Efficacy	129,09	17,64	130,23	19,76	-.362	ns
Diabetes Self-Care Management	128,04	20,90	131,77	23,87	-.988	ns
Glicemic Control	8,02	1,73	8,22	1,61	-.71	ns

Note ns = nonsignificant

Table 2 shows that there were statistically significant mean differences between individuals who were younger (n = 72) and individuals who were older (n = 69) on diabetes knowledge, t (139) = 2.60, p = .010, self-care agency, t (139) = -2.32, p = .022, and diabetes self-care management, t (139) = -2.33, p = .021. The power analysis of this test was between 83 to 85 percent considering a medium effect size d = .50 and a two tailed alpha level of .05.[25,26]

On average, individuals who had higher diabetes knowledge scores (M = 18.97, SD = 2.56) were younger than those who had lower scores (M = 17.58, SD = 3.68); the standard error of the mean differences was .54. And, individuals who had greater self-care agency (M = 94.58, SD = 11.11) and who performed more diabetes self-care activities (M = 134.43, SD = 19.96) were older than those who had less self-care agency (M = 90.35, SD 10.47) and who performed fewer diabetes self-care activities (M = 125.75, SD 24.08). The standard errors of the mean differences were 1.82 and 3.72 respectively.

Table 2 - Major study variables mean score differences by age

	Younger (n=72)		Older (n=69)			
Major Variables	**M**	**SD**	**M**	**SD**	**T**	**P**
Diabetes Knowlege	18,87	2,56	17,58	3,68	2,601	<.01
Social Support	71,44	17,88	75,78	17,51	-1.456	ns
Self-Care Angency	90,35	10,47	94,58	11,11	-2.325	<05
Self-Efficacy	128,82	17,79	130,59	19,75	-.560	ns
Diabetes Self-Care Management	125,75	24,08	134,43	19,96	-2.335	<05
Glicemic Control	8,36	1,79	7,89	1,50	-1.67	ns

Note ns = nonsignificant

Sousa VD, Zauszniewski JA, Musil CM. Demographic Differences of Adults with Diabetes Mellitus- cross-sectional study.. Online braz j nurs [internet]. 2006 Jan [cited month day year]; 5 (2):xx-xx. Available from: http://www.objnursing.uff.br/index.php/nursing/article/view/3715

Table 3 also shows that there were statistically significant mean differences in diabetes knowledge, t (139) = -3.91, p < .001, between individuals with a high school education or less (n = 49) and those with more than a high school education (n = 92). The power analysis of this test was between 67 to 71 percent considering a medium effect size d = .50 and a two tailed alpha level of .05.[25,26] However, individuals with a high school education or above had more diabetes knowledge (M = 19.10, SD 2.62) than those with less than a high school education (M = 16.78, SD = 3.69)**. T**his result must be interpreted with caution because the power of the statistical test was below the accepted criterion of 80 percent for behavioral research.[25] The standard error of the mean differences was .59.

Table 3 - Major study variables mean score differences by educational level

	High School or Less (n=49)		More than high school (n=92)			
Major Variables	**M**	**SD**	**M**	**SD**	**T**	**P**
Diabetes Knowlege	16,78	3,69	19,10	2,62	-3.910	<.001
Social Support	72,37	18,19	74,21	17,61	-.578	ns
Self-Care Angency	90,33	10,16	93,53	11,26	-1.718	ns
Self-Efficacy	127,39	17,67	130,91	19,25	-1.093	ns
Diabetes Self-Care Management	129,63	22,21	130,20	22,78	-.142	ns
Glicemic Control	8,29	1,77	8,04	1,61	-.81	ns

Note ns = nonsignificant

As Table 4 shows, there were statically significant differences between individuals with diabetes type 1 (n =63) and individuals with diabetes type 2 (n = 78) in scores on diabetes knowledge, t(139) = - 2.77, p = .006, and diabetes self-care management, t (139) = - 2.06, p = .041. The power analysis of this test was exactly 80 percent considering a medium effect size d = .50 and a two tailed alpha level of .05.[25,26]

Individuals with type 1 diabetes had better diabetes knowledge (M = 19.11, SD = 3.19) and performed more diabetes self-care activities (M = 134.25, SD = 20.71) than those with type 2 diabetes (M = 17.63, SD = 3.11 and M 126.56, SD = 23.43, respectively). The standard errors of the differences were .53 and 3.72.

Table 4 - Major study variables mean score differences by type of diabetes

	Diabetes type 1 (n=63)		Diabetes type 2 (n=78)			
Major Variables	**M**	**SD**	**M**	**SD**	**T**	**P**
Diabetes Knowlege	19,11	3,19	17,63	3,11	2.776	<.01
Social Support	73,21	18,90	73,86	16,91	-.214	ns
Self-Care Angency	94,08	10,75	91,08	11,01	1.631	ns
Self-Efficacy	132,65	16,60	127,29	20,07	1.734	ns
Diabetes Self-Care Management	134,25	20,71	126,56	23,43	2.067	<.05
Glicemic Control	8,04	1,46	8,20	1,82	-.57	ns

Note ns = nonsignificant

Table 5 shows that there were also statistically significant differences between individuals who had had diabetes for less than 172 months ($n = 71$) and those who had had diabetes for more than 172 months ($n = 70$) in regard to diabetes knowledge, t (139) = -2.82, $p = .005$, self-care agency, t (139) = -3.13, $p = 002$, and diabetes self-care management, t (139) = -2.50, $p = .014$. The power analysis of this test was between 83 to 85 percent considering a medium effect size d = .50 and a two tailed alpha level of .05.[25,26]

Individuals who had had diabetes longer had more knowledge (M = 19.04, SD = 2.77), greater self-care agency (M = 131.77, SD = 18.39), and performed more self-care activities (M = 134.69, SD = 20.58) than those who had had the disease for less time (M = 17.55, SD = 3.47; M = 89.63, SD = 10.29; and M = 125.38, SD = 23.50, respectively). The standard errors of the mean differences were .53, 1.79, and 3.72, respectively.

Table 5 - Major study variables mean score differences by duration of diabetes

	Shorter duration (n=49)		Longer duration (n=92)			
Major Variables	**M**	**SD**	**M**	**SD**	**T**	**P**
Diabetes Knowlege	17,55	3,47	19,04	2,77	-2.826	<01
Social Support	74,39	16,47	72,73	19,08	.555	ns
Self-Care Angency	89,63	10,29	95,24	10,96	-3.131	<01
Self-Efficacy	127,63	18,97	131,77	18,39	-1.315	ns
Diabetes Self-Care Management	125,38	23,50	134,69	20,58	-2.503	<05
Glicemic Control	8,32	1,91	7,93	1,36	-1.40	ns

Note ns = nonsignificant

DISCUSSION AND IMPLICATIONS

There were no significant differences of demographics with social support, self-efficacy, and glycemic control. Overall, the study findings on differences of age and type of diabetes with self-care and self-efficacy were consistent with prior reports[15-17], but those differences of gender and duration of illness were not.[19] In this study, younger individuals had more diabetes knowledge than those who were older. This was unexpected because younger individuals usually have less experience in managing their disease; however, being younger, they may be able to acquire knowledge faster and retain it longer. Further, younger persons may be more exposed to other means of obtaining information, such as the Internet.

Older individuals and those with a longer duration of diabetes felt more capable (higher self-care agency), and in turn showed better diabetes self-care management. These findings were supported by other studies.[15-17] Individuals who have had diabetes for a longer period of time have had more opportunities to practice self-care, and this would logically lead to greater self-care management skills.

These results have implications for health care providers who teach people with diabetes about the disease, its complications**,** and progression. For older individuals, who may have less diabetes knowledge but who adhere to more self-care activities, increased emphasis should be placed on education, with more frequent diabetes classes, individual reeducation and skills maintenance activities. The younger individuals, who may retain knowledge longer but show less adherence in self-care, the major emphasis should be on factors that increase adherence**,** such as self-care skills development and motivation for self-care management to prevent or delay the disease-related complications.

Sousa VD, Zauszniewski JA, Musil CM. Demographic Differences of Adults with Diabetes Mellitus- cross-sectional study.. Online braz j nurs [internet]. 2006 Jan [cited month day year]; 5 (2):xx-xx. Available from: http://www.objnursing.uff.br/index.php/nursing/article/view/3715

There were no differences between males and females in diabetes knowledge, social support, self-care agency, self-efficacy, or diabetes self-care management in this sample of individuals with diabetes. Other researchers[38,39] have also reported that gender had no effect on self--care agency or self-care management. Only one study has reported that females showed a higher level of self-care than males.[19] However, gender differences have been found in support seeking, depressive symptoms and psychological adjustment to diabetes were found, though gender did not differ in glycemic control among adults with type 1 diabetes.[40] Thus, it may be important to consider the effects of these factors on well--being, even if the overall outcome of control of diabetes does not differ. As few studies have investigated relationships between gender and the major study variables, replication of these results is warranted, especially given the recent interest in gender differences in health.

In this study, individuals who had more education also had greater diabetes knowledge. This was expected since individuals who have more education can learn more quickly and generally have a broader base of knowledge that may help to reinforce new information. There were no significant differences, however, between individuals with less or more education in social support, self-care agency, self-efficacy, and diabetes self-care management**.**

Individuals with type 1 diabetes had better self-care management than those with type 2 diabetes, although they did not differ on the other study variables**.** Since individuals with type 1 and type 2 diabetes have similar management approaches (dieting, exercising, performing self--blood glucose monitoring, and injecting their own insulin), the differences observed here may reflect a difference in familiarity with the routine or length of time managing the disease, rather than the illness per se.

While individuals who had a longer duration of diabetes had greater diabetes knowledge, they did not differ in self-care agency, self--efficacy, or diabetes self-care management from individuals who had had the disease for less time. Thus, individuals with a longer duration of diabetes might have had more opportunities to learn and master the specific knowledge and skills fundamental for diabetes monitoring and management, but this knowledge did not translate into differences in self-care management. Additional work is clearly needed to examine these associations. Sensitivity of the instruments may also be an issue here, and should be carefully considered when planning further studies.

CONCLUSION

None of the selected demographics differ in social support, self-efficacy, and glycemic control. However, age, educational levels, type of diabetes, and duration of diabetes appear to be important demographics to consider when designing and implement a diabetes educational program. These demographics were significantly associated with diabetes knowledge, self-care agency, and self-care activities, which are some of the fundamental factors to achieve glycemic control and prevent disease-related complications.

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