Health literacy and health-promoting behaviors among adults at risk for diabetes in a remote Filipino community

Belitung Nursing Journal
Volume 7(2), 88-97

https://doi.org/10.33546/bnj.1298

Christian Sandor B. Ydirin*

Abstract

Background: Diabetes risk assessment is an essential preboarding tool before implementing health literacy programs to change an adult's health behavior positively. Research has shown an association between health literacy and health behaviors, but there is a dearth of literature that delineates the difference between the health literacy and health behaviors of adults according to their diabetes risks; high risk vs. low risk.

Objective: This study aimed to determine the difference between the health literacy and health behaviors of adults and establish the relationship between the two variables when classified according to their diabetes risks.

Methods: This study utilized a descriptive cross-sectional design with 400 adults in a remote Filipino community in November 2019. Data were gathered using the Health Promoting Lifestyle Profile II (HPLP II) and Health Literacy Survey-Short Form 12 (HLS-SF12) questionnaires. Descriptive statistics, independent *t*-test, and Pearson's *r* were used to analyze the data.

Results: There is a significant difference between the health literacy index scores ($p < .05$); but no significant difference between the health behavior mean scores ($p > .05$) of adults when grouped according to their diabetes risks. Health literacy is significantly ($p < .05$) correlated with health behaviors of adults, with a moderate positive correlation in the high-risk group ($r = .43$), and both weak positive correlation in the low-risk group ($r = .13$) and entire group ($r = .17$).

Conclusion: All adult inclusion efforts in promoting health literacy, with emphasis on the high-risk group, are needed to improve awareness of the degree of diabetes risks. Nurses should take an active role in the assessment of diabetes risks, evaluation of results, and implementation of interventions that could increase health literacy to facilitate the development of healthy behaviors. Stakeholders are urged to advance the availability of evidence-based lifestyle interventions to reduce the growth in new cases of diabetes.

Keywords

adult; health literacy; health behavior; risk assessment; nursing; Philippines

Diabetes risk assessments are essential information that could be utilized in promoting health education among adults at risk for the disease. The impact of diabetes risk factors on health outcomes can be overestimated when ascertaining the disease based on medical diagnoses rather than on risk assessments (Feldman et al., 2017). In health promotion activities, health education is essential, wherein the role of health literacy is indispensable. However, health literacy should not be assessed as an isolated concept but should be evaluated in combination with health behaviors (Yeh et al., 2018). In this research, Diabetes Mellitus Type 2 (DM2) is a lifestyle-related disease taken into the limelight. The International Diabetes Federation (2014) estimated that there are 3.2 million cases of DM2 in the Philippines with a 5.9% prevalence rate in adults between the ages of 20-79 years, with more than half of the population remained to be undiagnosed. In one of the regional administrative units of the Philippines, Western Visayas has been reported to have one out of five adults having diabetes (Conserva, 2014), with a similar statistic

University of the Philippines Open University, Los Baños, Laguna 4031, Philippines

Corresponding author:
Christian Sandor B. Ydirin, MAN, BSN, RN, CCRN
University of the Philippines Open University, Los Baños, Laguna 4031, Philippines
Email: christiansandor.ydirin@upou.edu.ph

Article Info:
Received: 7 January 2021
Revised: 17 February 2021
Accepted: 1 March 2021

E-ISSN: 2477-4073 | P-ISSN: 2528-181X

applicable to the whole nation, wherein one out of five Filipinos either has pre-diabetes or diabetes. On a local municipal unit, there is an annually increasing case of diabetes among adults in President Roxas, Capiz, with a prevalence rate of 1.4% (Pilar, 2018). This number shows those who were only diagnosed with diabetes. Still, nothing is known about those at risk for the disease, leaving the percentage as an underestimation of the true prevalence of undiagnosed diabetes in the municipality. The report enumerated several reasons for the increase in diabetes cases, such as the unhealthy lifestyle of the community, incidental screening of few adults seeking treatment at the rural health unit, and regular services in nearby accessible barangays.

Several studies pointed out the benefits of diabetes risk assessment, with suggested approach including employment of a diabetes risk assessment questionnaire (Lindström et al., 2010; Pippitt et al., 2016), application of screening using a home-based approach (Pastakia et al., 2013) and targeted implementation in racial, ethnic and remotely underserved individuals to improve its advantage (Wilson et al., 2010). Two population studies concluded that people with undiagnosed diabetes considerably underestimate their probability of developing the disease (Adriaanse et al., 2008; Kowall et al., 2017). Relatively, the conduct of diabetes risk assessment is essential to include the entire population, but the economy of its practice is challenged. On a particular note, if significant differences could be determined between the health outcomes of persons with high and low risk for diabetes, practical implications can be derived thereafter. In addition to diabetes risk assessment, the health literacy and health behaviors of adults in remotely located upland barangays are not assessed because of their inaccessibility to the healthcare facility and the large disparity between the health budget and maintenance and operating costs (Pilar, 2018). It is noted that patients seek medical consultation when they are very sick and that low health literacy affects health behaviors, with lifestyle diseases such as diabetes (Gloor, 2014). In the Philippines, it is disturbing to note that despite the country's high reading and writing literacy, it appears that this does not always translate to high health literacy (Agosto et al., 2018; Maduramente et al., 2019).

There is a dearth of literature that presents correlations between health behaviors and health literacy in marginalized groups, more lacking when classified according to their diabetes risk. To the best of the author's knowledge, only one study (Sutherland et al., 2012) have classified diabetes risk and investigated its association with health behaviors, with the exclusion of health literacy in its variables. There is a need for additional studies with a higher hierarchical sampling design that could support the importance of nurse-directed assessment of diabetes risk. Conclusive shreds of evidence that could show significant differences in health behaviors and health literacy between adults with low or high risk for developing diabetes imply that risk assessment is a practical and strategical approach before implementing health promotion activities, whether on a large scale or a targeted population.

At present, only a few studies are being conducted that classify the adult population according to their diabetes risk (Sutherland et al., 2012) and most lacking or probably none when relationships between their health literacy and health behaviors are further examined. On the contrary, numerous studies have revealed an association between health behaviors and health literacy in different populations (Chahardah-Cherik et al., 2018; Hansen et al., 2015; Kim et al., 2018; Suka et al., 2015; Yeh et al., 2018). These studies focus only on the urban population and adults diagnosed with diabetes or, otherwise, healthy persons. Thus, this study aims to delineate differences between health literacy and health behaviors among adults, when categorized according to their diabetes risk, and establish the relationship between these variables.

Methods

Study Design

A descriptive correlational research design with a cross-sectional approach was utilized in this study. It was carried out in Barangay Vizcaya, President Roxas, Capiz, Philippines, during the whole month of November 2019.

Sample/Participants

A sample from the population of the aforementioned location, with low-income, remotely located, and medically underserved adults were selected. Barangay Vizcaya, with a population of 2,464 and an average household size of 5.37, was chosen as the accessible population. As one of the most populous Barangay compared to the other 22 Barangays of the municipality, it was selected to expect a higher return rate. The sample size was determined using the G*Power 3.1 (Faul et al., 2009) calculator for sample size, with a priori power analysis for Pearson's r correlation for two independent samples; calculated based on the power of 80%, .05 alpha level of significance and the smallest effect size of .1. The largest required sample size was 433. The researcher deliberately allotted a total of 500 randomly selected participants to increase the return rate. From the accessible population, stratified random sampling was employed to systematically choose the sample according to age and sex. Inclusion criteria encompassed those who were never diagnosed with diabetes, not taking insulin or oral medications for blood glucose control, able to hear and understand a common language (*Hiligaynon*, English or *Tagalog*), and all adults aged 18-59 years old with signed written informed consent. Exclusion criteria included those who were pregnant, lactating, with illness having a likely prognosis of less than one-year, psychiatric illness, those who were less than 18 years old and refused to participate. Using the inclusion and exclusion criteria, minus the unreturned questionnaires and tool with missing data, a total of 400 eligible participants were included in the final sample of the research, with an overall response rate of 80%.

Measures

Pilot and Pre-testing. The simplified Finnish Diabetes Risk Score (FINDRISC) Questionnaire, Health Literacy Survey Short Form 12 (HLS-SF12), and Health-Promoting Lifestyle Profile II (HPLP II) instruments were all originally written in English. The HLS-Asian *Tagalog* (Agosto et al., 2018) and the HPLP II *Hiligaynon* (Beliran & Legaspi, 2014) were utilized in this study after being granted permission for its use. Permission to use the original HPLP II (Walker & Hill-Polerecky, 1995) and HLS-SF12 (Duong et al., 2019) were obtained. Since previous studies were conducted in urban settings, pilot testing among 30 conveniently selected adults in the accessible population was carried out. These participants were not included in the final sample population. The reliability testing for the translated versions of HLS-SF 12 and HPLP II resulted in acceptable Cronbach's alpha coefficients of .71 and .89, respectively. Since subscales were utilized, composite reliability for both HLS-SF12 and HPLP II was also determined, resulting in composite reliability coefficients of .93 and .90, respectively.

Sociodemographic Questionnaire & Diabetes Risk Score. A researcher-made questionnaire to determine the sociodemographic characteristics was constructed. Individual characteristics such as age bracket, sex, civil status, educational attainment, monthly income, employment status, type of family structure, health status, presence of health insurance, and a number of doctor's visits in the last year were obtained using the researcher-made questionnaire for sociodemographic. Permission to use the original (Lindström et al., 2010) and the simplified (Ku & Kegels, 2013) FINDRISC questionnaire were obtained from the authors. The simplified tool was utilized to determine the diabetes risk scores. The decision was based on its applicability to Filipinos and the need for less expertise and equipment in a resource-constrained setting without compromising its performance. A cut-off diabetes risk scores greater than or equal to seven (≥7) was the decisional score for the participants to be considered at high risk for diabetes, which is in line with previous studies (Ku & Kegels, 2013).

Health Promoting Behavior Questionnaire. The HPLP II is a 52-item, four-point, Likert-styled instrument consisting of the following subscales: spiritual growth, interpersonal relations, nutrition, physical activity, health responsibility, and stress management. The HPLP II measured the health behavior scores of the participants. The 4-point response scale consists of 1 representing "never", 2 as "sometimes", 3 as "often", and 4 as "routinely", which was used to determine the frequency of each behavior. The tool has been reported to have established content validity, construct validity, criterion-related validity, and reliability, with an alpha coefficient of internal consistency of .94 and alpha coefficients ranging from .79 to .87 for all subscales. On the other hand, the HPLP II *Hiligaynon* reported acceptable face validity and internal consistency of the translated questionnaire. The recommended use of means rather than sums of scale items to retain the metrics of item responses and to allow meaningful comparison of scores across subscales was implemented. A mean of ≥ 2.50 was considered to be a positive health behavior, in line with previous studies (Beliran & Legaspi, 2014; Sutherland et al., 2012).

Health Literacy Questionnaire. Duong et al. (2019) advanced the use of a new comprehensive HLS-SF12, originally derived from the original HLS-EU-Q47, consisted of 12 items and validated among different groups of the Asian population. The instrument includes the three subscales: healthcare, health promotion, and disease prevention. It consists of a 4-point response scale, which translates 4 as "very easy", 3 as "easy", 2 as "difficult", and 1 as "very difficult", to determine the level of difficulty of each item in different components. The HLS-SF12 English version demonstrated high alpha coefficient reliability of .85, good criterion-related validity, and a high level of item-scale convergent validity (Duong et al., 2019). On the other hand, the HLS-EU-Q47 *Tagalog* (Briones, 2017) reported general health literacy Cronbach's alpha coefficient of .91 and subscale Cronbach's alpha coefficients ranging from .80 to .85**.** The general indices for HLS-SF12 were standardized to unified metric scores from 0 to 50 using the formula index= (M-1) x (50/3). The health literacy index was obtained by calculating the total scores of the individual's responses to all 12 items. The classification of health literacy indexes and its descriptive interpretation were as follows: 0-25, inadequate; >25-33, problematic; >33-42, sufficient, and >42-50, excellent (Sørensen et al., 2013).

Data Collection

After completion of written informed consent, the survey was initiated. Each participant was assigned with a serial number to ensure anonymity. The identifying number was double-checked with the name on the master list, while the serial number was written on the consent form and every page of the research instrument. The responses were recorded on the simplified FINDRISC questionnaire, and the waist circumference (cm) of each participant was measured. Ten barangay health workers were officially hired to help in the conduct of the survey. All have attended the orientation and skills check-off for proper data collection and waist circumference measurement. Consistency in data collection was ensured through carrying out uniform protocols, adapted from WHO STEPS Surveillance Manual 2008*,* which included step-by-step details for measuring waist circumference and obtaining self-reported answers. Diabetes risk scores were derived from participant's responses and values of waist circumference. For the health literacy and health behavior questionnaires, an item-by-item and word-by-word reading of the respective instrument was employed. The choices for the answers after each item were repeatedly provided, using a cue card as a memory aid for the participants. All the responses were recorded after that.

Data Analysis

All raw data were encoded in Microsoft Excel©2014 and exported to the IBM©2019 software for SPSS©2019 statistical testing. Data were analyzed using descriptive statistics, Levene's, independent *t*, and Pearson's *r* correlation tests. Statistical significance was set at < .05. Parametric statistics were used to determine significant differences between the health literacy and health behaviors of adults, grouped according to diabetes risk, and determine the relationship between the two variables. The homogeneity in the sample variance was met as evidenced by the p-values for health literacy indexes and health behavior scores, $p = .487$ and $p = .072$, respectively, which meant that the requirement of equal variance for utilizing parametric testing is appropriate. Since adults at high risk and low risk for diabetes were two sub-samples in a given total sample, Levene's test was appropriate to determine equality in variance (Derrick et al., 2018). To quantify the degree of difference between groups, Hedges *g* was utilized in this study. This is an appropriate measure of effect size when two sample sizes have a similar standard deviation but different sample sizes (Borenstein et al., 2011). Moreover, it is emphasized that the effect size (ES) presented in this study was based on a correlation effect size due to the research design. This is represented as a typology of $_{corr}$ES (Fitz-Gibbon, 2002). Hedges g above .4 is interpreted as medium $_{corr}$ES in meta-analysis studies (Brydges, 2019; Gignac & Szodorai, 2016).

Ethical Considerations

Research ethics committee approval from OVCAA UP Open University Los Banos, Laguna, Philippines was accomplished through the application for ethical review before the conduct of the study (Document date and number: 11 March 2019; 0111-1900-0064-8507). The procurement of written informed consent and an official permit from the barangay ensured individual and collective autonomy. The consent was written in the language understood by the participants. Moreover, the following elements were explained: the purpose of the study, expected duration of participation, description of procedures to be followed, disclosure of confidentiality, minimal risk involvement, compensation, principal researcher's contact information, refusal to participate, and voluntary withdrawal options at any time without penalty or loss of benefits.

Results

In general, the participant's age ranged from 18 to 59 years (M=36.19, SD=11.58) and were predominantly males (53.3%); young adults (18 to 44 years old) (71.3%), married or in a common-law relationship (70.8%), had at least a high school level of education (47.3%), and in a nuclear type of family structure (62.7%). Almost three-quarters (71.8%) claimed to have health insurance, with almost all of the population (92.8%) reported having no medical condition. This may owe an explanation to just above half (57.0%) of the population seeking doctor's consultation one to three times in the last year. Only half of the participants (50.2%) reported to have been employed, and the majority of them have the lowest bracket of family income amount of ≤5,000 Php per month (84.3%) (Table 1).

Table 1 Distribution of participants according to socio-demographic and health characteristics

Characteristics	Frequency	Percentage
Entire group	400	100
Age		
18-44 (young adult)	289	72.3
45-54 (middle-aged)	81	20.2
55-59 (older adult)	30	7.5
Sex		
Male	212	53.2
Female	188	46.8
Civil status		
Married/Common Law	283	70.8
Single	88	22.0
Widowed	21	5.3
Separated	8	2.0
Educational level		
Elementary	132	33.0
Highschool	189	47.2
Vocational	8	2.0
College	71	17.8
Work status		
Employed	201	50.2
Unemployed	199	49.8
Family structure		
Nuclear	251	62.7
Extended	128	32.0
Dyad	8	2.0
Single	13	3.3
Monthly income		
≤ 5,000 (lowest)	337	84.2
5,001-9,999 (lower)	56	14.0
≥ 10,000 (low)	7	1.8
No. of doctor visits in the last year		
Never	158	39.5
1-3	228	57.0
4-6	10	2.5
≥ 7	4	1.0
Health insurance		
With	287	71.8
Without	113	28.2
Health status		
With a diagnosed medical condition	29	7.2
Without diagnosed medical condition	371	92.8
Diabetes risk status		
High risk	106	26.5
Low risk	294	73.5

The data in Table 1 also presents a remarkably lower percentage of the adults reported to have a diagnosed medical condition (7.2%); however, it may not reflect the real situation since it appears that just about less than a half (39.5%) of the adults claimed never to seek a doctor in the

last year. Based on diabetes risk assessments, out of 400 respondents, 106 participants (26.5%) were classified as high risk for diabetes, while 294 respondents (73.5%) were grouped as low risk for diabetes.

Table 2 shows the differences in health literacy indexes between adults at high and low risk for diabetes. Although the results showed the presence of low levels of health literacy, both in the high-risk group (*M* = 25.20, *SD* = 4.76) and low-risk group (*M* = 27.66, *SD* = 4.69), there is sufficient evidence that supports a significant difference between the health literacy index mean scores of adults among the two groups, *t* (398) = -4.61, *p* = .000, at .05 level of significance. The high-risk group (*M* = 25.20, *SD* = 4.76) showed significantly worse health literacy indexes compared to the low-risk group (*M* = 27.66, *SD* = 4.69). Moreover, correlation effect size, $_{corr}$ES = .52 (Hedges *g*), revealed a medium effect, which meant that the level of risk for developing diabetes had a moderate magnitude effect on the differences between their health literacy levels. Specifically, among the three health dimensions of health literacy, the disease prevention subscale obtained the lowest health literacy indexes for both groups, high risk (*M* = 24.21, *SD* = 6.30) and low risk (*M* = 26.81, *SD* = 5.94).

Table 2 Differences in the means of health literacy index, grouped according to diabetes risks: high risk vs. low risk

Health literacy index	*M*	*SD*	*t*-value	$_{corr}$ES *(Hedges 'g)*	*p*-value
Healthcare					
High	25.47	6.18	-4.98	.56	.000*
Low	28.64	5.40			
Disease prevention					
High	24.21	6.30	-3.79	.43	.000*
Low	26.81	5.94			
Health promotion					
High	25.90	5.61	-2.49	.28	.013*
Low	27.59	6.11			
General health literacy					
High	25.20	4.76	-4.61*	.52	.000*
Low	27.66	4.69			
Overall health literacy index	27	5			

**p* < .05 (significant)

Table 3 Differences in the means of health-promoting behaviors, grouped according to diabetes risks: high risk vs. low risk

Health behaviors	*M*	*SD*	*t*-value	*p*-value
Nutrition				
High	2.24	.702	-1.23	.220
Low	2.33	.626		
Health responsibility				
High	2.28	.607	2.46	.215
Low	2.20	0.555		
Spiritual growth				
High	2.66	.647	1.88	.061
Low	2.53	.596		
Stress management				
High	2.38	.719	-.84	.440
Low	2.32	.673		
Physical activity				
High	1.94	.720	-.67	.503
Low	1.99	.635		
Interpersonal relationship				
High	2.41	.662	.72	.475
Low	2.36	.601		
General health behaviors				
High	2.32	.708	-.81	.420
Low	2.29	.635		
Overall health behaviors	2.3	.672		

**p* < .05 (significant)

Table 3 shows the differences in the mean scores of health behaviors between adults at high and low risk for diabetes. The health behaviors of adults at high risk (*M* = 2.32, SD = .708) and low risk (*M* = 2.29, *SD* = .635) were both considered as negative health-promoting behaviors. Consistently, statistical testing showed no significant difference between the health behaviors of adults grouped according to their diabetes risk, *t* (398) = -.81, *p* = .420.

Analysis of the subscales showed consistently negative behaviors in five health behavior subscales, except in the spiritual growth, which had a positive health behavior for both adults at high risk (*M* = 2.66, *SD* = .647) and low-risk group (*M* = 2.53, *SD* = .596). Among the six subscales of health behaviors, the lowest health behavior mean scores were in the physical activity subscale, both in the high risk (*M* = 1.94, *SD* = .720) and the low-risk group (*M* = 1.99, *SD* = .635). The highest health behavior scores were in the spiritual growth subscales.

Table 4 Correlation between health literacy indexes and health behavior scores, grouped according to high risk, low risk, and the entire group

Variables	*r*	*p*-value	Interpretation
High	.43	.000*	Significant moderate positive
Low	.13	.029*	Significant weak positive
Overall	.17	.000*	Significant weak positive

*$p < .05$ (significant)

Table 4 shows that there is a statistically significant relationship ($p < .05$) but a moderately positive correlation ($r = .43$) between the health literacy and health-promoting behaviors of adults at high risk for diabetes. Furthermore, a statistically significant relationship ($p < .05$), but a weak positive correlation ($r = .13$) exists between health literacy and health behaviors among adults in the low risk for diabetes group. Correspondingly, the same significant relationship ($p < .05$) but a weak positive correlation ($r = .17$) exists when adults were taken as an entire group.

Discussion

The results practically implied that both adults at high and low risk for diabetes have difficulties finding, understanding, judging, and applying health information with the worst regards to disease prevention. Adults at high risk for diabetes have difficulty accessing information regarding medical issues and accessing the information on their risk factors for health, as they have the lowest mean scores in their capacity to find information regarding healthcare and access information regarding disease prevention. It is also important to note that adults in the high-risk group had difficulty applying health information regarding what determines the promotion of health in their physical and social environment, such as doing physical exercises. On the other hand, having a relatively higher literacy index in utilizing information in seeking care and health treatments has favorable and unfavorable consequences. A favorable example of which is when adults at low risk for diabetes can make informed decisions on medical issues; however, the challenge lies in the decision making regarding the proper time to consider a situation to be an emergency. Furthermore, the disparity between the non-uniform trends of health literacy scores in health promotion and healthcare dimensions between the two groups could be ascribed to a greater percentage of the adults, classified as low risk for diabetes, and categorized as having the lowest socio-economic status, taking more advantage of available free healthcare services compared to their high-risk counterpart. However, this is still considered as suboptimal visits to a healthcare provider, with the study results showing just a slightly higher percentage of adults visiting a medical doctor at least 1-3 times (57%) in a year compared to those who had never seen one (39.5%).

The study results are consistent with the results of other research that involved populations with lower socio-economic status in local studies (Agosto et al., 2018). This is also parallel to the findings of most international studies among general adults (Choi et al., 2013; Coffman et al., 2012; Jordan & Hoebel, 2015) that revealed low, limited, problematic, or inadequate health literacy descriptions among its study population. However, the study results contrast to the results of studies that showed sufficient and acceptable health literacy (Chahardah-Cherik et al., 2018; De Castro et al., 2014; Tol et al., 2014) among adults with diagnosed diabetes. The difference in the results could be credited to the fact that the population mentioned in these studies was among adults already diagnosed with diabetes compared to the studies discussed earlier, among general adults. Furthermore, a higher prevalence of limited health literacy was reported in the population surveyed in the community compared with those who attended primary care or hospitals (Abdullah et al., 2019).

In terms of health behaviors, the results of this study are the same as the results of other studies conducted on other chronic diseases (Maheri et al., 2016; Mohsenipoua et al., 2016) and adults stratified to different levels of diabetes risk (Sutherland et al., 2012), which revealed that the levels of physical activity and the levels of spiritual growth are the subscales with the lowest and highest levels, respectively. The data imply that in adults with a high risk of diabetes, the physical dimensions represented by the subscales of nutrition and physical activity were uniformly lower than those in the low-risk group. In contrast, health behavior subscales of those adults at high risk for diabetes that appeal to the psychological, spiritual, and social aspects had consistently higher scores than their low-risk counterparts. It could mean that adults in the high-risk group have relatively lower physical health behavior scores but somewhat higher psychosociospiritual health behavior scores than those in the low-risk group. A study among diabetic and non-diabetic adults in Brazil (De Oliveira et al., 2018) showed partially consistent analogous results where people with diabetes had better dietary habits than those without diabetes but still had risk behaviors such as insufficient physical activity. It is remarkable to note that if

adults at high risk for diabetes are to be considered as future diabetics, while adults at low risk for diabetes remained to be non-diabetics, it could imply that health behaviors in different subscales could vary in results, but in non-uniform directions. To wit, one subscale may connote desirable health behaviors but the others like the opposite.

The results of this study are similar to the results of a study among low income, low education, middle-aged Hispanics (Sutherland et al., 2012), which reported a higher mean score of health responsibility, interpersonal relationship, and stress management on those adults with a higher risk for diabetes than those adults with lower risk. In the case of health responsibility, an example to better understand this situation is that in developing countries, health decisions are often not made by individuals but are made collectively by family members. This is a cultural difference among Filipino adults, especially in a rural setting. On a particular issue, an individual, such as a husband, would decide on behalf of his wife. Overall, the level of health behaviors among adults at high risk and low risk for diabetes is just the same. This is consistent with the findings of a study among low-income Latino adults that states no significant differences between adults in different levels of diabetes risk when it comes to their level of engagement in physical activity, the extent of monitoring nutrition, and owing to one's own health responsibility (Sutherland et al., 2012).

The results of statistical testing that revealed no significant difference between the health behavior mean scores of adults at high and low risk for diabetes denote that adoption of risk reduction behavior among the entire population of adults, with special regards to the level of physical activity and nutrition, are homogeneously low. Thus, an all-adult inclusion effort is needed to improve awareness of the degree of risk for developing diabetes, increase promotion of healthy behaviors and advance the availability of evidence-based lifestyle interventions to reduce the growth in new cases of diabetes. The results of this study could not rule out the effect of the adult's level of risk for diabetes on the level of their health behaviors. However, it could imply that the sample of the adult population seems to give priority to better their spirituality than to adopt healthy behaviors in other subscales, as evidenced by higher spiritual behaviors scores.

Most studies consistently report a low level of health behaviors among adults in a low-income and rural setting. A probable explanation about the lacking influence of diabetes risk level on health behaviors could be supported by the absence of studies from low and middle-income countries that could show the association between health behaviors and reduction in diabetes risk, particularly one that employed higher hierarchical research evidence. This result is further supported by a sensitivity analysis study (Feldman et al., 2017), which revealed no single health behavior that drives the relationship between diabetes risk and health behaviors, suggesting that there could be interactive effects with other variables. One suggestive independent variable in this study is health literacy, where a significant difference between adults at high and low risks for diabetes exists.

The study revealed a significant positive relationship between health literacy and health behaviors. This implies that the adult's health literacy indexes have significantly influenced their health behaviors. Limitations on the interpretative value of correlation results were present, but with the utilization of the Health Promotion Model (Pender et al., 2011) and the Health Literacy Conceptual Model (Sørensen et al., 2013) as the theoretical basis of this study, the existing relationship between health literacy and health behavior is supported. This is consistent with the results of other researchers who worked on the population of adults with known cardiovascular diseases (Aaby et al., 2017), infectious respiratory diseases (Sun et al., 2013), and diabetes (Chahardah-Cherik et al., 2018; Kim et al., 2018; Yeh et al., 2018). The moderate magnitude of correlation could be credited to the non-uniform variation of the direction of scores in all the subscales of health-promoting behavior. A significant weakening in the correlation could be ascribed greatly to surprisingly higher spiritual behavior scores among adults, which could pull up higher a supposedly low general health behavior scores in relation to a uniformly lower health literacy index.

Numerous literatures exist about the relationship between health literacy and health behaviors among healthy adults (Hansen et al., 2015; Suka et al., 2015) or even individuals with other disease risks (Sun et al., 2013; Wong et al., 2018). However, there is a conflicting study that reports no significant association between health literacy and some measures of health outcomes in a random sample of adults who were already diagnosed with diabetes (Singh & Aiken, 2017) in Western Jamaica. Furthermore, a meta-analysis report (Al Sayah et al., 2015) among 723 eligible studies about the relationship between health literacy and health outcomes also proposes that there is still insufficient or inconsistent evidence that independently associates health literacy with health outcomes adults diagnosed with diabetes. Thus, it is still premature to advance research with higher hierarchical evidence since there are still no sufficient data to suggest the independent relationship between health literacy and health outcomes.

The study utilized a large sample size, implemented a random probability sampling technique, and garnered a high response and return rate. This was a good representation of the target population regarding adults in the rural setting. It was found out that even in the remote rural setting, health literacy had a significant positive relationship with health behaviors. Healthcare workers, including nurses, need to focus on increasing the health literacy of adults, especially those who are at high risk for diabetes, to facilitate the development of healthy behaviors. Moreover, the risk assessment was only limited to diabetes risk factors such as age, sex, waist circumference; family history of diabetes, high blood sugar, and high blood pressure; and measurement of waist circumference to estimate diabetes risk levels. Health literacy and health

behaviors might be different in adults who have already been diagnosed with diabetes. However, the tool for assessing diabetes risk could help healthcare workers who have less training since it is practical, cost-effective, and easy to implement.

The result of non-significant differences between the health behaviors of adults at high and low risk for diabetes should not be misunderstood as a failure of the study, but instead, a springboard for another research to scrutinize the characteristics of these adults that influence their health behaviors. Adults at high risk for diabetes had low health behavior scores, but their health behavior subscale scores in spiritual growth, health responsibility, and interpersonal relationships were better compared to their low-risk counterparts. Further study of the characteristics of adults at high risk for diabetes that makes them have better scores in the aforementioned subscales of health behavior is recommended.

On the other hand, the significant difference between the health literacy of the two groups of adults had practical implications. The prioritization of health education among those at high risk for diabetes should be in place, as the economy of practicing health information campaigns has always been costly. However, the needs of those adults at low risk should also not be overlooked, as the health behaviors for both groups had no significant difference. Disease prevention, being the subscale with the worst health literacy index for both adults at high and low risk for diabetes, should be a major concern in implementing health promotion projects. A greater number of adults have low health behaviors in nutrition, physical activity, and health responsibility, more so a higher percentage of adults in the low-risk group. Improving the health literacy of adults regarding where to find information on proper nutrition, practical exercises, and family members' inclusion in support of one's health responsibility is a target objective.

Limitations

Caution is advised about the temporality of the results between variables. Since this a cross-sectional study, direct causality cannot be inferred. This study was only limited to diabetes risk factors such as age, sex, waist circumference; family history of diabetes, high blood sugar, and high blood pressure; and measurement of waist circumference to estimate diabetes risk levels. Health literacy and health behaviors might be different in adults who have already been diagnosed with diabetes, as well as in other settings and populations.

Conclusion

The classification of adults according to diabetes risks had brought light to the fact that adults in the accessible population do not only have a low level of health literacy but an alarming inadequate health literacy. This is remarkably evident in adults at high risk for diabetes, inclined to have worse health literacy compared to those adults who have a low risk for diabetes. Thus, the total inclusion of adults with low health literacy in health education could avoid the worsening effects of diabetes in the underprivileged population. The significantly positive correlation between health literacy and health behavior should be a calling for political will to push for government officials, legislators, and stakeholders to institutionalize programs that could increase health information competencies, such as making health information available in strategic health stations, taking advantage of multimedia broadcast advertisements, disseminating free health information through text messaging, and utilizing language appropriate, and "no read-no write" friendly pamphlets. Furthermore, the local government unit is suggested to capitalize on pre-existing public education infrastructures to deliver health information among the locales, as remediation for the low health literacy, as well as a starting solution for disease prevention against diabetes.

Declaration of Conflicting Interest
The author reports no actual or potential conflicts of interest.

Funding
The author independently funded the study.

Acknowledgment
The author wishes to thank all the participants for participating in the study and the barangay health workers to engage in data collection. The author is grateful to Quennie R. Ridulme, MAN, RN, for her mentorship and guidance and to Ryan Michael Oducado, PhD, RN, RM, LPT, for suggesting revisions in the manuscript suitable for publication.

Author Biography
Christian Sandor B. Ydirin, MAN, RN, CCRN is an alumnus and the first Chancellor's lists graduate of the Master of Arts in Nursing Program of the University of the Philippines Open University, Los Banos, Philippines.

Author Contribution
CSY solely conceptualized the study, actively supervised data collection, was intensively involved in data analysis, and exclusively approved the final manuscript.

Data Availability Statement
The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical considerations.

References

Aaby, A., Friis, K., Christensen, B., Rowlands, G., & Maindal, H. T. (2017). Health literacy is associated with health behaviour and self-reported health: A large population-based study in individuals with cardiovascular disease. *European Journal of Preventive Cardiology, 24*(17), 1880-1888. https://doi.org/10.1177/2047487317729538

Abdullah, A., Liew, S. M., Salim, H., Ng, C. J., & Chinna, K. (2019). Prevalence of limited health literacy among patients with type 2 diabetes mellitus: A systematic review. *PloS One, 14*(5), e0216402. https://doi.org/10.1371/journal.pone.0216402

Adriaanse, M. C., Twisk, J. W. R., Dekker, J. M., Spijkerman, A. M. W., Nijpels, G., Heine, R. J., & Snoek, F. J. (2008). Perceptions of risk in adults with a low or high risk profile of developing type 2 diabetes; a cross-sectional population-based study. *Patient*

Education and Counseling, 73(2), 307-312. https://doi.org/10.1016/j.pec.2008.06.009

Agosto, H. G. C., Briones, M. V. A., & Palatino, M. C. (2018). Correlates of health literacy among Filipinos aged 50-70 years old belonging to low-income families in a selected community. *Acta Medica Philippina, 52*(3). https://doi.org/10.47895/amp.v52i3.397

Al Sayah, F., Majumdar, S. R., Egede, L. E., & Johnson, J. A. (2015). Associations between health literacy and health outcomes in a predominantly low-income African American population with type 2 diabetes. *Journal of Health Communication, 20*(5), 581-588. https://doi.org/10.1080/10810730.2015.1012235

Beliran, S. P., & Legaspi, M. S. (2014). Health-promoting behaviors and quality of life of Filipino older persons. *Asia Pacific Journal of Education, Arts and Sciences, 1*(5), 11-20.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2011). *Introduction to Meta-Analysis*. West Sussex, United Kingdom: John Wiley & Sons.

Briones, M. V. (2017). *Health literacy among Filipino adults belonging to low-income families and its association with cancer screening utilization: A cross-sectional study.* (MSc. Epidemiology (Public Health) Thesis), University of the Philippines Manila.

Brydges, C. R. (2019). Effect size guidelines, sample size calculations, and statistical power in gerontology. *Innovation in Aging, 3*(4), igz036. https://doi.org/10.1093/geroni/igz036

Chahardah-Cherik, S., Gheibizadeh, M., Jahani, S., & Cheraghian, B. (2018). The relationship between health literacy and health promoting behaviors in patients with type 2 diabetes. *International Journal of Community Based Nursing and Midwifery, 6*(1), 65. https://doi.org/10.30476/IJCBNM.2018.40815

Choi, S. E., Rush, E., & Henry, S. (2013). Health literacy in Korean immigrants at risk for type 2 diabetes. *Journal of Immigrant and Minority Health, 15*(3), 553-559. https://doi.org/10.1007/s10903-012-9672-9

Coffman, M. J., Norton, C. K., & Beene, L. (2012). Diabetes symptoms, health literacy, and health care use in adult Latinos with diabetes risk factors. *Journal of Cultural Diversity, 19*(1), 4-9.

Conserva, L. (2014). 1 of 5 Ilonggos suffers diabetes. *The Daily Guardian*. Retrieved from http://www.thedailyguardian.net/index.php/local-news/41653-1-of-5-ilonggos-suffers-diabetes-xx

de Castro, S. H., Brito, G. N. O., & Gomes, M. B. (2014). Health literacy skills in type 2 diabetes mellitus outpatients from an university-affiliated hospital in Rio de Janeiro, Brazil. *Diabetology & Metabolic Syndrome, 6*(1), 1-5. https://doi.org/10.1186/1758-5996-6-126

de Oliveira, A. P. D. N., Maia, E. G., Silva, F. M., Martins, A. P. B., & Claro, R. M. (2018). Needed improvements in diabetes prevention and management in Brazil. *Preventing Chronic Disease, 15*, E153. https://doi.org/10.5888/pcd15.180269

Derrick, B., Ruck, A., Toher, D., & White, P. (2018). Tests for equality of variances between two samples which contain both paired observations and independent observations. *Journal of Applied Quantitative Methods, 13*(2), 36-47.

Duong, T. V., Aringazina, A., Kayupova, G., Pham, T. V., Pham, K. M., Truong, T. Q., . . . Majid, H. A. (2019). Development and validation of a new short-form health literacy instrument (HLS-SF12) for the general public in six Asian countries. *HLRP: Health Literacy Research and Practice, 3*(2), e91-e102. https://doi.org/10.3928/24748307-20190225-01

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149-1160. https://doi.org/10.3758/BRM.41.4.1149

Feldman, A. L., Long, G. H., Johansson, I., Weinehall, L., Fhärm, E., Wennberg, P., . . . Rolandsson, O. (2017). Change in lifestyle behaviors and diabetes risk: Evidence from a population-based cohort study with 10 year follow-up. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1), 1-10. https://doi.org/10.1186/s12966-017-0489-8

Fitz-Gibbon, C. T. (2002). A Typology of Indicators for an Evaluation-Feedback Approach 'in AJ Visscher and R. Coe (Eds.) School Improvement Through Performance Feedback. In A. J. Visscher & R. Coe (Eds.), *School improvement through performance feedback*. Lisse: Swets and Zeitlinger.

Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Personality and Individual Differences, 102*, 74-78. https://doi.org/10.1016/j.paid.2016.06.069

Gloor, R. (2014). Health literacy. Retrieved from https://www.pchrd.dost.gov.ph/index.php/news/library-healthnews/3590-health-literacy

Hansen, H. R., Shneyderman, Y., & Belcastro, P. A. (2015). Investigating the association of health literacy with health knowledge and health behavior outcomes in a sample of urban community college undergraduates. *American Journal of Health Education, 46*(5), 274-282. https://doi.org/10.1080/19325037.2015.1055016

International Diabetes Federation. (2014). *Global diabetes scorecard: Philippines, 2014*. Retrieved from http://www.idf.org/global-diabetes-scorecard/assets/downloads/Scorecard-29-07-14.pdf

Jordan, S., & Hoebel, J. (2015). Health literacy of adults in Germany-Findings from the 'German Health Update', wave 2013–2014 Susanne Jordan. *European Journal of Public Health, 25*(suppl_3), ckv173.043. https://doi.org/10.1093/eurpub/ckv173.043

Kim, K. A., Kim, Y. J., & Choi, M. (2018). Association of electronic health literacy with health-promoting behaviors in patients with type 2 diabetes: A cross-sectional study. *CIN: Computers, Informatics, Nursing, 36*(9), 438-447. https://doi.org/10.1097/CIN.0000000000000438

Kowall, B., Rathmann, W., Stang, A., Bongaerts, B., Kuss, O., Herder, C., . . . Huth, C. (2017). Perceived risk of diabetes seriously underestimates actual diabetes risk: The KORA FF4 study. *PloS One, 12*(1), e0171152. https://doi.org/10.1371/journal.pone.0171152

Ku, G. M. V., & Kegels, G. (2013). The performance of the Finnish Diabetes Risk Score, a modified Finnish Diabetes Risk Score and a simplified Finnish Diabetes Risk Score in community-based cross-sectional screening of undiagnosed type 2 diabetes in the Philippines. *Primary Care Diabetes, 7*(4), 249-259. https://doi.org/10.1016/j.pcd.2013.07.004

Lindström, J., Absetz, P., Hemiö, K., Peltomäki, P., & Peltonen, M. (2010). Reducing the risk of type 2 diabetes with nutrition and physical activity–efficacy and implementation of lifestyle interventions in Finland. *Public Health Nutrition, 13*(6A), 993-999. https://doi.org/10.1017/s1368980010000960

Maduramente, T. S., Orendez, J. D., Saculo, J. A., Trinidad, A. L. A., & Oducado, R. M. F. (2019). Health literacy: Knowledge and experience among senior students in a nursing college. *Indonesian Nursing Journal of Education and Clinic (INJEC), 4*(1), 9-19. https://doi.org/10.24990/injec.v4i1.227

Maheri, A., Sadeghi, R., Shojaeizadeh, D., Tol, A., Yaseri, M., & Ebrahimi, M. (2016). Associations between a health-promoting lifestyle and quality of life among adults with beta-thalassemia major. *Epidemiology and Health, 38*. https://doi.org/10.4178/epih.e2016050

Mohsenipoua, H., Majlessi, F., Shojaeizadeh, D., Rahimiforooshani, A., Ghafari, R., & Habibi, V. (2016). Predictors of health-promoting behaviors in coronary artery bypass surgery patients: An application of Pender's health promotion model. *Iranian Red Crescent Medical Journal, 18*(9), e38871. https://doi.org/10.5812/ircmj.38871

Pastakia, S. D., Ali, S. M., Kamano, J. H., Akwanalo, C. O., Ndege, S. K., Buckwalter, V. L., . . . Bloomfield, G. S. (2013). Screening for diabetes and hypertension in a rural low income setting in western Kenya utilizing home-based and community-based strategies. *Globalization and Health, 9*(1), 1-9. https://doi.org/10.1186/1744-8603-9-21

Pender, N. J., Murdaugh, C., & Parsons, M. A. (2011). *Health promotion in nursing practice*. Boston: Pearson.

Pilar, P. (2018). *2017 Health Situation of the Municipality of Pres. Roxas, Capiz, Philippines*. Philippines: President Roxas, Capiz.

Pippitt, K., Li, M., & Gurgle, H. E. (2016). Diabetes mellitus: Screening and diagnosis. *American Family Physician, 93*(2), 103-109.

Singh, S. G., & Aiken, J. (2017). The effect of health literacy level on health outcomes in patients with diabetes at a type v health centre in Western Jamaica. *International Journal of Nursing Sciences, 4*(3), 266-270. https://doi.org/10.1016/j.ijnss.2017.06.004

Sørensen, K., Van den Broucke, S., Pelikan, J. M., Fullam, J., Doyle, G., Slonska, Z., . . . Brand, H. (2013). Measuring health literacy in populations: illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC Public Health, 13*(1), 1-10. https://doi.org/10.1186/1471-2458-13-948

Suka, M., Odajima, T., Okamoto, M., Sumitani, M., Igarashi, A., Ishikawa, H., . . . Sugimori, H. (2015). Relationship between health literacy, health information access, health behavior, and health status in Japanese people. *Patient Education and Counseling, 98*(5), 660-668. https://doi.org/10.1016/j.pec.2015.02.013

Sun, X., Shi, Y., Zeng, Q., Wang, Y., Du, W., Wei, N., . . . Chang, C. (2013). Determinants of health literacy and health behavior regarding infectious respiratory diseases: A pathway model. *BMC Public Health, 13*(1), 1-8. https://doi.org/10.1186/1471-2458-13-261

Sutherland, L. L., Weiler, D. M., Bond, L., Simonson, S., & Reis, J. (2012). Northwest Latinos' health promotion lifestyle profiles according to diabetes risk status. *Journal of Immigrant and Minority Health, 14*(6), 999-1005. https://doi.org/10.1007/s10903-012-9641-3

Tol, A., Mohebbi, B., Sadeghi, R., Maheri, A. B., & Eshraghian, M. R. (2014). Determinants of health-promoting behaviors among type 2 diabetic patients: Voice of Iran. *Open Journal of Endocrine and Metabolic Diseases, 4*(09), 219. https://doi.org/10.4236/ojemd.2014.49021

Walker, S. N., & Hill-Polerecky, D. M. (1995). *Psychometric evaluation of the health-promoting lifestyle profile II*. Unpublished manuscript. University of Nebraska Medical Centre. Omaha.

Wilson, S. E., Rosella, L. C., Lipscombe, L. L., & Manuel, D. G. (2010). The effectiveness and efficiency of diabetes screening in Ontario, Canada: A population-based cohort study. *BMC Public Health, 10*(1), 1-12. https://doi.org/10.1186/1471-2458-10-506

Wong, K. K., Velasquez, A., Powe, N. R., & Tuot, D. S. (2018). Association between health literacy and self-care behaviors among patients with chronic kidney disease. *BMC Nephrology, 19*(1), 1-8. https://doi.org/10.1186/s12882-018-0988-0

Yeh, J.-Z., Wei, C.-j., Weng, S.-f., Tsai, C.-y., Shih, J.-h., Shih, C.-l., & Chiu, C.-h. (2018). Disease-specific health literacy, disease knowledge, and adherence behavior among patients with type 2 diabetes in Taiwan. *BMC Public Health, 18*(1), 1-15. https://doi.org/10.1186/s12889-018-5972-x

Cite this article as: Ydirin, C. S. B. (2021). Health literacy and health-promoting behaviors among adults at risk for diabetes in a remote Filipino community. *Belitung Nursing Journal, 7*(2), 88-97. https://doi.org/10.33546/bnj.1298