# Health Literacy among University Students: A Comparative Study between Health-Related and Non-Health-Related Academic Fields

**Natasha Aqmarina**
* Master's Students in Community Health Development Program, Department of Community, Family and Occupational Medicine, Faculty of Medicine, Khon Kaen University, Thailand.
(Corresponding Author):
natashaaqmarina@gmail.com
**Sauwanan Bumrerraj**
Department of Community, Family and Occupational Medicine, Faculty of Medicine, Khon Kaen University, Thailand.
Received: 19 March 2025
Accepted: 26 July 2025
Doi: 10.22038/jhl.2025.88018.1781

## ABSTRACT

Background and Objectives: Health literacy is increasingly recognized as a crucial competency for university students, especially in developing countries like Indonesia, where disparities in health education across academic disciplines may impact health outcomes. Students in non-health-related fields may have limited exposure to health information, potentially leading to gaps in preventive behavior and healthcare decision-making. This study aimed to compare the levels of health literacy between students from health-related and non-health-related academic fields and to assess the association between academic discipline and health literacy status among undergraduate students in Semarang, Indonesia.

Materials and Methods: A cross-sectional survey was conducted from September to December 2024 among 505 undergraduate students at Diponegoro University. Participants were selected using simple random sampling. Health literacy was measured using the validated Indonesian version of the HLS-EU-Q16, which demonstrated high internal consistency (Cronbach's α = 0.854). Data were analyzed using descriptive statistics, chi-square tests (including Monte Carlo simulation and Fisher–Freeman–Halton exact tests when appropriate), and odds ratio analysis. To address the imbalance in group sizes between academic fields, a matched sample analysis (n = 274) was conducted by randomly selecting 137 non-health-related respondents to match the number of health-related students.

Results: The mean and median of health expenditure in the sample was 703 thousand Rials and 257.4 million IRR (equal to 143.3 and 525.3 US$, respectively), with the highest expenditures among individuals with limited disability and those self-assessing their health as poor. Health literacy scores averaged 71.7 (SD±15.1), with higher scores among women, singles, and those with higher education. A quantile regression revealed that self-rated health consistently predicted lower costs, while health literacy was linked to higher spending at median and upper quantiles. Unemployment and student status were associated with significantly reduced costs, especially among higher spenders.

Conclusion: Students in health-related programs had significantly higher health literacy levels, likely due to greater exposure to health content in their curriculum. These findings highlight the need to integrate health literacy education into non-health programs to reduce disparities. Interdisciplinary efforts and digital literacy strategies may help equip all students with the skills needed to manage their health effectively.

**Paper Type:** Research Article
Keywords: Academic Disciplines, Health-related Program, HLS-EU-Q16.

**Citation:** Aqmarina N, Bumrerraj S. Health Literacy among University Students: A Comparative Study between Health-Related and Non-Health-Related Academic Fields. *Journal of Health Literacy*. Autumn 2025; 10(4): 74-92.

## Introduction

Health literacy is increasingly recognized as a key determinant of health outcomes and equity (1). It comprises the knowledge, motivation, and competencies required to access, understand, evaluate, and apply health information for informed decision-making across healthcare, disease prevention, and health promotion (2). According to the World Health Organization (WHO), improving health literacy is critical for the prevention and control of noncommunicable diseases (NCDs) (3). Higher health literacy levels are associated with better self-care, adherence to treatment, and chronic disease management (4), thereby reducing the burden on healthcare systems and contributing to more equitable health outcomes (5). Evidence shows that health literacy is linked to reduced hospitalization (6), increased use of preventive services (2, 7), and improved health behaviors (8).

Among university students, health literacy is particularly important as this population begins to assume full responsibility for their health-related decisions (9, 10). This period is marked by increased autonomy, exposure to stress, and emerging risks such as mental health issues and NCDs (11, 12). Adequate health literacy during this period helps students make healthier lifestyle choices, understand medical instructions, and navigate the healthcare system effectively (4, 11, 13, 14), while limited health literacy may lead to poor decisions and underutilization of health services. Previous studies have linked higher health literacy in this group to lower stress, fewer depressive symptoms, and better quality of life (11).

This gap is especially relevant given Indonesia's ongoing challenges with rising NCD rates and health misinformation, which disproportionately affect the youth population. A significant proportion of individuals aged 18–25 are already showing early indicators of chronic illnesses such as obesity (15) and hypertension (16), conditions that can be mitigated through better health literacy and preventive behaviors (17,18).

In Indonesia, although a few studies have examined health literacy using standardized tools such as the HLS-EU-Q16 (19–21). Additionally, health literacy research in Indonesia faces unique challenges because some conditions in Indonesia have unequal access to quality health education (22), regional disparities in internet access and digital literacy (23), and limited integration of health literacy content in university curricula (24).

The HLS-EU-Q16 is a validated short-form instrument developed from the integrated model of health literacy by Sørensen et al. It measures individuals' perceived ability to access, understand, appraise, and apply health information in the domains of healthcare, disease prevention, and health promotion (2). In Indonesia, the HLS-EU-16Q has been utilized in several studies to measure health literacy using a standardized instrument; however, only a few studies have explored academic disparities in depth (25, 26).

Given these gaps, this study aims to compare the levels of health literacy among undergraduate students from health-related and non-health-related academic programs in Semarang, Indonesia. Specifically, it

examines whether health literacy levels differ significantly between these two academic groups.

## Materials and Methods

### Population and Sample

This study employed a quantitative, cross-sectional survey design to examine the health literacy levels of undergraduate students. The target population for this study consisted of undergraduate students in Semarang City, Central Java Province, Indonesia. The accessible population was defined as students currently enrolled at Diponegoro University, a major public university in Semarang City. Data collection for this study was conducted between September and December 2024.

Before data collection, a pilot test involving 30 undergraduate students was conducted to assess the clarity and reliability of the questionnaire. The estimated proportion used for the sample size calculation was derived from this pilot, which included general health-related items relevant to the current study's objectives. The sample size was determined using the n4studies application with two formulas: (1) the infinite population proportion formula, which yielded a minimum required sample of 337 students, and (2) the unmatched case-control formula, which resulted in a sample size of 214 (107 per group). To ensure statistical power, accommodate subgroup analysis, and account for potential non-response or data exclusion, we adopted the higher estimate (n = 337) and increased the sample size to 506 participants. After data cleaning, 505 responses were included in the final analysis.

Participant recruitment was conducted in two stages. First, a university-wide invitation was disseminated to all undergraduate students via email (coordinated by the university's IT department), social media, and campus posters. A total of 2,019 students responded by completing the digital registration form, of which 2,002 met the inclusion criteria and confirmed willingness to participate. These students comprised the sampling frame.

In the second stage, a simple random sampling method was applied to this sampling frame using an online randomization tool, resulting in the selection of 506 participants. One student declined to complete the questionnaire, yielding a final sample size of 505 respondents. This two-stage sampling approach, while initiated through open invitation, incorporated random selection at the final stage to ensure representativeness. Figure 1 presents the flowchart of the sampling procedure.

Participants were classified into two academic groups for comparison. The health-related group included students from the Faculty of Medicine, Public Health, and Psychology. Psychology was classified as a health-related field due to its curriculum involving health sciences, mental health, and clinical components. The non-health-related group comprised students from the Faculties of Law, Humanities, Economics and Business, Engineering, Fisheries and Marine Science, Animal Science and Agriculture, Science and Mathematics, and Social and Political Science.

The inclusion criteria were as follows: (1) undergraduate students aged 18–25 years old, (2) willingness to participate in the study, and (3) active enrollment at Diponegoro

University in the 2024 academic year. While these criteria ensured a relevant and uniform sample, they may limit generalizability to other populations, such as postgraduate students, older learners, or those not currently enrolled. Future research may consider broader inclusion criteria to capture a wider spectrum of student experiences.

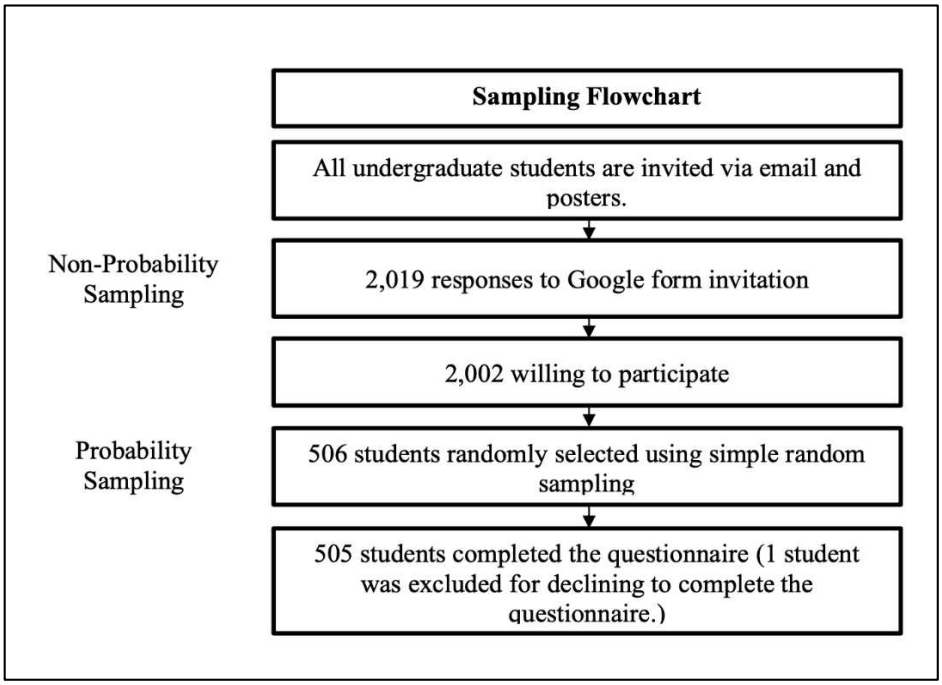


**Figure 1. Sampling Flowchart**

## Data Collection Tools

This study utilized the Indonesian version of the HLS-EU-Q16, which was previously translated and validated by the Asian Health Literacy Association (AHLA)(19). In this study, internal consistency was assessed using Cronbach's Alpha, which yielded a coefficient of 0.854, indicating a high level of reliability. Similar reliability coefficients have been reported in earlier studies, such as 0.758 in a study involving undergraduate students (27), indicating that the instrument maintains good internal consistency across various demographic groups.

The original HLS-EU-Q16 consists of 16 items, each rated on a four-point Likert scale ranging from "very difficult" to "very easy." Responses are used to calculate a total score between 16 and 64, which is then transformed into a Health Literacy Index (HLI) ranging from 0 to 16. Based on the HLI score, health literacy is categorized into three levels: Inadequate Health Literacy (HLI 0–8), Problematic Health Literacy (HLI 9–12), and Sufficient Health Literacy (HLI 13–16).

## Data Analysis

All data were analyzed using IBM SPSS Statistics software, version 27. Descriptive statistics were used to summarize the respondents' sociodemographic characteristics and describe the distribution of health literacy levels among students from health-related and non-health-related academic fields.

Health literacy scores were categorized into three levels: inadequate, problematic, and sufficient. For inferential analysis, health literacy was recoded into two categories, low (inadequate + problematic) and sufficient, to facilitate 2×2 comparisons and odds ratio estimation, following previous literature. The OR was obtained through a cross-tabulation analysis with risk estimates in SPSS. An OR greater than 1 indicates an increased likelihood of the outcome, an OR less than 1 indicates a protective effect, and an OR equal to 1 suggests no association (28, 29).

The Chi-square test of independence was used to assess associations between categorical variables. When more than 20% of expected cell counts were below 5, alternative methods were applied. These included the Fisher–Freeman–Halton exact test for R×C tables and a Monte Carlo simulation (10,000 replications, 99% confidence interval) to obtain accurate p-values.

This approach is recommended in situations where classical asymptotic methods may yield inaccurate results due to small expected frequencies. As demonstrated by Reshid (2023), Monte Carlo simulation provides a robust alternative by empirically estimating the sampling distribution and significance level, enhancing the validity of inference when the Chi-square assumptions are not satisfied (30).

While this study primarily analyzed the full sample (n = 505), the authors recognized an imbalance in the number of respondents between health-related and non-health-related academic fields. This study was part of a broader survey project that did not impose strict quotas during participant recruitment. To ensure analytical robustness and improve group comparability, a matched sample analysis was additionally conducted by randomly selecting 137 non-health-related students to match the number of health-related respondents (n=137). The association between academic field and health literacy was then reassessed using this matched sample.

The results from both the full and matched samples are presented in the same tables to enhance transparency and allow direct comparison between the two analytical approaches.

## Result

The respondents' characteristics in this study are presented in Table 1, highlighting the distribution of age, sex, and academic fields/faculties among the 505 participants, comprising 137 (27.1%) from health-related faculties and 368 (72.9%) from non-health-related faculties. The participants were predominantly female (61.6%), and in terms of age, the majority of students were between 19 and 22 years old. The most common age was 21 years (24.8%), followed by 20 years (19.0%) and 22 years (17.8%).

For the year of study, 14.7% were first-year students, 18.4% were second-year students, 19.4% were third-year students, 23.6% were fourth-year students, and 24.0% were in their fifth year or higher. The distribution was relatively even across academic years, with the highest proportions in the later years of study.

Figure 2 illustrates the distribution of respondents across the various faculties. The highest representation came from the Faculty of Humanities (12.7%), followed closely by

the Faculty of Engineering (12.3%) and the Faculty of Economics and Business (9.9%).

Other faculties with notable participation included Medicine (9.7%), Psychology (9.1%), and Public Health (8.3%), which together formed the group of health-related faculties. The remaining faculties, such as Law, Animal Science and Agriculture, Fisheries and Marine Science, Social and Political Sciences, Science and Mathematics, each contributed between 6% and 9% of the total respondents.

**Table 1. Characteristic of the Respondents**

| Variable | Category | Health-related students (n=137) | | Non-health-related students (n=368) | | Total (n=505) | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| Age | 18 years | 14 | 10.2 | 44 | 12.0 | 58 | 11.5 |
| | 19 years | 24 | 17.5 | 57 | 15.5 | 81 | 16.0 |
| | 20 years | 27 | 19.7 | 69 | 18.8 | 96 | 19.0 |
| | 21 years | 28 | 20.4 | 97 | 26.4 | 125 | 24.8 |
| | 22 years | 29 | 21.2 | 61 | 16.6 | 90 | 17.8 |
| | 23 years | 8 | 5.8 | 28 | 7.6 | 36 | 7.1 |
| | 24 years | 5 | 3.6 | 9 | 2.4 | 14 | 2.8 |
| | 25 years | 2 | 1.5 | 3 | 0.8 | 5 | 1.0 |
| Sex | Male | 34 | 24.8 | 160 | 43.5 | 194 | 38.4 |
| | Female | 70 | 75.2 | 208 | 56.5 | 311 | 61.6 |
| Year of Study | First-year | 22 | 16.1 | 52 | 14.1 | 74 | 14.7 |
| | Second-year | 25 | 18.2 | 68 | 18.5 | 93 | 18.4 |
| | Third-year | 27 | 19.7 | 71 | 19.3 | 98 | 19.4 |
| | Fourth-year | 30 | 21.9 | 89 | 24.2 | 119 | 23.6 |
| | Fifth-year or more | 33 | 24.1 | 88 | 23.9 | 121 | 24.0 |
| Academic Fields | Health-Related Faculty | 137 | 27.1 | - | - | 137 | 27.1 |
| | Non-Health-Related Faculty | - | - | 368 | 72.9 | 368 | 72.9 |

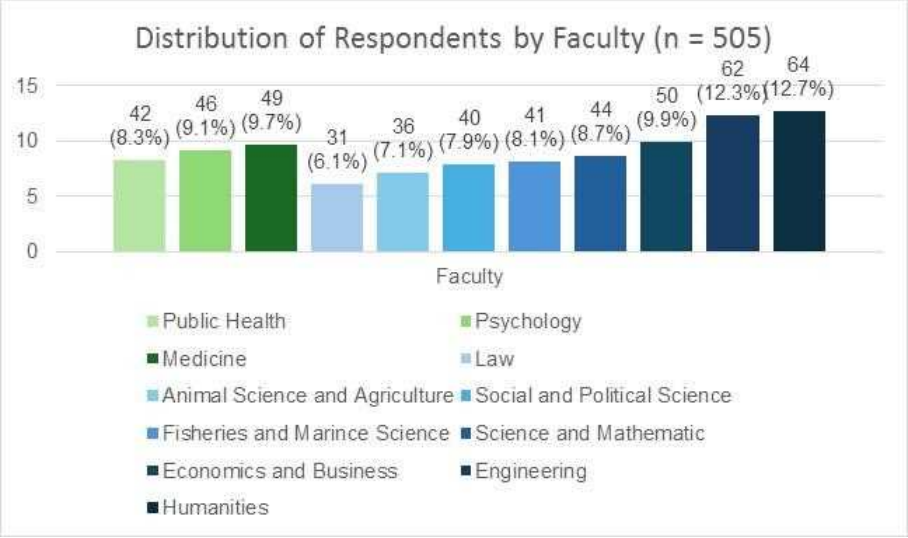


**Figure 2. Distribution of Respondents by Faculty**

Table 2 presents the responses of 505 students to the HLS-EU-Q16 items, showing variation across academic groups. For accessing information (e.g., treatments, professional help, mental health, and well-being), over 88% of respondents found the tasks easy. Health-related students consistently reported greater ease. For example, 40.1% of health students found it very easy to find treatment information (item 1), compared to 34.2% of non-health students. Similar trends appeared for finding professional help (item 2: 62.9% vs. 55.2%) and mental health resources (item 8: 42.3% vs. 31.5%).

In understanding health information (e.g., doctor's instructions, health warnings, screening), both groups reported high ease. However, health students showed slightly higher "very easy" responses, particularly for understanding health screenings (item 10: 51.1% vs. 34.5%) and media advice on getting healthier (item 15: 53.3% vs. 46.7%).

For appraising health information (e.g., judging credibility, deciding on second opinions), health-related students appeared more confident. For instance, 21.9% found it very easy to assess media information (item 11), versus 11.7% of non-health students. Likewise, fewer health students reported difficulty in judging when to seek a second opinion (item 5).

Regarding applying information (e.g., making health decisions, following instructions), students generally felt confident. Health-related students more frequently rated these tasks as "very easy," including following medical instructions (item 7: 65.0% vs. 58.7%). Across competencies, health-related students consistently reported higher ease in accessing, understanding, appraising, and applying health information, reflecting potential curricular exposure and familiarity with health systems. Figure 3 displays the distribution of health literacy among all 505 respondents, with 4.2% classified as inadequate, 23.0% as problematic, and 72.9% as sufficient. Figure 4 compares health literacy levels by academic field, showing a significantly higher proportion of sufficient health literacy among health-related students (86.9%) than non-health-related peers (67.7%) ($p = 0.001$).

In addition to the academic field, Table 3 shows the distribution of health literacy levels across age, year of study, and sex among the 505 undergraduate students. Regarding age, the proportion of students with sufficient health literacy ranged from 64.3% among 24-year-olds to 86.1% among 23-year-olds. Although students aged 20 and 23 showed relatively higher proportions of sufficient health literacy (81.3% and 86.1%, respectively), the association between age and health literacy was not statistically significant ($p = 0.062$). Given that 41.7% of expected cells had a count below 5, additional testing was performed using a Monte Carlo simulation ($p = 0.070$) and a Fisher–Freeman–Halton exact test ($p=0.063$), both of which confirmed the non-significant association.

Analysis by sex also revealed no statistically significant difference in health literacy levels ($\chi^2(2)=1.410$, $p=0.494$). While a slightly higher proportion of females (74.6%) had sufficient health literacy compared to males (70.1%), the difference was not significant. Additionally, all chi-square assumptions were met for this variable.

**Table 2. Distribution of Respondents' Answers for HLS-EU-16 Questionnaire**

| No. | Question | Answer | Health-related students (n=137) | | Non-health-related students (n=368) | | Total (n=505) | |
|---|---|---|---|---|---|---|---|---|
| | | | n | % | n | % | n | % |
| 1 | Find information on treatments of illnesses that concern you? | Very Difficult | 0 | 0.0 | 5 | 1.2 | 5 | 1.0 |
| | | Somewhat Difficult | 5 | 3.6 | 48 | 13.0 | 53 | 10.5 |
| | | Somewhat Easy | 77 | 56.2 | 189 | 51.4 | 266 | 52.7 |
| | | Very Easy | 55 | 40.1 | 126 | 34.2 | 181 | 35.8 |
| 2 | Find out where to get professional help when you are ill? | Very Difficult | 0 | 0.0 | 2 | 0.5 | 2 | 0.4 |
| | | Somewhat Difficult | 4 | 2.9 | 36 | 9.8 | 40 | 7.9 |
| | | Somewhat Easy | 50 | 36.5 | 127 | 34.5 | 177 | 35.0 |
| | | Very Easy | 83 | 62.9 | 203 | 55.2 | 286 | 56.6 |
| 3 | Understand what doctor says to you? | Very Difficult | 0 | 0.0 | 3 | 0.7 | 3 | 0.6 |
| | | Somewhat Difficult | 7 | 5.1 | 40 | 10.9 | 47 | 9.3 |
| | | Somewhat Easy | 73 | 53.3 | 193 | 52.4 | 266 | 52.7 |
| | | Very Easy | 57 | 41.6 | 132 | 35.9 | 189 | 37.4 |
| 4 | Understand your doctor's pharmacist's instruction on how to take a prescribed medicine? | Very Difficult | 0 | 0.0 | 2 | 0.5 | 2 | 0.4 |
| | | Somewhat Difficult | 2 | 1.5 | 4 | 1.1 | 6 | 1.2 |
| | | Somewhat Easy | 45 | 32.8 | 108 | 29.3 | 153 | 30.3 |
| | | Very Easy | 90 | 65.7 | 254 | 69.0 | 344 | 68.1 |
| 5 | Judge when you may need to get a second opinion from another doctor? | Very Difficult | 4 | 2.9 | 25 | 6.8 | 29 | 5.7 |
| | | Somewhat Difficult | 38 | 27.7 | 135 | 36.7 | 173 | 34.3 |
| | | Somewhat Easy | 67 | 48.9 | 144 | 39.1 | 211 | 41.8 |
| | | Very Easy | 28 | 20.4 | 64 | 17.4 | 92 | 18.2 |
| 6 | Use information the doctor gives you to make decisions about your illness? | Very Difficult | 0 | 0.0 | 10 | 2.7 | 10 | 2.0 |
| | | Somewhat Difficult | 8 | 5.8 | 39 | 10.6 | 47 | 9.3 |
| | | Somewhat Easy | 64 | 46.7 | 182 | 49.5 | 246 | 48.7 |
| | | Very Easy | 65 | 47.4 | 137 | 37.2 | 202 | 40.0 |
| 7 | Follow instructions from your doctor or pharmacist? | Very Difficult | 0 | 0.0 | 7 | 1.9 | 7 | 1.4 |
| | | Somewhat Difficult | 4 | 2.9 | 18 | 4.9 | 22 | 4.4 |
| | | Somewhat Easy | 44 | 32.1 | 127 | 34.5 | 171 | 33.9 |
| | | Very Easy | 89 | 65.0 | 216 | 58.7 | 305 | 60.4 |
| 8 | Find information on how to manage mental health problems like stress or depression? | Very Difficult | 3 | 2.2 | 19 | 5.2 | 22 | 4.4 |
| | | Somewhat Difficult | 17 | 12.4 | 77 | 20.9 | 94 | 18.6 |
| | | Somewhat Easy | 59 | 43.1 | 156 | 42.4 | 215 | 42.6 |
| | | Very Easy | 58 | 42.3 | 116 | 31.5 | 174 | 34.5 |
| 9 | Understand health warnings about behavior such as smoking, low physical activity and drinking too much? | Very Difficult | 0 | 0.0 | 6 | 1.6 | 6 | 1.2 |
| | | Somewhat Difficult | 1 | 0.7 | 10 | 2.7 | 11 | 2.2 |
| | | Somewhat Easy | 26 | 19.0 | 80 | 21.7 | 106 | 21.0 |
| | | Very Easy | 110 | 80.3 | 272 | 73.9 | 382 | 75.6 |
| 10 | Understand why you need health screenings? | Very Difficult | 0 | 0.0 | 16 | 4.3 | 16 | 3.2 |
| | | Somewhat Difficult | 8 | 5.8 | 82 | 22.3 | 90 | 17.8 |
| | | Somewhat Easy | 59 | 43.1 | 143 | 38.9 | 202 | 40.0 |
| | | Very Easy | 70 | 51.1 | 127 | 34.5 | 197 | 39.0 |

| No. | Question | Answer | Health-related students (n=137) | | Non-health-related students (n=368) | | Total (n=505) | |
|---|---|---|---|---|---|---|---|---|
| | | | n | % | n | % | n | % |
| 11 | Judge if the information on health risks in the media is reliable? | Very Difficult | 4 | 2.9 | 28 | 7.6 | 32 | 6.3 |
| | | Somewhat Difficult | 42 | 30.7 | 151 | 41.0 | 193 | 38.2 |
| | | Somewhat Easy | 61 | 44.5 | 146 | 39.7 | 207 | 41.0 |
| | | Very Easy | 30 | 21.9 | 43 | 11.7 | 73 | 14.5 |
| 12 | Decide how you can protect yourself from illness based on information in the media? | Very Difficult | 1 | 0.7 | 8 | 2.2 | 9 | 1.8 |
| | | Somewhat Difficult | 19 | 13.9 | 80 | 21.7 | 99 | 19.6 |
| | | Somewhat Easy | 78 | 56.9 | 202 | 54.9 | 280 | 55.4 |
| | | Very Easy | 39 | 28.5 | 78 | 21.2 | 117 | 23.2 |
| 13 | Find out about activities that are good for your mental well-being? | Very Difficult | 1 | 0.7 | 10 | 2.7 | 11 | 2.2 |
| | | Somewhat Difficult | 8 | 5.8 | 46 | 12.5 | 54 | 10.7 |
| | | Somewhat Easy | 56 | 40.9 | 170 | 46.2 | 226 | 44.8 |
| | | Very Easy | 72 | 52.6 | 142 | 38.6 | 214 | 42.4 |
| 14 | Understand advice on health from family members or friends? | Very Difficult | 0 | 0.0 | 8 | 2.2 | 8 | 1.6 |
| | | Somewhat Difficult | 10 | 7.3 | 38 | 10.3 | 48 | 9.5 |
| | | Somewhat Easy | 72 | 52.6 | 194 | 52.7 | 266 | 52.7 |
| | | Very Easy | 55 | 40.1 | 128 | 34.8 | 183 | 36.2 |
| 15 | Understand information in the media on how to get healthier? | Very Difficult | 0 | 0.0 | 2 | 0.5 | 2 | 04 |
| | | Somewhat Difficult | 3 | 2.2 | 19 | 5.2 | 22 | 4.4 |
| | | Somewhat Easy | 61 | 44.5 | 175 | 47.6 | 236 | 467 |
| | | Very Easy | 73 | 53.3 | 172 | 46.7 | 245 | 48.5 |
| 16 | Judge which everyday behavior is related to your health? | Very Difficult | 1 | 0.7 | 10 | 2.7 | 11 | 2.2 |
| | | Somewhat Difficult | 14 | 10.2 | 70 | 19.0 | 84 | 16.6 |
| | | Somewhat Easy | 69 | 50.4 | 167 | 45.4 | 236 | 46.7 |
| | | Very Easy | 53 | 38.7 | 121 | 32.9 | 174 | 34.5 |

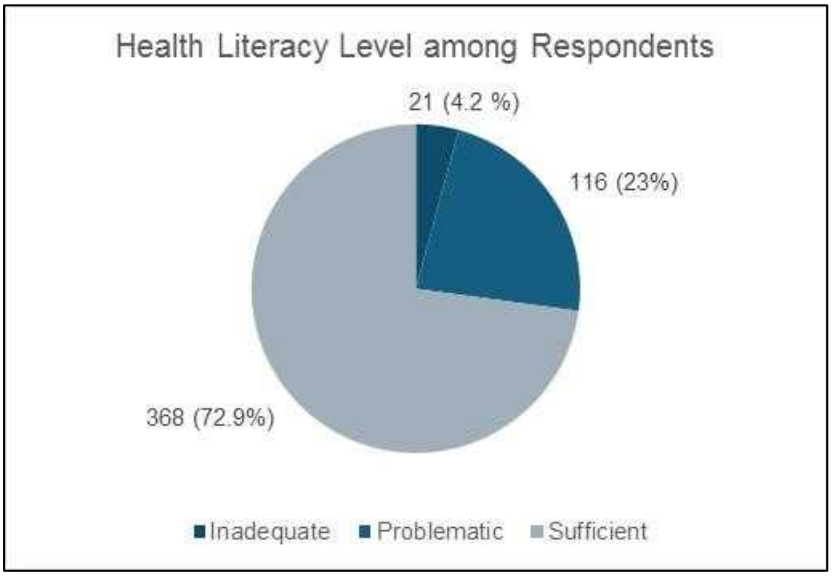

Figure 3. Health Literacy Level

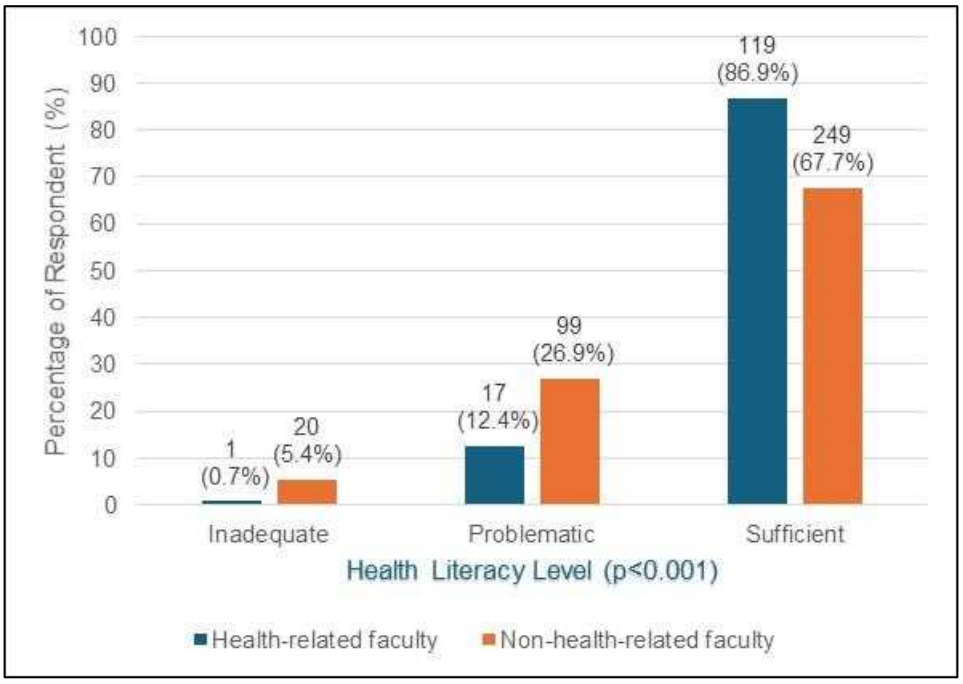


Figure 4. Distribution of Health Literacy Levels by Academic Field

Similarly, no significant relationship was found between year of study and health literacy level ($\chi^2(8)=5.043$, p=0.753). Although slight variations were observed, for example, fifth-year students had the highest proportion of sufficient health literacy (77.7%), while fourth-year students had the lowest (68.9%), the differences were not statistically meaningful. Monte Carlo (p=0.759) and Fisher–Freeman–Halton exact test (p=0.758) confirmed this result.

To further examine the association between academic field and health literacy, the three health literacy categories were dichotomized into low health literacy (combining inadequate and problematic) and sufficient health literacy, which is shown in Table 4. The analysis was performed for both the full sample and a matched sample (n = 274), in which 137 respondents were randomly selected from the non-health-related group to match the number of students from health-related faculties.

In the full sample (n = 505), students from health-related faculties were significantly less likely to have low health literacy (13.2%) compared to those from non-health-related faculties (30.2%). The odds ratio was 0.351 (95% CI: 0.185–0.668; p < 0.001), indicating a strong protective effect of health-related academic exposure.

In the matched sample (n = 274), a similar pattern was observed. Only 13.2% of students in health-related faculties had low health literacy, while 33.3% of students from non-health-related faculties did. The odds ratio was 0.305 (95% CI: 0.166–0.561; p < 0.001), confirming a significant association. These findings demonstrate the consistency of the results, even when adjusting for the unequal group sizes.

**Table 3. Association between Health Literacy and Sociodemographic Characteristics (n = 505)**

| Variable | Health Literacy Level | | | | | | Pearson Chi square | Monte Carlo (2-sided) | Fisher-Freeman-Halton |
|---|---|---|---|---|---|---|---|---|---|
| | Inadequate | | Problematic | | Sufficient | | | | |
| | n | % | n | % | n | % | | | |
| Age | | | | | | | | | |
| 18 | 5 | 8.6 | 12 | 20.7 | 41 | 70.7 | $\chi^2(14) = 22.923$, $p = 0.062$ | $p = 0.070$ (99% CI: 0.063–0.076) | $p = 0.063$ |
| 19 | 4 | 4.9 | 20 | 24.7 | 57 | 70.4 | | | |
| 20 | 3 | 3.1 | 15 | 15.6 | 78 | 81.3 | | | |
| 21 | 6 | 4.8 | 30 | 24.0 | 89 | 71.2 | | | |
| 22 | 1 | 1.1 | 30 | 33.3 | 59 | 65.6 | | | |
| 23 | 1 | 2.8 | 4 | 11.1 | 31 | 86.1 | | | |
| 24 | 0 | 0.0 | 5 | 35.7 | 9 | 64.3 | | | |
| 25 | 1 | 20.0 | 0 | 0.0 | 4 | 80.0 | | | |
| Total | 21 | 4.2 | 116 | 23.0 | 368 | 72.9 | | | |
| Sex | | | | | | | | | |
| Male | 8 | 4.1 | 50 | 25.8 | 136 | 70.1 | $\chi^2(2) = 1.410$, $p = 0.494$ | | |
| Female | 13 | 4.2 | 66 | 21.2 | 232 | 74.6 | | | |
| Total | 21 | 4.2 | 116 | 23.0 | 368 | 72.9 | | | |
| Year of Study | | | | | | | | | |
| First-year | 4 | 5.4 | 18 | 24.3 | 52 | 70.3 | $\chi^2(8) = 5.043$, $p = 0.753$ | $p = 0.759$ (99% CI: 0.748–0.770) | $p = 0.758$ |
| Second-year | 6 | 6.5 | 20 | 21.5 | 67 | 72.0 | | | |
| Third-year | 3 | 3.1 | 22 | 22.4 | 73 | 74.5 | | | |
| Fourth-year | 4 | 3.4 | 33 | 27.7 | 82 | 68.9 | | | |
| Fifth-year and more | 4 | 3.3 | 23 | 19.0 | 94 | 77.7 | | | |
| Total | 21 | 4.2 | 116 | 23.0 | 368 | 72.9 | | | |

**Table 4. 2x2 Contingency Table for Association between Academic Field and Health Literacy Level**

| Academic Field | Health Literacy Level | | | | Odds Ratio (95% CI) | P-value |
|---|---|---|---|---|---|---|
| | Low Health Literacy | | Sufficient Health Literacy | | | |
| | n | % | n | % | | |
| Full Sample (n=505) | | | | | | |
| Health-related Faculty | 12 | 13.2 | 79 | 86.8 | 0.351 (0.185–0.668) | <0.001 |
| Non-health-related Faculty | 125 | 30.2 | 289 | 69.8 | | |
| Total | 137 | 27.1 | 368 | 72.9 | | |
| Matched Sample (n= 137 each group) | | | | | | |
| Health-related Faculty | 18 | 13.2 | 118 | 86.8 | 0.305 (0.166–0.561) | <0.001 |
| Non-health-related Faculty | 46 | 33.3 | 92 | 66.7 | | |
| Total | 64 | 23.4 | 210 | 76.6 | | |

The consistency across both analytical approaches strengthens the evidence that academic background plays a significant role in determining health literacy levels among university students.

## Discussion

This study assessed health literacy using the Indonesian version of HLS-EU-16Q, revealing that most respondents (72.9%) demonstrated sufficient health literacy. Indonesia's health literacy levels appear relatively high compared to studies from other countries, particularly developing ones. For instance, a survey from Semarang Regency found that only 55% of respondents had high health literacy (31). In contrast, health literacy in developing countries like Ghana and rural India shows a more concerning trend. In Ghana, 55% of university students exhibited limited health literacy, with 20.4% having inadequate health literacy (32). In contrast, in rural India, only 11.7% of participants demonstrated sufficient health literacy, with the majority (61.6%) showing inadequate levels (33). These figures reflect the challenges faced in developing nations, where low education levels, limited healthcare access, and cultural factors significantly hinder health literacy.

However, health literacy is not a problem exclusive to developing countries. Even in developed countries, significant issues persist. A large-scale European survey found that 47% of participants across eight countries had limited health literacy (34), showing that this issue is still prevalent even in nations with advanced healthcare systems. Similarly, studies in Saudi Arabia and Spain revealed that over half of the respondents had inadequate or problematic health literacy, despite well-established healthcare infrastructure (35, 36).

These findings underscore that limited health literacy is not only a challenge in developing countries but also a widespread issue in high-income nations. Furthermore, a systematic review on university students in developed countries found that most reported lower health literacy scores than reference samples (37). The review highlighted that health literacy among students is influenced by various factors, including age, gender, academic discipline, and socioeconomic background. These findings suggest that even in developed countries, university students may face challenges in accessing, understanding, and applying health information effectively.

The association between academic field and health literacy level remained significant in both the full sample and the matched sample, reinforcing the strength of the observed relationship. In the full sample ($n = 505$), students from health-related faculties were significantly more likely to exhibit sufficient health literacy ($p < 0.001$). This association was even stronger in the matched sample ($n = 274$), with an odds ratio of 0.305 ($p < 0.001$). These consistent findings across both analytical approaches suggest that the relationship is not merely a product of sample size imbalance, but rather reflects a true difference in health literacy levels between academic fields.

Students enrolled in health-related programs had approximately 65% lower odds of possessing low health literacy, compared to their non-health-related peers, highlighting the potential influence of academic exposure to health-related content. This result is in line with previous research by Akelina Butar Butar et al. (25) that found significantly higher health literacy among health-related students ($p = 0.003$). Similarly, another study reported that medical students

exhibited higher health literacy than non-medical students ($p < 0.001$) (26). In a study conducted at a university in Semarang, 64.6% of students in health-related programs were also found to have higher health literacy (38), further supporting this trend.

In addition to academic discipline, this study also explored potential associations between health literacy and demographic variables such as age, year of study, and sex. However, the findings revealed no statistically significant relationships between these variables and health literacy levels ($p > 0.05$). One possible explanation is that the age range (18–25 years) and academic year categories (1st to 5th year) were relatively narrow, which may have limited the observable variability in health literacy. This relative homogeneity in developmental and academic experiences might reduce the likelihood of detecting significant differences. Similarly, no gender differences were observed, aligning with previous research that has reported mixed or inconclusive findings regarding sex-based differences in health literacy (39–42). These findings highlight the complexity of health literacy as a construct, which is shaped by a combination of many factors.

Health students have advantages in obtaining a higher level of health literacy than non-health students (26). Students from health-related courses are naturally acquainted with more health-related information, the health care setting, issues of health promotion, and disease prevention compared to students from non-health-related programs (32). This trend is attributed to the curriculum's focus on health promotion, disease prevention, and access to health information, which enhances their understanding and application of health-related knowledge (37, 39, 43). Students in non-health fields often have limited exposure to health education, leading to a poor understanding of disease prevention, health promotion, and healthy behaviors (44).

These findings highlight a notable disparity in health literacy levels between students from health-related and non-health-related academic programs, which warrants closer attention. While health students benefit from structured exposure to health-related knowledge, students in other disciplines may be left without the necessary competencies to make informed health decisions. This academic gap in health literacy should be addressed through university-level strategies that promote equitable access to health education.

To further explore the observed differences in health literacy between health-related and non-health-related students, an analysis was conducted using the integrated model developed by Sørensen et al., which conceptualizes health literacy through four core competencies: accessing, understanding, appraising, and applying health-related information. Based on responses to the 16-item questionnaire, it is evident that students from health-related academic backgrounds consistently reported greater ease across most items within each of these competencies.

Within the domain of accessing health information (items 1, 2, 8, and 13), students from health-related faculties consistently reported greater ease compared to their non-health-related peers. For instance, 40.1% of health students rated finding treatment

information as very easy, versus 34.2% of non-health students. Only 3.6% of health-related students reported difficulty with this task, compared to 14.2% in the non-health group. These patterns may reflect structured exposure to health content and stronger information-seeking skills cultivated through health-oriented curricula.

Similar patterns emerged for item 8, which addressed students' ability to find information on managing mental health problems. A larger proportion of health-related students rated this task as very easy or somewhat easy, suggesting a higher level of comfort and familiarity with mental health resources. This may be attributed to increased exposure to mental health topics in academic settings, reduced stigma, and greater health awareness promoted in health-focused disciplines (45). As highlighted by Sørensen et al. (2012), the ability to access health information is a fundamental component of health literacy and is strongly influenced by educational and contextual factors (2). In addition, another study emphasized that students' ability to locate and access appropriate health services is shaped by formal instruction and the accessibility of campus-based resources (46–48).

In the understanding competency (items 3, 4, 9, 10, 14, and 15), which involves the ability to comprehend health information, both groups generally reported high levels of perceived ease. However, health-related students consistently demonstrated slightly higher percentages of "very easy" responses. For example, 51.1% of health-related students found it very easy to understand why health screenings are needed (item 10), in contrast to just 34.5% of students from non-health disciplines. Notably, more than 26.6% of non-health students stated that they found it "somewhat difficult" and "very difficult" to understand why they need health screenings (item 10), compared to 5.8% of health students. This suggests that educational background significantly shapes comprehension of health messages, particularly when the content involves medical reasoning or public health rationale.

For the appraising competency (items 5, 11, 16), which involves evaluating the relevance and credibility of health information, notable differences emerged between groups. Health-related students reported greater ease in assessing media messages (item 11) and knowing when to seek a second opinion (item 5). Nearly half of non-health students (48.6%) struggled with evaluating media credibility, compared to 33.6% of health students. Similarly, 42.3% of non-health students found it difficult to decide when to seek a second opinion, versus 30.6% of their health-related peers. On item 16, more health students rated it "very easy" to judge health-related behaviors (38.7% vs. 32.9%).

These findings suggest that health-related students are better equipped to critically appraise health information, likely due to formal training. However, despite reported difficulties with evaluation, most respondents felt confident accessing and applying health information, 88.5% found it easy to locate treatment information (item 1), and 78.6% felt confident in acting on media-based advice (item 12). This contrast reflects a gap between access and critical

appraisal, possibly influenced by information overload and conflicting online content.

In the final competency, applying health information (items 6, 7, and 12), which pertains to using knowledge to make informed health decisions, health-related students again reported greater ease. A particularly notable gap was observed in following medical instructions (item 7), 65.0% of health-related students rated this as "very easy," while only 58.7% of non-health-related students did so. Finally, in item 6 (using doctor-provided information to make decisions), 47.4% of health students rated it very easy compared to 37.2% of non-health peers. Combined with lower difficulty responses, these results suggest greater confidence in acting on health advice among health students, possibly a result of familiarity with clinical reasoning processes.

Overall, these findings underscore the significant influence of academic background on health literacy, particularly in the competencies of accessing and appraising, as conceptualized by Sørensen et al. (2). These results highlight the multidimensional nature of health literacy and reveal disparities between students from different academic fields. To reduce this gap, universities should consider targeted interventions for non-health students, such as interdisciplinary health promotion programs, integration of health literacy into general education curricula, or Digital Health Literacy (DHL) workshops. Such initiatives can equip all students, regardless of discipline, with the skills needed to navigate health information and services effectively. A cross-disciplinary approach to curriculum and campus health strategies is vital to fostering equitable health literacy.

Study Limitations and Strengths: This study has several limitations. First, the absence of a categorized university-wide student registry precluded stratified probability sampling by academic field. Consequently, participant recruitment via self-registration followed by simple random sampling may have led to unequal representation between health-related and non-health-related disciplines. To address this, both full sample and matched sample analyses were conducted to enhance analytical rigor.

Second, the focus on undergraduate students aged 18–25 limits the generalizability of the findings to older or postgraduate populations. The restricted age and academic year range may have also reduced the variability needed to detect differences in health literacy.

Third, reliance on self-reported data introduces potential social desirability bias, while the online survey format may have excluded individuals with limited internet access or digital literacy, affecting sample inclusiveness.

## Conclusion

This study investigated the differences in health literacy levels between students from health-related and non-health-related academic fields in Semarang City, Indonesia. The HLS-EU-Q16 questionnaire and bivariate analysis results demonstrated a statistically significant association between academic background and health literacy level ($p < 0.001$). Students in health-related faculties had a markedly higher proportion of sufficient health literacy (86.9%) than those in non-health-related faculties (67.7%).

Furthermore, the odds of having low health literacy were significantly lower among health-related students, with an odds ratio of 0.351 (95% CI: 0.185–0.668, $p < 0.001$).

These findings confirm that academic exposure to health-related content contributes substantially to developing health literacy competencies, particularly in accessing, appraising, and applying health information. Academically, this study supports the need for integrating health literacy into broader educational frameworks, especially for non-health students who may lack sufficient exposure through their curriculum.

Regarding policy, universities should consider implementing cross-disciplinary health promotion programs, including integrating digital and general health literacy modules into non-health-related programs. This strategy would help reduce disparities in health knowledge, empower students to make informed decisions, and support long-term public health objectives.

**Acknowledgment:** The authors would like to express their sincere gratitude to Khon Kaen University for academic support and scholarship funding, and to Diponegoro University for providing access and assistance during the data collection process.

**Availability of data and materials:** The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Conflict of Interest:** The authors declare no conflict of interest.

**Consent for publication:** Not applicable as this study does not include images or personal identifying information of participants.

**Ethics approval and consent to participate:** This study was conducted in accordance with the Declaration of Helsinki. The Khon Kaen University Ethics Committee for Human Research granted ethical clearance for the research (Approval No. HE671228). All participants provided informed consent prior to participation.

**Funding:** The KKU ASEAN and GMS Countries' Personnel Scholarship and Faculty of Medicine, Khon Kaen University.

**Authors' contribution:** NA and SB conceptualized and designed the study. NA collected the data, performed the analysis, interpreted the findings, and drafted the manuscript. SB provided supervision and critically reviewed the manuscript for important intellectual content. All authors approved the final version for submission.

## References

1- Vozikis A, Drivas K, Milioris K. Health literacy among university students in Greece: Determinants and association with self-perceived health, health behaviours and health risks. Arch Public Health. 2014; 72(1):15. https://doi.org/10.1186/2049-3258-72-15 PMid: 24987522 PMCid: PMC4066308.

2- Sørensen K, Van Den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, et al. Health literacy and public health: A systematic review and integration of definitions and models. BMC Public Health. 2012; 12(1):1-13. https://doi.org/10.1186/1471-2458-12-80 PMid: 22276600 PMCid: PMC3292515.

3- Leventi N. Health literacy for the prevention of noncommunicable diseases-health sciences students' perception. The European Journal of Public Health. 2023; 33(Suppl 2): ckad160.1443. https://doi.org/10.1093/eurpub/ckad160.1443 PMCid: PMC10595897.

4- Abor PA, Tetteh CK. Evaluation of Health Literacy in Academics at the University of Ghana: A Cross-sectional Study. Journal of Health Literacy. 2025; 10(2):57-67. doi: 10.22038/jhl.2024.76614.1508.

5- Olayiwola JN, Anteyi E, Obanua F, Rollins A, Baustien LB, Smith T, et al. To Advance Health Equity, Make Health Literacy A Priority at The Organizational Level. Health Affairs Forefront [Internet]. 2024 Jul 22 [cited 2025 May 10]; Available from: https://www.healthaffairs.org/do/10.1377/forefront.20240718.801922/full/.

6- Baker DW, Parker RM, Williams M V., Clark WS. Health Literacy and the Risk of Hospital Admission. J Gen Intern

Med. 1998; 13(12):791https://doi.org/10.1046/j.1525-1497.1998.00242.x PMid:9844076 PMCid:PMC1497036.

7- Almachavan SA. The role of health literacy in enhancing preventive healthcare: A comprehensive review of challenges, interventions, and future directions. Journal of Research in Clinical Medicine. 2024; 12(1):36-36. https://doi.org/10.34172/jrcm.35126.

8- Kinoshita S, Hirooka N, Kusano T, Saito K, Aoyagi R. Does health literacy influence health-related lifestyle behaviors among specialists of health management? A cross-sectional study. BMC Primary Care. 2024; 25(1):1-9 https://doi.org/10.1186/s12875-024-02263-1 PMid: 38245688 PMCid: PMC10799471.

9- Nutbeam D. Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. Health Promot Int. 2000; 15(3):259-67. https://doi.org/10.1093/heapro/15.3.259.

10- Manochaiwuthikul T, Chaichutchouwakul A, Yunan N, Winothai N, Kanta P, Sapbamrer R. Health literacy disparities in Thai university students: exploring differences between health science and non-health science disciplines. BMC Public Health. 2025; 25(1):557. https://doi.org/10.1186/s12889-025-21761-0 PMid: 39934783 PMCid: PMC11817181.

11- Rababah JA, Al-Hammouri MM, Drew BL. The impact of health literacy on college students' psychological disturbances and quality of life: a structural equation modeling analysis. Health Qual Life Outcome. 2020; 18(1):292. https://doi.org/10.1186/s12955-020-01541-7 PMid: 32867807 PMCid: PMC7457482.

12- Tajdar D, Schäfer I, Lühmann D, Fertmann R, Steinberg T, van den Bussche H, et al. The Link between Health Literacy and Three Conditions of Metabolic Syndrome: Obesity, Diabetes and Hypertension. Diabetes, Metabolic Syndrome and Obesity [Internet]. 2022 [cited 2025 May 10]; 15:1639-50. https://doi.org/10.2147/DMSO.S363823 PMid: 35651900 PMCid: PMC9150919.

13- Asturiningtyas IP, Ashar H, Purwoko S, Annashr NN. Non-Communicable Disease Morbidity among Young Adults: A Cross-Sectional Study in Indonesia. Al-Sihah: The Public Health Science Journal. 2023; 63-74. https://doi.org/10.24252/al-sihah.v15i1.33605.

14- Palumbo R, Annarumma C, Manna R, Musella M, Adinolfi P. Improving quality by involving patient. The role of health literacy in influencing patients' behaviors. Int J Healthc Manag. 2021; 1-9. https://doi.org/10.1080/20479700.2019.1620458.

15- Kohir DS, Murhan A, Sulastri S. Screening of obesity risk factors in productive age. Jurnal Wacana Kesehatan. 2024; 9(2):97. https://doi.org/10.52822/jwk.v9i2.673

16- Amanda D, Martini S. The Relationship between Demographical Characteristic and Central Obesity with Hypertension. Jurnal Berkala Epidemiologi. 2018; 30;6(1):43. https://doi.org/10.20473/jbe.V6I12018.43-50.

17- Mahato RK, Myint Htun SS, Htike KM, Nawawonganun R, Sornlorm K. Development of health literacy tool for hypertension and determinants of limited health literacy in rural Myanmar: Implications for targeted public health interventions. Clin Epidemiol Glob Health. 2025 May 1; 33:102018 https://doi.org/10.1016/j.cegh.2025.102018.

18- Upton A, Spirou D, Craig M, Saul N, Winmill O, Hay P, et al. Health literacy and obesity: A systematic scoping review. Obesity Reviews. 2025;e13904.https://doi.org/10.1111/obr.13904 PMid: 39933504 PMCid: PMC12069161.

19- Rababah JA, Al-Hammouri MM, Drew BL, Aldalaykeh M. Health literacy: exploring disparities among college students. BMC Public Health [Internet]. 2019 Oct 1 [cited 2023 Oct 16]; 19(1):1-11. https://doi.org/10.1186/s12889-019-7781-2 PMid: 31664973 PMCid: PMC6819582

20- Bhusal S, Paudel R, Gaihre M, Paudel K, Adhikari TB, Pradhan PMS. Health literacy and associated factors among undergraduates: A university-based cross-sectional study in Nepal. PLOS Global Public Health. 2021; 1(11):e0000016. https://doi.org/10.1371/journal.pgph. 0000016 PMid: 36962072 PMCid: PMC10022320.

21- Shahrahmani H, Kariman N, Ahmadi A, Nasiri M, Keshavarz Z. Factors Related to Health Literacy Among the Iranian Population: A Scoping Review. Med J Islam Repub Iran. 2023; 37(1):138. https://doi.org/10.47176/mjiri.37.138 PMid: 38435830 PMCid: PMC10907049.

22- Gallè F, Calella P, Napoli C, Liguori F, Parisi EA, Orsi GB, et al. Are Health Literacy and Lifestyle of Undergraduates Related to the Educational Field? An Italian Survey. Int J Environ Res Public Health. 2020; 17(18):6654. https://doi.org/10.3390/ijerph17186654 PMid: 32932646 PMCid: PMC7558704.

23- Nurjanah, Rachmani E, Manglapy YM. Assessing Health Literacy on Student Using Online HLS-EU-16. Research Gate [Internet]. 2015 [cited 2023 Dec 11]; 23. Available from: https://www.researchgate.net/publication/281235055.

24- Prihanto JB, Nurhayati F, Wahjuni ES, Matsuyama R, Tsunematsu M, Kakehashi M. Health literacy and health behavior: Associated factors in Surabaya high school students, Indonesia. Int J Environ Res Public Health. 2021 Aug 1; 18(15):8111.https://doi.org/10.3390/ijerph18158111 PMid: 34360404 PMCid: PMC8345632.

25- Suardi, Ernawati, Patmawati, Zainuddin, Nurfateha, Najihah. Effectiveness of the Smart DSME Booklet as an Educational Medium on Diabetes Literacy in Type 2 DM Patients with Pre-Ulcers in the Working Area of Mangarabombang Health Center, Takalar. Malahayati Nursing Journal. 2024; 6(10):3898-909. https://doi.org/10.33024/mnj.v6i8.15871.

26- Muttaqin T. Determinants of Unequal Access to and Quality of Education in Indonesia. Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning. 2018 Mar 27; 2(1). https://doi.org/10.36574/jpp.v2i1.27.

27- Afrina C, Zulaikha SR, Jumila. The Low Level of Digital Literacy in Indonesia: An Analysis of Online Media Content. Record and Library Journal. 2024; 10(2):374-87. https://doi.org/10.20473/rlj.V10-I2.2024.374-387.

28- Lasminawati E, Wilujeng I, Syamsussabri M, Suyanta S. Exploration of Health Literacy in Science Learning Curriculum in Indonesia. Jurnal Penelitian Pendidikan IPA. 2022 Oct 31; 8(4):2176-80. https://doi.org/10.29303/jppipa.v8i4.1209.
29- Akelina Butar Butar H, Aryani L, Hartini E, Wulandari F. Comparison of Health Literacy of Active Students of the Faculty of Health and Non-Health, Dian Nuswantoro University, Semarang. Afiasi : Jurnal Kesehatan Masyarakat. 2024; 9(2):146-54. https://doi.org/10.31943/afiasi.v9i2.368.
30- Lestari P, Handiyani H. The higher level of health literacy among health students compared with non-health students. UI Proc HealthMed. 2017; 1.
31- Sjamsuddin IN, Anshari D. Reliability and Validity Test of Digital Health Literacy Instruments for Undergraduate Students. Indonesian Health Promotion Publication Media. 2023; 6(1):68-74. https://doi.org/10.56338/mppki.v6i1.2902.
32- Szumilas M. Explaining Odds Ratios. Journal of the Canadian Academy of Child and Adolescent Psychiatry. 2010; 19(3):227. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC2938757/.
33- Cook A, Sheikh A. Descriptive statistics (Part 2): Interpreting study results. Nature Publishing Group. 2000; 8. https://doi.org/10.1038/pcrj.2000.6.
34- Reshid TM. Monte Carlo Simulation and Derivation of Chi-Square Statistics. American Journal of Theoretical and Applied Statistics 2023, Volume 12, Page 51. 2023; 12(3):51-65. https://doi.org/10.11648/j.ajtas.20231203.13.
35- Roiefah AL, Pertiwi KD, Siswanto Y. The Relationship between Health Literacy Levels and Non-communicable Disease Prevention Behavior in Adolescents in Semarang Regency. Pro Health Jurnal Ilmiah Kesehatan. 2021; 3 (2):167-78. (Indonesian).
36- Evans AY, Anthony; Edusei, Gabriel G. Comprehensive Health Literacy among Undergraduates: A Ghanaian University-Based Cross-Sectional Study. HLRP: Health Literacy Research and Practice. 2019; 3(4):227-37 https://doi.org/10.3928/24748307-20190903-01 PMid: 31637363 PMCid: PMC6786689.
37- Reshma AS, Chandrasekhar T, Paul B, Das A. A Cross-Sectional Study on Health Literacy and its associated factors among Adults of a Rural Area of Hooghly District, West Bengal. Journal of Health Literacy. 2024; 9(3):95-105. doi: 10.22038/jhl.2024.79591.1566.
38- Sørensen K, Pelikan JM, Röthlin F, Ganahl K, Slonska Z, Doyle G, et al. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). The European Journal of Public Health. 2015; 25(6):1053. https://doi.org/10.1093/eurpub/ckv043 PMid: 25843827 PMCid:PMC 4668324.
39- McCaskill A, Gasch-Gallen A, Montero-Marco J. Measuring general health literacy using the HLS19-Q12 in specialty consultations in Spain. BMC Public Health. 2024; 24(1):1-10. https://doi.org/10.1186/s12889-024-20710-7 PMid: 39574059 PMCid: PMC11583419.
40- Alahmadi YM. Evaluation of Health Literacy and Associated Factors among Adults Living in Saudi Arabia: A Cross-Sectional Study. Inquiry (United States). 2023 Jan 1; 60. https://doi.org/10.1177/00469580231161428 PMid: 36932856 PMCid: PMC10026131.
41- Kühn L, Bachert P, Hildebrand C, Kunkel J, Reitermayer J, Wäsche H, et al. Health Literacy Among University Students: A Systematic Review of Cross-Sectional Studies. Front Public Health. 2022 Jan 21; 9:680999. https://doi.org/10.3389/fpubh.2021.680999 PMid: 35127605 PMCid: PMC8814326.
42- Fathonah S, Cahyono E, Sarwi S, Wusqo IU, Hanifah N, Agustin LR. The Influence of Health Literacy and Nutrition Literacy on the Nutritional Status of Unnes Students. Proceedings of the National Postgraduate Seminar [Internet]. 2020 [cited 2025 Jan 20]; 3(1):1063-70. Available from: https://proceeding.unnes.ac.id/snpasca/article/view/1321 (Indonesian).
43- García-García D, Pérez-Rivas FJ. Health Literacy and Its Sociodemographic Predictors: A Cross-Sectional Study of a Population in Madrid (Spain). Int J Environ Res Public Health. 2022; 19(18):11815. https://doi.org/10.3390/ijerph191811815 PMid: 36142082 PMCid: PMC9517037.
44- Dolezel D, Shanmugam R, Morrison EE. Are college student's health literate? Journal of American College Health. 2020; 68(3):242-9. https://doi.org/10.1080/07448481.2018.1539001 PMid: 30457454.
45- Rehman A ur, Bin Naeem S, Faiola A. The prevalence of low health literacy in undergraduate students in Pakistan. Health Info Libr. 2023; 40(1):103-8 https://doi.org/10.1111/hir.12475 PMid: 36722458.
46- Rita Pedro Pedro AA, Rosá rio R, Monteiro I, Cerqueira M, Roque S, Assunçã V, et al. Health literacy in higher education students: findings from a Portuguese study. Eur J Public Health. 2022; 32(Supplement_3). https://doi.org/10.1093/eurpub/ckac130.140 PMCid: PMC9835489.
47- Nutbeam D. The evolving concept of health literacy. Soc Sci Med [Internet]. 2008; 67(12):2072-8. https://doi.org/10.1016/j.socscimed.2008.09.050 PMid: 18952344.
48- 48. Oktarianita, Sartika A, Wati N, Ferasinta. Factors Related to the Utilization of Health Services during the COVID-19 Pandemic at the Lingkar Barat Community Health Center. Proceedings National Seminar UNIMUS. 2021; 4. (Indonesian).
49- Lahagu E, Nurhidayah RE. Interprofessional Education as an Effort to Develop Nurses' Ability to Collaborate with Other Health Workers. Jurnal Keperawatan Cikini. 2023 Jul; 4(2):117-29. doi: https://doi.org/10.55644/jkc.v4i02.117 (Indonesian).
50- Rahmadani Hasibuan A, Fahira Pasaribu A, Alfiyah S, Nazwa Utami J, Rahma Yanti Harahap N. The Role of Health Education in Increasing Public Awareness of Healthy Lifestyles in the Digital Era. 2024. doi: https://doi.org/10.58230/27454312.1515 (Indonesian).
51- Kuutila M, Kiili C, Kupiainen R, Huusko E, Li J, Hosio S, et al. Revealing complexities when adult readers engage in the credibility evaluation of social media posts. Comput

Human Behav. 2023; 151. doi: https://doi.org/10.1016/j.chb.2023.108017.

52- Hamzah MR, Mohamad E, Abdullah MY. The Influence of Health Literacy on Health Information Seeking Behavior among Public University Students. Malaysian Journal of Communication. 2016; 32(2):405-24. Available from: https://journalarticle.ukm.my/10512/1/16488-46322-1-SM.pdf (Malaysian) https://doi.org/10.17576/JKMJC-2016-3202-21.