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MIDDLE-AGED AND ELDERLY HEALTH LITERACY: A CROSS-SECTIONAL EXPLORATION

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Abstract: *This study investigates the key factors influencing health literacy among middle-aged and elderly adults in Seremban, Negeri Sembilan. The study aimed to explore health literacy among older adults as well as to evaluate the factors that influence health literacy among them. The factors investigated include gender, age, race, education level, self-rated health status, self-rated financial status, and self-rated self-esteem. The data was gathered from a group of middle-aged and elderly individuals, aged 45 and older, living in Seremban, Negeri Sembilan. The sample of this study consisted of 456 respondents. The binary logistic regression analysis was conducted, and the results of this study indicated that among seven predictor variables, there were two significant factors influencing health literacy, which were age (p-value = 0.000) and self-rated self-esteem (p-value = 0.000). These findings highlight how crucial both influential factors were in affecting the health literacy of the targeted population. The study also contributed to closing the knowledge gap in the research study on health literacy generally in Malaysia, besides raising awareness and insights on the importance of health literacy among middle-aged and elderly people in Negeri Sembilan.*

Keywords: *health literacy; factors; middle-aged; elderly; older adults*

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Introduction

Health literacy is defined as the degree to which individuals can access, process, and comprehend basic health information and services to make better and more appropriate health decisions for their healthcare. This matter includes understanding and studying health-related information as well as successfully applying the knowledge gained in health-related scenarios (Chiu et al., 2020). In addition to what has been stated, the term" health literacy" also refers to various kinds of abilities, such as verbal and non-verbal communication, mathematical skills, and critical thinking, all of which are necessary for deciding how to deal with the healthcare system and thus, will independently take an active role in their own healthcare (Hoa et al., 2020). Previous research from Wu et al. (2022) has also shown adequate health literacy is one of the benefits of preventing illness and promoting healthcare, even for a community. For example, during public health emergencies, public health information is crucial for reducing risky behaviours such as panic attacks while facing a critical situation, especially for those in their late adulthood, or mostly known as the elderly, and adults in their middle ages.

Khan et al. (2024) and Seo et al. (2022) stated that late middle-aged adults are individuals who fall between the ages of 45 and 64 years old, while the elderly, also known as senior citizens, are people from the age of 65 years old and above. There are various life events these individuals must go through in their older life phase, including job growth, family responsibilities, or parenting duties, and they will also experience changes in physical and mental ability. Furthermore, they frequently encounter several common major problems, including maintaining their health. Most of the individuals in their late adulthood, unfortunately, face some health issues due to limited health literacy. A research study by Liu et al. (2020) has found that a lack of health literacy is linked to poor health knowledge and inadequate self-care. It may also influence how they manage their healthcare. Therefore, since health literacy affects their physical and mental health, even their mortality, health literacy is genuinely crucial for these older adults.

Concerns about health literacy among older people have been widely discussed, and Malaysia is not an exception. According to Kosmo! Malaysia (2022), the Ministry of Health Malaysia (MOH) has announced that the country had the highest obesity rate in Southeast Asia in the year 2019, which was at 15.6%. Other than that, there are two leading causes of high mortality rates in this country, and those are cardiovascular disease and diabetes (Khan et al., 2022). A statement from Khan et al. (2024) also said that older Malaysian female adults are more likely to be overweight and obese, and most of them also have a common disease, which is diabetes. On that occasion, Negeri Sembilan, one of the states in Malaysia, is not excluded from the common health issue in Malaysia either.

Based on Table 1, provided by Jabatan Kesihatan Negeri Negeri Sembilan, Seremban district has the highest frequency of both new and cumulative diabetes cases in 2021. Seremban also has the highest frequency of total active cases of diabetes, out of all the districts in Negeri Sembilan.

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Table 1: Number of New, Registered, and Active Diabetes Cases by Negeri Sembilan Districts in 2021

District	Number of New Diabetes (Health Facilities)	Cumulative Diabetes Cases	Total Active Diabetes Cases
Seremban	1,174	51,044	25,521 (50.0%)
Kuala Pilah	223	12,236	5,164 (42.2%)
Jempol	460	14,113	6,385 (45.2%)
Rembau	133	5,494	2,609 (47.5%)
Tampin	456	14,525	6,583 (45.3%)
Port Dickson	269	15,733	6,284 (39.9%)
Jelebu	268	7,089	3,233 (45.6%)
Negeri Sembilan	**1,809**	**120,450**	**55,779 (46.3%)**

Source: *Laporan Tahunan 2021* (pg 99) by Jabatan Kesihatan Negeri Negeri Sembilan, 2021, Copyright by Jabatan Kesihatan Negeri Negeri Sembilan

Older people nowadays, including Malaysian adults, are carelessly taking care of their well-being; most of them eat without paying much attention to the ingredients, and they barely do basic physical moves, or at least go for a walk, to maintain good health and figures. As reported in a newspaper article by The Star (2023), Dewan Rakyat stated that 18.3% of the adults in Malaysia have diabetes, and Negeri Sembilan had the highest diabetic rate with 33.2% or 234,203 diabetes patients in 2019. Hence, according to Rizal et al. (2022), the overall health and well-being among older people in Malaysia are quite alarming due to the low health literacy rate. Consequently, the goal of this study was to discover the factors that contribute to health literacy among middle-aged adults and the elderly in Negeri Sembilan.

Furthermore, the factors that influence health literacy have not been thoroughly researched yet, and in general, the significance of health literacy is still unresolved (Jaafar et al., 2021). There are some important requirements, such as validated measurement tools and ethical research practices that are needed to perform a thorough analysis given the lack of research on the factors influencing health literacy among older adults. The study provided insights into how health literacy affects overall health conditions of the older adults by figuring out all these factors affecting the targeted variable. Aiming to close this knowledge gap and advance our understanding of the complexity of health literacy, this research aimed to explore health literacy among middle-aged and elderly people, as well as to evaluate the factors that influence health literacy among middle-aged adults and elderly people in Seremban, Negeri Sembilan.

Thus, the main aim of this study is to determine the factors that influence health literacy among middle-aged adults and the elderly in Seremban, Negeri Sembilan. Besides that, this study also intends to explore health literacy among middle-aged and elderly people in Seremban, Negeri Sembilan.

Although numerous studies have explored health literacy among older adults globally, limited research has focused on localized contexts such as Negeri Sembilan, Malaysia. This study is particularly crucial for Negeri Sembilan because recent health reports indicate that the state has one of the highest rates of diabetes and other chronic illnesses among older populations in Malaysia. According to the Jabatan Kesihatan Negeri Sembilan (2021), Seremban recorded the highest number of cumulative and active diabetes cases in the state, with 25,521 active cases,

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representing 50% of the district's total. This alarming trend underscores the need for targeted interventions informed by localized data. By investigating health literacy in Seremban, this study provides valuable, area-specific insights that can support more effective public health strategies tailored to the unique demographic and health profile of the region.

Additionally, unlike previous studies that often generalize findings across broader populations or focus on single demographic indicators, this research takes a multifactorial approach. It evaluates not only sociodemographic variables such as gender and age but also psychological and socioeconomic dimensions like self-rated financial status and self-esteem. This holistic methodology allows for a more nuanced understanding of what influences health literacy among middle-aged and elderly adults in Negeri Sembilan, distinguishing this study from earlier, more narrowly scoped research.

Literature Review

Despite a growing body of research on health literacy globally, studies focusing on Malaysian populations remain limited. Jaafar et al. (2021) and Rizal et al. (2022) emphasized alarming levels of health illiteracy and poor health-related quality of life in Malaysia. Jaafar et al. notably found that low literacy rates are prevalent among older adults, a finding echoed by Shah et al. (2021) who reported unmet healthcare needs among Malaysian elderly. These studies, while valuable, are either broad in scope or lack district-level analysis. By concentrating specifically on Negeri Sembilan, this study contributes a localized perspective to the Malaysian health literacy literature—addressing the current national gap with district-specific data and analysis.

In this study, six main factors were explored for their influence on health literacy: gender, age, education level, self-rated health status, self-rated financial status, and self-rated self-esteem. The following literature discussion not only synthesizes prior findings but also highlights contradictory outcomes and includes more Malaysian-based research to contextualize the study.

Health Literacy

Health literacy is commonly defined as the ability to access, process, and understand health information to make informed decisions (Chiu et al., 2020). While most studies affirm the importance of health literacy in disease prevention and self-care (Baysal & Yildiz, 2021), Bhusal et al. (2021) argue that low health literacy still persists as a barrier to good healthcare, especially in vulnerable groups.

Interestingly, while international studies often focus on vulnerable groups like immigrants or the mentally ill (Suka et al., 2015), Malaysian studies such as Jaafar et al. (2021) emphasize that even the general population in Malaysia scores poorly on health literacy indices. This suggests a broader systemic issue in public health education in Malaysia that may not be as prominent in some other countries.

Gender

Literature shows varied findings on gender differences in health literacy. Lee et al. (2014) and Li et al. (2023) found that females tend to have higher health literacy. Conversely, Amoah & Phillips (2019) observed that men in Ghana demonstrated better literacy when tied to behaviors like smoking reduction. Dadaczynski et al. (2020) also highlighted that male leaders with inadequate health literacy showed weaker health promotion practices.

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These contradictions suggest that gender-related health literacy differences may be influenced by contextual cultural, societal, and occupational factors. In the Malaysian context, no conclusive pattern has yet emerged, pointing to a gap that future local studies should explore.

Age

Although it is frequently asserted that older adults exhibit diminished health literacy due to physical and cognitive deterioration (Shah et al., 2021; Khamrin et al., 2021), certain studies, such as Bhusal et al. (2021), suggest that age may positively correlate with health literacy when seniors proactively pursue health information.

Locally, Rizal et al. (2022) highlight that low health literacy among Malaysia's older adults contributes significantly to poorer health-related quality of life. These contrasting perspectives point to the importance of behavioral factors—such as engagement with health services—over age alone.

Education Level

Most literature agrees that lower education levels are associated with poorer health literacy (He et al., 2016; Dong et al., 2023). However, exceptions exist. Zhang (2020) showed that illiteracy impacts mental health, while Seurer & Vogt (2013) emphasized how low literacy creates barriers even among people who engage with healthcare systems.

In Malaysia, Jaafar et al. (2021) found that even individuals with formal education could have low health literacy, indicating that formal schooling may not always equip individuals with functional health skills

Health Status

Studies such as Jaafar et al. (2021) and Arora & Grey (2020) contend that inadequate health status is generally associated with low health literacy, whereas Nock et al. (2023) propose that individuals with poor health may enhance their health literacy via regular engagement with healthcare services.

This contradiction highlights that health literacy can be both a cause and a consequence of health status. Malaysian studies (e.g., Rizal et al., 2022) also show this duality—low literacy leads to poor health outcomes, yet chronic conditions may prompt learning and adaptation.

Financial Status

Financial strain is widely seen as negatively impacting health literacy (Cho et al., 2020; Artazcoz et al., 2021). However, James et al. (2012) found that older adults with better financial literacy often have higher health literacy, indicating a potential positive feedback loop.

Interestingly, Boateng et al. (2024) found that even financially constrained individuals might prioritize health if they have high health literacy. This complexity suggests that while income is a factor, motivation and access to information also play vital roles. Malaysia's MyHEBAT study (Khan et al., 2022) reinforces that socioeconomic status should be examined alongside health awareness campaigns.

Self Esteem

Numerous research affirms the beneficial correlation between self-esteem and health literacy (Dennison et al., 2011; Ilhan & Bardakci, 2020), although Yodmai et al. (2021) demonstrated

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that older persons with compromised physical health exhibited low self-esteem irrespective of their literacy levels.

The relationship may be bidirectional—low self-esteem may reduce one's motivation to engage in health behavior, while poor health outcomes may further lower self-esteem. This nuance is especially important in Malaysia, where older populations often deal with stigma and self-neglect (Rizal et al., 2022).

Methodology

All middle-aged adults and senior citizens, aged 45 and older, living in Seremban, Negeri Sembilan, were selected as the population to represent the broader population of these older adults in Malaysia. The required sample in achieving the objectives of the research is 385 by using the Cochran's formula proposed by Nanjundeswaraswamy and Divakar (2021).

To ensure success, convenience sampling was used due to its practicality and accessibility, especially in reaching middle-aged and elderly populations who may face physical or logistical barriers. The nature of this demographic—particularly the elderly—often involves mobility limitations and reduced digital access, which constrained the feasibility of using more rigorous random sampling methods. Despite its inherent limitations, convenience sampling is a common approach in exploratory health studies. The sampling was designed to be demographically broad by covering multiple locations including elderly care homes and community housing areas in Seremban, to help ensure representativeness and reduce selection bias.

The research instrument was adopted from Bhusal et al. (2021) and Evans et al. (2019) and was adapted for contextual relevance. Both online and traditional paper-based questionnaires were used to gather the primary data for this study. The paper-based questionnaires were distributed after receiving the required ethical approval at an elderly care home in Negeri Sembilan, which was Pusat Jagaan Warga Emas dan Terapi Fitrah at Taman Seremban Tiga, with 15 patients, and distributed to older residents of Taman Pinggiran Senawang. On the other hand, online questionnaires were distributed via platforms such as WhatsApp, Instagram, Telegram, and Facebook. The researcher also handed out printed Quick Response (QR) codes to the targeted residents in Seremban.

Outliers were identified and handled before finalizing the regression analysis to ensure a robust model. The presence of outliers was assessed using standardized residuals and Cook's Distance. Any observations with standardized residuals exceeding ±3 or Cook's Distance above the threshold of 4/n-k-1 (where *n* is the sample size and *k* is the number of predictors) were flagged. A total of eight such outliers were removed from the dataset, as they were found to exert disproportionate influence on the regression model. Removing these entries helped preserve the accuracy and stability of the statistical results.

Research Instrument

The research instrument was guided by several previous studies on health literacy, including a study by Bhusal et al. (2021). The items of the questionnaire set have been adopted from Evans et al. (2019), The research instrument consist of three sections.

Section A provides four questions regarding their socio-demographic variables, including gender (male/ female), age (45-64 years old/ 65 years old and older), race (Malay/ Indian/

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Chinese/ Bumiputera/ Non-Bumiputera), and highest education level (no formal education/ primary/ secondary/ tertiary) (Evans et al., 2019 & Bhusal et al., 2021).

Section B contains questions related to the factors affecting health literacy with three subsections regarding their self-rated health status, financial status, and self-esteem (Evans et al., 2019). Self-rated health status was measured using SRH-7 (Eriksson et al., 2001), a scale of 1 to 7 (very poor, poor, slightly poor, moderate, slightly good, good, excellent), then will be re-categorized into satisfactory health and unsatisfactory health status as: 1-4 (unsatisfactory) and 5-7 (satisfactory). Self-rated financial status was measured using a scale of 1 to 7 as well (very poor, poor, slightly poor, moderate, slightly good, good, excellent), then categorized as a new variable; 1-4 as poor financial status and 5-7 as good financial status (Evans et al., 2019). Rosenberg Self-Esteem Scale (RSE) measured self-rated self-esteem, consisting of 10 items, from strongly agree to strongly disagree. The score was calculated by the items. Items 1 to 5 were measured as 0 (strongly disagree), 1 (disagree), 2 (agree), and 3 (strongly agree), while items 6 to 10 were measured as 0 (strongly agree), 1 (agree), 2 (disagree), and 3 (strongly disagree). The total score range was calculated from 0 to 30, the score of 15 and below suggested low self-esteem and 16 and above suggested high self-esteem (Robins et al., 2001).

Section C emphasize on the health literacy index score which in this study range from a low of 0, to a high of 50, and at least 13 items must be answered to ensure the validity of the index scores. Health literacy was evaluated using the 16-item short version of the European Consortium for Health Literacy Questionnaire (HLQ-EU-16), also adopted from Evans et al. (2019) with four responses (very easy, easy, difficult, very difficult) with a “don’t know” option. Each response was assigned the following numerical code: 1 (very difficult), 2 (difficult), 3 (easy), 4 (very easy) and 0 (don’t know). According to the guidelines provided by the European Health Literacy Consortium, adopted from Bhusal et al. (2021), the mean score for each item on the scale was determined.

Based on Bhusal et al. (2021), the index scores are categorized into four rate categories of health literacy, which are excellent (43-50), sufficient (34-42), problematic (26-33), and inadequate (0-25). Then, those health literacy categories were re-categorized into a binary outcome for binary logistic regression analysis; 0 as limited health literacy (category combination of inadequate and problematic; index scores of 0-33), and 1 as adequate health literacy (category combination of sufficient and excellent; index scores of 34-50). The following table indicates all the items comprising the instrument that have been used for this study.

Data Analysis

This study employed two types of analysis: descriptive and inferential. Selected graphical presentations, such as frequency distribution, along with basic numerical measures such as means and standard deviations, were used to gain insights into the patterns of the data.

In this study, binary logistic regression was hired in achieving the main goal of the objective of the study. The following subsection describes this statistical method.

Binary Logistic Regression (BLR)

Binary logistic regression (BLR) was conducted in this study to evaluate the factors that influence health literacy among middle-aged adults and the elderly in Seremban, Negeri Sembilan. BLR is one of the common statistical methods to estimate the binary outcomes of a target variable, which means that the target variable came out with only two possible outcomes,

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based on one or more input variables. For describing and testing relationships between one or more categorical or continuous independent variables, and a categorical outcome variable, logistic regression analysis is often a good choice. Hence, this analysis was much more suitable to use for this research study since the target variable came out with two results, which were adequate health literacy as 1, and inadequate health literacy as 0.

The binary logistic analysis of this study was carried out using IBM SPSS Statistics version 26, which is one of the most widely used statistical software among researchers. Based on the variables of this research, the logistic model was then defined as follows,

$$logit(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \varepsilon$$

where,
y = Health literacy
x_1 = Gender
x_2 = Age
x_3 = Race (Malay)
x_4 = Race (Indian)
x_5 = Race (Chinese)
x_6 = Race (Bumiputera)
x_7 = Education level (Tertiary)
x_8 = Education level (Secondary)
x_9 = Education level (Primary)
x_{10} = Self-rated health status
x_{11} = Self-rated financial status
x_{12} = Self-rated self-esteem

There were three fundamental assumptions underlying BLR, which were linearity, absence of multicollinearity, and lack of strong influential outliers.

(a) Strong Influential Outliers

Identifying outliers will be carried out by examining the existing residuals. The outliers for the dependent variable were identified using the standardized residuals by using cutoff of (-3, 3) (Midi et al., 2013), while the outliers for the independent variables were being detected by the Cook's distance (Marzjarani, 2015) by using the cutoff of the calculation or the formula as follows,

$$Cook's\ distance = \frac{4}{n-k-1}$$

where,
n = the sample size
k = the number of independent variables

(b) Linearity in the Logit for Continuous Variable

The dependent variable that had been logit transformed should have a linear relationship with the independent continuous variables. This assumption would be violated if any of the statistical terms were significant, which is when the p-value is less than 0.05 (Battey et al., 2019). There was only one continuous independent variable for this study, which is self-rated self-esteem.

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(c) Absence of Multicollinearity

Multicollinearity appears when two or more independent variables in a regression model have a strong relationship with one another, making it difficult to identify the 27 exact influences or effects of each independent variable on the dependent variable. The reason is because the predicted coefficients in a logistic regression model with significantly correlated with independent variables usually have large standard errors. Hence, a tolerance and variance inflation factor (VIF) statistics were used to determine the multicollinearity of the model. A tolerance value less than 0.2 and a VIF value greater than 10 indicated a significant multicollinearity (Neter et al., 2020).

Binary Logistic Regression Model Assessment

There are a few elements needed in conducting BLR. The elements are discussed in the following sections.

(a) Hosmer-Lemeshow Test

The Hosmer-Lemeshow test is the most often used approach for evaluating the goodness-of-fit of logistic regression models among goodness-of-fit tests. The concept of th Hosmer-Lemeshow test involves grouping or dividing the observations and generating a chi-square statistic that describes the difference between the number of actual events and the predicted variables. When the significance value is less than 0.05, the Hosmer-Lemeshow statistic for the significance value shows a poor fit. Based on Ailobhio and Ikughur (2024), the model does not fit the data when the p-value is less than or equal to 0.05, indicating that there is a significant difference between the independent and dependent variables. Meanwhile, when the p-value is greater than 0.05, the model fits the data, and the actual results align well with the predicted probabilities.

(b) Cox and Snell R-Square and Nagelkerke R-Square

Specifically, both the proportion of results and a conservative estimate for the created model's overall fit in the case of a logistic regression predictive model, as determined by the Cox-Snell R-square, or proportion of variance explained, need to be mentioned (Harrell, 2015). The Nagelkerke R-square, a modified version of the Cox and Snell R-square, that changed the statistic's scale to encompass the whole range from 0 to 1, is commonly employed for the analysis.

(c) Wald Statistics

Tests of statistical significance could be run on each variable's coefficients. A Wald test is used to compare the alternative that the coefficient is not zero to the null hypothesis that the coefficient is zero for each coefficient. On the condition that the p-value is less than 0.05, the null hypothesis is rejected (Alkhalaf & Bruno, 2017). A simplified model with some coefficients set to zero may be compared to a full model that includes all predictor variables using a Wald test.

(d) Omnibus Test of the Coefficient

Alkhalaf and Bruno (2017) stated that the new model with the included explanatory variables was compared to the baseline model using the Omnibus Test to see if there is an improvement on it. To determine whether there is a significant difference between the log-likelihoods of the baseline model and the new model, Chi-square tests were employed. An omnibus test indicated that at least one model parameter was significant if the significance value is less than 0.05 and

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the null hypothesis is rejected.

(e) Classification Table

The classification table served as an additional tool for evaluating the logistic regression model's predicted precision. The values that were observed for the dependent outcome and predicted values are cross-classified in this table. After the predictors were included in the study, the classification table showed how well the model could predict the correct category. Based on Hupman (2021), 70% classification accuracy is a relevant criterion in many classification tasks, especially in performance evaluations. This accuracy level is considered satisfactory since it shows that the classifier can accurately identify the target class 70 out of 100 times.

Results

The researcher managed to collect 456 complete answers from the targeted respondents in a couple of months, which the researcher targeted to get the sample size of 385 respondents. 98.9% of the respondents are accepted after filtering illogical results of the health literacy score index of 5 respondents.

Descriptive Analysis

The following descriptive statistics are based on 448 respondents. A dominant share of the respondents are females (59.6%), and between the ages of 45 and 64 years old (58.3%). More than half of the respondents were Malay (56.9%), followed by Indian (21.0%) and Chinese (20.5%), and the fewest participants were both Bumiputera (1.1%) and non-Bumiputera participants (0.4%). Meanwhile, nearly half of the respondents of this study have tertiary education (49.8%), followed by those with secondary education (29.7%) and those who have primary education (17.6%), with people with no formal education being the least of the respondents (2.9%).

Table 2: Demographic Characteristics of Respondents

Variable	N	%
Gender		
Male	181	40.4
Female	267	59.6
Age		
45-64 years old	261	58.3
65 years old and above	187	41.7
Race		
Malay	255	56.9
Indian	94	21.0
Chinese	92	20.5
Bumiputera	5	1.1
Non-bumiputera	2	0.4
Education level		
No formal education	13	2.9
Primary	79	17.6
Secondary	133	29.7
Tertiary	223	49.8

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Table 3 indicates the average score index is shown by the mean scores, and the respondents of the study generally have inadequate health literacy with an average score index of 33.337984. Meanwhile, the score index of the study respondents indicates a relatively low degree of variability, with a standard deviation of 8.4963192. The standard deviation value is low if compared to the entire large range of the health literacy scores index, from 0 to 50. Hence, it shows that the scores are gathered closer together instead of being scattered all over the scale.

Table 3: Summary of Health Literacy Score Index

	N	Minimum	Maximum	Mean	Standard Deviation
Health Literacy	448	0.0	50.0	33.337984	8.4963192

Table 4 shows the distribution of health literacy by age categories. Most middle-aged adults have limited health literacy, with 135 respondents, while the other 126 out of 261 have adequate health literacy. On the other hand, the majority the elderly also have limited health literacy, with 152 respondents and 35 of the elderly having adequate health literacy. The result also shows that middle-aged adults are more likely to have adequate health literacy than elderly people.

Table 4: Crosstabulation of Health Literacy by Age Category

		Age category		Total
		Middle-aged	Elderly	
Health Literacy	Limited health literacy	135	152	287
	Adequate health literacy	126	35	161

Binary Logistic Regression Analysis

Before the model evaluation of binary logistic regression was employed, the model assumptions on binary logistic regression analysis were evaluated to ensure the validity and reliability of the analysis and improve the accuracy of the results.

Using Cook's distance, eight strong outliers were later eliminated from the dataset to prevent extreme or abnormal data items from influencing the result of the analysis. The linearity in the logit for continuous variable indicated the assumption of linearity in the logit for continuous variables is fulfilled. The assumptions regarding the absence of multicollinearity were thoroughly examined by analyzing the Tolerance levels and the Variance Inflation Factor (VIF). To be more precise, thresholds of a Tolerance value above 0.2 and a VIF value below 10 were employed to ensure that there was no multicollinearity between the independent variables. Unfortunately, there were two independent variables among 12 independent variables showed the presence of multicollinearity during the first evaluation. The identified independent variables were race and education level. Thus, those variables have been removed to prevent any instability in the model.

The evaluation of binary logistic regression for this study has been discussed in this section, especially to evaluate the factors that influence health literacy among middle-aged adults and the elderly in Seremban, Negeri Sembilan, Malaysia based on gender, age, self-rated financial status and self-rated self-esteem.

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Binary Logistic Regression (BLR) Evaluation

Table 5 summarizes the variables in the equation: Hosmer-Lemeshow Test, Omnibus Test, as well as Cox and Snell R-Square and Nagelkerke R-Square. The result shows that there are two significant independent variables, which are age and self-rated self-esteem. Both p-values are less than the significance level of 0.05, indicating that there is a statistically significant relationship between age and health literacy, as well as the relationship between self-rated self-esteem and health literacy. Meanwhile, other independent variables such as gender, self-rated health status, and self-rated financial status did not significantly contribute to the model since the p-value of the variables is greater than 0.05.

Then, the p-value for the Hosmer and Lemeshow test is 0.470, which is greater than the significance level of 0.05. When the p-value of Hosmer and Lemeshow exceeded the significance level, the test suggested that there was no evidence of a poor fit between the observed and expected frequencies. To put it in another word, there is a good fit between the predictions of the model and the actual outcomes. Hence, the logistic regression model fits the data well and correctly predicts the probability of the outcome.

Next, for the Omnibus Test of Model Coefficients, the p-value of the test is less than 0.05, specifically reported as 0.00, indicating that the chi-square value is statistically significant. Hence, the model shows a significant relationship between the dependent variable, health literacy, and at least one of the independent variables. The result suggests that the independent variables contribute to explaining variations in health literacy, and the logistic regression model is statistically meaningful.

The model summary statistics reveal that the Cox and Snell R-square value for this study is 0.270, while the Nagelkerke R-square value is 0.370. Thus, it can be concluded that all independent variables explain 27.0% and 37.0%, respectively, of total variation, leaving the other 73.0% and 63.0% of the total variation unexplained, assigned to other factors.

Table 5: Binary Logistic Regression Analysis Results

Factor	β	p-value	Exp(β)
Gender	0.065	0.788	1.068
Age	-1.558	0.000	0.211
Self-rated health status	0.102	0.557	1.108
Self-rated financial status	0.217	0.205	1.243
Self-rated self-esteem	0.210	0.000	1.234
Constant	-4.188	0.000	0.015
Hosmer-Lemeshow Test (p-value)		0.470	
Omnibus Test of Model Coefficients (p-value)		0.000	
Cox and Snell R-square		0.270	
Nagelkerke R-square		0.370	

On the other hand, Table 6 provides insights into the performance of the predictive model in categorizing health literacy. The percentage of accuracy, sensitivity, and specificity of the model could be calculated. Therefore, the model excels in predicting the overall performance of the model with an accuracy rate of 79.77%.

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Other than that, the model was able to accurately identify 84.9% of people with low health literacy with a sensitivity value of 84.9%, and the model was able to accurately identify 70.3% of those who had sufficient health literacy with a specificity of 70.3%.

Table 6: Confusion Matrix for Health Literacy Predictive Model

			Predicted Health Literacy		Percentage Correct
			Limited Health Literacy	Adequate Health Literacy	
Observed	Health Literacy	Limited Health Literacy	242	43	84.9
		Adequate Health Literacy	46	109	70.3
Overall Percentage					79.8

Based on Table 5, it can be concluded that both age and self-rated self-esteem are the influential factors affecting health literacy among middle-aged and elderly people. The estimated best model based on logistic regression is as follows,

$$logit(p) = -4.188 \pm 1.557Age + 0.211\text{self} - \text{ratedself} - \text{esteem}$$

Thus, when age and self-rated self-esteem are not available, the average of health literacy will lie at -4.188. Meanwhile, the odds ratio for adequate health literacy for respondents aged 45 years old to 64 years old is 0.211 times higher than the respondents aged 65 years old and older, and when self-rated self-esteem increases by one unit, health literacy will increase by 0.210 unit.

Discussion

The aims of this study were to explore health literacy among middle-aged and elderly people and to evaluate the factors that influence health literacy among middle-aged adults and the elderly in Seremban, Negeri Sembilan, Malaysia. The study found that 64.1% of the respondents had limited health status, pointing out that a significant amount of the population found it hard to access and understand the information related to health and struggled to apply any basic health-related information in real-life situations. Meanwhile, the other percentage of 35.9% of the respondents had adequate health literacy. In the previous study by Bhusal et al. (2021), 60.8% of their respondents had limited literacy. Comparatively, the findings of this study are in the same vein as the results of the previous study.

The descriptive analysis of the study has indicated that the respondents generally have limited health literacy with an average score index of 33.33798, suggesting a slightly lower index score compared to the adequate health literacy index score, which is 34 and above. The result from a previous study by Bhusal et al. (2021) showed that most of the undergraduate students also have limited health literacy, corresponding to the analysis result of this study.

Then, the study has found that the respondents with satisfactory health status have limited health literacy, while those with unsatisfactory health status have adequate health literacy. The

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analysis result of this study is quite irrational since some previous studies from Svendsen et al. (2020) and Huang et al. (2021) have found that individuals with unsatisfactory health status are likely to have limited health literacy, indicating that people with satisfactory health status have better health literacy. Nevertheless, Nock et al. (2023) have indicated that people with poor health status, especially those who struggle with chronic conditions and diseases, tend to have better understanding of the health information, which helps them to improve their health literacy. On the other hand, the respondents with poor financial status have adequate health literacy. The result is also not aligned with some previous studies, from Lastrucci et al. (2019) and Wilson et al. (2018), suggesting that better financial status can enhance health literacy, which is crucial for encouraging productive aging among older adults. Hence, the analytical results of this study contradict earlier research, and these results could be of self-rated assessments may not always be totally accurate, where individuals might not be completely aware, or they just randomly rate nonchalantly out of dispassionateness (Stanton et al., 2019).

Meanwhile, the result of this study showed the alignment study result with the results from previous research by Bhusal et al. (2021), which also proved the positive relationship between self-rated self-esteem and health literacy among the undergraduate students in a university in Nepal. In connection with that, self-rated self-esteem is one of the influential factors affecting health literacy in both studies, demonstrating that self-esteem plays a crucial role in influencing the ability of an individual to effectively understand, evaluate, and apply the health-related information. Therefore, both studies came out with similar results on the self-rated self-esteem and health literacy.

The study found that among seven predictor variables, there were two significant factors influencing health literacy, which are age (p-value = 0.000) and self-rated self-esteem (p-value = 0.000). These findings highlight how crucial both influential factors were in affecting the health literacy of the respondents. Moreover, health literacy was not influenced by the other remaining predictor variables, indicating that they only had minor or no influence on the health literacy of the respondents. On the other hand, Bhusal et al. (2021) also found similar factors affecting health literacy among undergraduate university students of Tribhuvan University in Nepal, which are both age and self-esteem are the influential factors, along with other factors including health status, financial status, education level, and gender. However, a previous study from Li et al. (2022) has found that the significant factors affecting health literacy among older adults across urban areas of Western China include the level of education and financial status of the respondents, suggesting that health literacy levels in the population of Western China are significantly influenced by both educational and economic factors.

Conclusion

The study provides new insights into influential factors affecting health literacy among middle-aged adults and the elderly, including gender, age, race, level of education, self-rated health status, self-rated financial status, and lastly, self-rated self-esteem. This study demonstrated how to measure the score index of health literacy by using the European Health Literacy Consortium from the previous study by Bhusal et al. (2021), and the findings of the study revealed the detailed relationship between those factors and health literacy.

The researcher conducted a primary data survey and aimed to directly collect the data from primary sources to ensure the originality and authenticity of the data. The research was observational research, and a specific research design was applied to structure the research study, which was the cross-sectional study design. The research design was selected wisely

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since it was suitable to investigate the influential factors affecting health literacy among middle-aged adults as well as the elderly. There was a total of 80,400 older adults as the population of the research, including both middle-aged people and senior citizens. Essentially, the researcher has successfully collected a total sample size of 456 respondents, which exceeded the targeted sample size of 385 respondents. Despite being only, a small percentage of the population, the sample size could still provide important information on health literacy among middle-aged and elderly people based on predictor variables.

The data for the study was collected using both online and traditional paper-based questionnaires. The paper-based questionnaires were distributed after receiving the required ethical approval at an elderly care home in Negeri Sembilan, which was Pusat Jagaan Warga Emas dan Terapi Fitrah, located in Taman Seremban Tiga with 15 patients, and distributed to older residents of Taman Pinggiran Senawang. On the other hand, online questionnaires were being distributed through some online platforms, such as WhatsApp, Instagram, Telegram, and Facebook. The researcher also handed out printed Quick Response (QR) codes to the targeted residents in Seremban.

Both descriptive and binary logistic regression analyses were conducted in this study. The descriptive analysis was used to fulfil the first research objective, which was to explore health literacy among middle-aged and elderly, while binary logistic regression was employed to fulfil the second objective, which was to evaluate the factors that influence health literacy among middle-aged adults and the elderly in Seremban, Negeri Sembilan, Malaysia.

The results of the study revealed some important findings about health literacy. Starting off with gender, it did not show any statistically significant relationship with health literacy, showing that the health literacy of the respondents was not influenced by whether they were male or female. Health literacy was also unaffected by the variation of races and the level of education among the respondents. Both self-rated health and financial statuses similarly had no influential effects on the health literacy of the respondents, indicating that health literacy results could be more influenced by other factors. Nevertheless, there were two influential factors affecting the health literacy of the respondents, which were age and self-rated self-esteem.

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Journal website: www.academicinspired.com/jised
DOI: 10.55573/JISED.107321

References

Ailobhio, D. T., & Ikughur, J. A. (2024). A Review of Some Goodness-Of-Fit Tests for Logistic Regression Model. *Asian Journal of Probability and Statistics*, 26(7), 75–85. https://doi.org/10.9734/ajpas/2024/v26i7631

Alkhalaf, A., & Zumbo, B. D. (2017). The Impact of Predictor Variable(s) with Skewed Cell Probabilities on Wald Tests in Binary Logistic Regression. *Journal of Modern Applied Statistical Methods*. 16(2), 40-80. doi: 10.22237/jmasm/1509494640

Amoah, P. A., & Phillips, D. R. (2019). Socio-Demographic and Behavioral Correlates of Health Literacy: *A Gender Perspective in Ghana. Global Health Action*. https://doi.org/10.1080/16549716.2019.1607459

Arora, T., & Grey, I. (2020). Health Behaviour Changes During COVID-19 and The Potential Consequences: A mini-review. *Journal of Health Psychology*. https://doi.org/10.1177/1359105320937053

Artazcoz, L., Cortès-Franch, I., Escribà-Agüir, V., & Benavides, F. G. (2021). Financial Strain and Health Status Among European Workers: Gender and Welfare State Inequalities. *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2021.616191

Battey, H. S., Cox, D. R., & Jackson, M. V. (2019). On The Linear in Probability Model for Binary Data. *Royal Society Open Science*, 6(1), Article 190067. https://doi.org/10.1098/rsos.190067

Baysal, H. Y., & Yildiz, M. (2021). Determining of Health Literacy Level in Elderly: An Example of Eastern Turkey. *Middle Black Sea Journal of Health Science*. https://doi.org/10.19127/mbsjohs.784674

Bhusal, S., Paudel, R., Gaihre, M., Paudel, K., Adhikari, T. B., & Pradhan, P. M. S. (2021). Health Literacy and Associated Factors Among Undergraduates: A University-Based Cross-Sectional Study in Nepal. *PLOS Global Public Health*, 1(11), e0000016. https://doi.org/10.1371/journal.pgph.0000016

Boateng, M. O., Asuman, D., Kugbey, N., Amoah, P. A., Agyei-Baffour, P., & Enemark, U. (2024). Health Literacy and Household Financial Loss on Malaria Treatment for Children Under Five in Ghana: A patients' perspective. *International Health*. https://doi.org/10.1093/inthealth/ihae022

Chiu, C. J., Hu, Y. H., & Lo, Y. T. (2020). Exploring The Influencing Factors of Health Literacy Among Older Adults: A Cross-Sectional Survey. *Medicina*, 56(9), 469. https://doi.org/10.3390/medicina56090469

Cho, M., Lee, Y. M., Lim, S. J., & Lee, H. K. (2020). Factors Associated with The Health Literacy on Social Determinants of Health: A Focus on Socioeconomic Position and Work Environment. *International Journal of Environmental Research and Public Health*, 17(18), 6633. https://doi.org/10.3390/ijerph17186633

Dennison, C. R., McEntee, M. L., Samuel, L., Johnson, B. J., & Rotman, S. (2011). Adequate Health Literacy Is Associated with Higher Heart Failure Knowledge and Self-Care Confidence in Hospitalized Patients. *Journal of Cardiovascular Nursing*, 26(5), 359-367. https://doi.org/10.1097/JCN.0b013e3181f16f88

Dong, Z., Ji, M., Shan, Y., Xu, X., & Xing, Z. (2023). Functional Health Literacy Among Chinese Populations And Associated Factors: Latent Class Analysis. *JMIR Formative Research*. https://doi.org/10.2196/43348

Evans, A., Anthony, E., & Gabriel, G. (2019). Comprehensive Health Literacy Among Undergraduates: A Ghanaian University-Based Cross-Sectional Study. *HLRP: Health Literacy Research and Practice*, 3(4), e217-e226. https://doi.org/10.3928/24748307-20191010-01

Volume: 10 Issues: 73 [June, 2025] pp. 258 - 276
Journal of Islamic, Social, Economics and Development (JISED)
eISSN: 0128-1755
Journal website: www.academicinspired.com/jised
DOI: 10.55573/JISED.107321

Glassman, S. D., Carreon, L. Y., Broen, M. E., Jones, J. S., Edward, J., Li, J., & William, M. V. (2019). The Impact of Health Literacy on Health Status and Resource Utilization In Lumbar Degenerative Disease. *The Spine Journal.* https://doi.org/10.1016/j.spinee.2018.10.012

Harrell, F. E. (2015). Binary Logistic Regression. In Regression Modeling Strategies (pp. 219–274). *Springer*. https://doi.org/10.1007/978-3-319-19425-7_10

He, Z., Cheng, Z., Shao, T., Liu, C., Shao, P., Bishwajit, G., Feng, D., & Feng, Z. (2016). Factors Influencing Health Knowledge and Behaviors Among the Elderly in Rural China. *International Journal of Environmental Research and Public Health*, 13(10), 1075. https://doi.org/10.3390/ijerph13111075

Hoa, H. T., Hung, D. D., Long, H. T., & Linh, D. H. (2020). Factors Associated with Health Literacy Among the Elderly People in Vietnam. *Biomed Research International.* https://doi.org/10.1155/2020/3490635

Hupman, A. C. (2021). Cutoff Threshold Decisions for Classification Algorithms with Risk Aversion. Decision Analysis. https://doi.org/10.1287/deca.2021.0438

Ilhan, A., & Bardakci, U. S. (2020). Analysis on The Self-Confidence of University Students According to Physical Activity Participation. *African Educational Research Journal*, 8(S1), 143-150. https://doi.org/10.30918/AERJ.8S1.20.017

Jaafar, N., Perialathan, K., Krishnan, M., Juatan, N., Ahmad, M., Sui Mien, T. Y., Salleh, K. Z., Isa, A., Syed Mohamed, S., Abu Hanit, N. H., Rodzlan Hasani, W. S., Mohamada, E. M. W., & Johari, M. Z. (2021). Malaysian Health Literacy: Scorecard Performance from A National Survey. *International Journal of Environmental Research and Public Health,* 18(23), 12345. https://doi.org/10.3390/ijerph182312345

Jabatan Kesihatan Negeri Negeri Sembilan. (2021). Laporan Tahunan. Ministry of Health Malaysia. https://jknns.moh.gov.my/images/LaporanTahunan/Laporan_Tahunan_2021.pdf

James, B. D., Boyle, P. A., & Bennett, D. A. (2012). The Impact of Health and Financial Literacy on Decision Making in Community-Based Older Adults. *Gerontology*, 58(6), 531-539. https://doi.org/10.1159/000339094

Khamrin, P., Boonyathee, S., Ong-Artborirak, P., & Saeangpraw, K. (2021). Factors Associated with Health Literacy, Social Support, And Oral Health Care Behaviors Among Elderly in Northern Border Community Thailand. *Clinical Interventions in Aging.* https://doi.org/10.2147/CIA.S320900

Khan, S. A. R., Kadir, S. Z. A., Cheong, K. C., Sharifudin, M. A., Omar, M., Nordin, S. A., Zakaria, M. I., Mat-Salih, S. N., Abdul-Razak, S., & Noor, A. M. (2022). The Malaysian Health and Wellbeing Assessment (MyHEBAT) Study Protocol: An Initiation of a National Registry for Extended Cardiovascular Risk Evaluation in The Community. *International Journal of Environmental Research and Public Health*, 19(18), 11789. https://doi.org/10.3390/ijerph191811789

Khan, A. E., Hasan, M. J., Anjum, H., Mohammed, N., & Momen, S. (2024). Predicting Life Satisfaction Using Machine Learning and Explainable *AI. Heliyon*, 10, e31158. https://doi.org/10.1016/j.heliyon.2024.e31158

Kosmo! Malaysia. (2022, January 24). Malaysia Negara Paling Tinggi Obes di Asia Tenggara. Kosmo! Retrieved from https://www.kosmo.com.my/2022/01/24/malaysia-negara-paling-tinggi-obes-di-asia-tenggara/

Lee, H. Y., Lee, J., & Kim, N. K. (2014). Gender Differences in Health Literacy Among Korean Adults: Do Women Have a Higher Level of Health Literacy Than Men? *Health Promotion Practice*, 15(5), 740-747. https://doi.org/10.1177/1557988314545485

Volume: 10 Issues: 73 [June, 2025] pp. 258 - 276
Journal of Islamic, Social, Economics and Development (JISED)
eISSN: 0128-1755
Journal website: www.academicinspired.com/jised
DOI: 10.55573/JISED.107321

Lastrucci, V., Lorini, C., Caini, S., Florence Health Literacy Research Group, & Bonaccorsi, G. (2019). Health Literacy as a Mediator of The Relationship Between Socioeconomic Status and Health: A Cross-Sectional Study in a Population-Based Sample in Florence. *PLoS ONE*, 14(12), e0227007. https://doi.org/10.1371/journal.pone.0227007

Li, C., Liu, M., Zhou, J., Zhang, M., Liu, H., Wu, Y., Li, H., Leeson, G. W., & Deng, T. (2022). Do Health Information Sources Influence Health Literacy Among Older Adults: A Cross-Sectional Study in The Urban Areas of Western China. *International Journal of Environmental Research and Public Health,* 19(20), 13106. https://doi.org/10.3390/ijerph192013106

Li, D. L., Wang, S., Zhang, D., Yang, R., Hu, J., Xue, Y., Xuexue, H., Wan, Y., Pan, C. W., & Zhang, S. (2023). Gender Difference in The Associations Between Health Literacy and Problematic Mobile Phone Use in Chinese Middle School Students. *BMC Public Health*. https://doi.org/10.1186/s12889-023-16055-7

Liu, Y., Ma, L., Zhou, Y., Zhang, L., & Wang, J. (2020). The Relationship Between Health Literacy, Social Support, Depression, And Frailty Among Community-Dwelling Older Patients with Hypertension and Diabetes in China. *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2020.00255

Midi, H., & Ariffin, S. B. (2013). Modified Standardized Pearson Residual for The Identification of Outliers in Logistic Regression Model. *Journal of Applied Sciences*, 13(5), 828–836. https://doi.org/10.3923/jas.2013.828.836

Nanjundeswaraswamy, T. S., & Divakar, S. (2021). Determination of Sample Size and Sampling Methods in Applied Research. *Proceedings on Engineering Sciences*, 3(1), 25-32. https://doi.org/10.24874/PES03.01.003

Neter, J., Kutner, M. H., Nachtsheim, C. J., & Wasserman, W. (2020). Applied Linear Statistical Models (5th ed.). McGraw-Hill. Retrieved from Research Gate: https://www.researchgate.net/publication/344587293_Applied_Linear_Statistical_Models

Nock, A. M., Metzing, S., Jürgensen, I.-N., & Petersen-Ewert, C. (2023). Health Literacy in Adults with Chronic Diseases in The Context of Community Health Nursing: A scoping review. *Nursing Reports*, 13(2), 823–834. https://doi.org/10.3390/nursrep13020072

Rizal, H., Said, M. A., Majid, H. A., Su, T. T., Pin, T. M., Ismail, R., & Zaidi, M. A. S. (2022). Health-Related Quality of Life of Younger and Older Lower-Income Households in Malaysia. *PLoS ONE*. https://doi.org/10.1371/journal.pone.0263751

Seo, H. J., Chung, S. J., Cho, M. S., Park, J. Y., & Oh, J. (2023). Consumer Acceptance of Texture-Modified Mackerel Stew Products in Older Adults. *Foods*. https://doi.org/10.3390/foods12224049

Seurer, A. C., & Vogt, H. B. (2013). Low Health Literacy: A Barrier to Effective Patient Care. *South Dakota Medicine*, 66(2), 51-57. https://www.sdsma.org/

Shah, S. A., Safian, N., Nurumal, S. R., Mohammad, Z., Mansor, J., Wan Ibadullah, W. A. H., Shobugawa, Y., & Rosenberg, M. (2021). Unmet Healthcare Needs Among Elderly Malaysians. *Journal of Multidisciplinary Healthcare.* https://doi.org/10.2147/JMDH.S326209

Stanton, K., Brown, M. F. D., Bucher, M. A., Balling, C., & Samuel, D. B. (2019). Self-ratings of Personality Pathology: Insights Regarding Their Validity and Treatment Utility. *Current Treatment Options in Psychiatry*, 6(4), 345–356. https://doi.org/10.1007/s40501-019-00188-6

Suka, M., Odajima, T., Okamoto, M., Sumitani, M., Igarashi, A., Ishikawa, H., Kusama, M., Yamamoto, M., Nakayama, T., & Sugimori, H. (2015). Relationship Between Health Literacy, Health Information Access, Health Behaviour, And Health Status in Japanese people. *Patient Education and Counseling*. http://dx.doi.org/10.1016/j.pec.2015.02.013

Volume: 10 Issues: 73 [June, 2025] pp. 258 - 276
Journal of Islamic, Social, Economics and Development (JISED)
eISSN: 0128-1755
Journal website: www.academicinspired.com/jised
DOI: 10.55573/JISED.107321

Svendsen, M. T., Bak, C. K., Sørensen, K., Pelikan, J., Riddersholm, S. J., Skals, R. K., Mortensen, R. N., Maindal, H. T., Bøggild, H., Nielsen, G., & Torp-Pedersen, C. (2020). Associations of Health Literacy with Socioeconomic Position, Health Risk Behavior, And Health Status: A Large National Population-Based Survey Among Danish Adults. *BMC Public Health*, 20, 565. https://doi.org/10.1186/s12889-020-08498-8

The Star. (2023, November 30). Almost 20% of Malaysian adults have diabetes, says Dr. Zaliha. The Star. Retrieved from https://www.thestar.com.my/news/nation/2023/11/30/almost-20-of-malaysian-adults-have-diabetes-says-dr zaliha#:~:text=KUALA%20LUMPUR%3A%20Some%203%2C899%2C940%20or,the%20Dewan%20Rakyat%20was%20told

Wilson, R. S., Yu, L., James, B. D., Bennett, D. A., & Boyle, P. A. (2017). Association of Financial and Health Literacy with Cognitive Health in Old Age. *Neuropsychology, Development, and Cognition B: Aging, Neuropsychology, and Cognition*, 24(2), 186–197.

Wu, X., Yang, X., Zhou, Q., Zhang, L., & Li, J. (2022). Awareness of Nutrition and Health Knowledge and Its Influencing Factors Among Wuhan Residents. *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2022.816076

Yodmai, K., Pechrapa, K., Kittipichai, W., Charupoonpol, P., & Suksatan, W. (2021). Factors Associated with Good COVID-19 Preventive Behaviors Among Older Adults in Urban Communities in Thailand. *SAGE Open Medicine*. https://doi.org/10.1177/20503121211034834

Żelaźniewicz, A., Nowak, J., Łącka, P., & Pawłowski, B. (2020). Facial Appearance and Metabolic Health Biomarkers in Women. *Scientific Reports*, 10, 12555. https://doi.org/10.1038/s41598-020-70119-6

Zhang, Q. (2020). The cost of illiteracy: A Causal Inference Study On How Illiteracy Affects Physical And Mental Health. *Health Education Journal*. https://doi.org/10.1177/0017896920949894