

e-Health Risk Assessment on Non-Communicable Diseases, Quality of Life, And Health Promotion Behavioral Among University Personnel in Thailand

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Abstract

Background

Nowadays, information systems play an essential role in daily life, particularly in medical services and health screening, with increasing emphasis on preliminary health risk assessment. The development of an applied e-health information system for assessing health risks related to non-communicable diseases (NCDs) among university personnel requires a systematic approach to health data management. Such a system enables the establishment of a comprehensive health database that can be utilized to support health promotion initiatives, enhance quality of life, and encourage appropriate health-promoting behaviors. In addition, the information generated can inform institutional planning and policy development aimed at improving workforce well-being, enhancing work efficiency, and reducing healthcare expenditures. Ultimately, the implementation of an e-health risk assessment system contributes to the advancement of a sustainable healthy university environment.

Objective

To assess the NCD health risks related to quality of life and health promotion behaviors among Chiang Mai University (CMU) personnel using an applied e-Health Risk Assessment (CMU i-Health) web-application.

Methodology:

A study using a descriptive correlational design was conducted with a sample group of 650 people selected by convenience sampling, who were working at CMU between January 2021 and June 2021. Data were collected using the e-Health Risk Assessment named “CMU i-Health web-application”, and the instruments consisted of 1) a health risk assessment form, 2) the abbreviated WHO Quality of Life Assessment Form (WHOQOL-BREF), and 3) the Health-promoting Lifestyle Profile-II (Thai-CMU version). Cronbach’s alpha coefficient was higher or equal to 0.95 and 0.9. Data were analyzed using descriptive statistics and Pearson’s correlation coefficient.

Results

The sample group consisted of females (68.6%) and males (31.4%), most of whom had moderate health risk (46.5%). Some participants had a history of taking NCD medication (18.9%), with the top four NCD risks being hypertension (13.2%), hyperlipidemia (13.2%), coronary artery disease (2.8%), and diabetes (1.2%). The main risk factors for developing chronic NCDs were excessive Body Mass Index (BMI) (99.7%), inappropriate dietary habits (98%), excess waist/hip ratio (57.4%), stress (42.5%), lack of exercise (30.2%), drinking alcoholic beverages (27.5%), and smoking (2.5%). The mean for quality of life

was at a moderate level (76.78), while health promotion behavior was at a decent level (2.98). No statistically significant differences were found in the quality-of-life mean comparison and the health promotion behaviors mean comparison after 6 months, although quality of life was found to be moderately correlated with health promotion behaviors ($r = 0.358$, $p < 0.01$).

Conclusions

CMU personnel should be encouraged to practice appropriate health promotion behaviors in order to reduce risk factors and prevent the occurrence of non-communicable chronic diseases in the working-age population leading to wellness, good quality, and efficiency of work at CMU.

BACKGROUND OF THE STUDY

The promotion of and support for Chiang Mai University (CMU) personnel to have desirable health behaviors is one important aspect of being a healthy university. The Health Promotion Model by Pender et al. ^[1, 2] is a concept that includes a health behavior model for individuals with a clear focus on health promotion. These researchers developed the Health Promotion Lifestyle Profile II, which aims to describe six areas of practice: 1) health responsibilities; 2) age-appropriate routines and exercise; 3) dietary intake; 4) cognitive development; 5) relationships with other people; and 6) stress management. Regular application of the six areas has become a way of life for the individual, and the development of health promotion models with university personnel participation is a component of the health care arrangements that support CMU personnel as they transition to an aging society in the future.

This represents a new paradigm in health care that places an emphasis on the responsibility of the individual for their own health and will aim to respond to CMU personnel's transition towards the status of elderly people who still have active aging or healthy aging by encouraging a way of life that involves practicing appropriate health promotion behaviors and taking complete care of one's health. It takes action to achieve a sustainable model of participation in which CMU personnel can continue to operate on their own or have access to useful resources that will support health promotion behaviors, a very common educational process. For example, hold group discussions, workshops, brainstorming sessions, and public hearings to obtain patterns and guidelines that can be tailored to the needs and context of the community ^[3].

This study on a model of health promotion for personnel at CMU was carried out by applying the 5-level participation process through group meetings, which included those who are directly involved as the model's beneficiaries and who can be divided into two groups: academic personnel (faculty members and university employees) and support personnel (civil servants and employees). The age range for personnel group is 25–65 years old, and they have a wide range of health conditions as well as the ability to care for or promote their own health. In particular, their age group between 40 and 65 years old often suffers from chronic non-communicable diseases such as vascular disease (hypertension, diabetes,

hyperlipidemia, kidney disease, and heart disease), occupational illnesses, and degenerative diseases such as osteoporosis and osteoarthritis. Work at Chiang Mai University is quite severe and tiring, which may cause difficulty in allocating appropriate time to accomplish all functions in accordance with set goals. This can also cause stress and anxiety, and if the condition occurs for a continuous period of time, it can affect both physical and mental health. In addition, the limited time each day combined with the exhaustion of work tasks means there is less time to take care of one's health or carry out self-promoting behaviors, for example, doing exercise or recreation to relieve stress, which can lead to the severity of chronic disease.

The concept of developing the potential for health promotion among CMU personnel is to become a healthy university under the concept of applied health information. It will be the basis for developing university into a university of health by reaching users through the health information system in the application. Nowadays, it plays a role in every aspect of daily life ^[4, 5]. Applications related to physicians or public health services, especially for health surveillance, are becoming increasingly widely used and popular. Currently, people pay more attention to health care. Health-related apps are becoming more and more popular. The application is expected to be used as a tool for medical treatment. These applications are used in both primary and secondary medical treatment or surveillance applications ^[6, 7].

Efforts to develop various information systems in Thailand have been widely promoted by the government within the context of medical management. The main system developed by the government may not be able to meet spatial usage and other limitations. As a result, the health information system in Thailand continues to be a problem ^[8, 9]. CMU itself does not have a health information system other than the Maharaj Nakorn Chiang Mai Hospital system, which is supervised by the Faculty of Medicine. A holistic health assessment system that was not developed specifically for the health care of personnel and the data collection of health information at CMU by the Human Resource Management Division could not access or plan the university's health. Over the past 5 decades, CMU has not established a clear policy framework for personnel health promotion, nor has it maintained systematic reporting on work-related health impacts. This gap is largely attributable to the absence of an integrated health information system that could support evidence-based planning and the development of sustainable health promotion strategies for university personnel.

This research recognizes the value of developing and maximizing the potential of CMU personnel to contribute to the development of CMU into a university of good health based on the significance and necessity of health problems among working-age personnel there. An analysis of the health status and health promotion practices of academic and support personnel will provide foundational data for the development of health promotion initiatives for personnel at CMU. The aim is to be able to take care of oneself, prevent common non-communicable diseases, and reduce the incidence of health problems and disabilities among CMU personnel when entering old age, increasing their potential and efficiency at work and preparing them for retirement appropriately.

The development of CMU's health information system under the policy of proactively driving strategy 2 in food innovation, health, and elderly care focuses on the health of CMU personnel. It is also intended to supervise, monitor, and formulate key policies and plans to care for personnel through health informatics and to link with plans to develop CMU into a health-promoting university. Health information is critical information to help universities stay informed about the health of their personnel as well as promote supportive care and health promotion behaviors, all of which will also benefit the development of CMU as a whole.

Thus, this approach to health information system development adopts a developmental research framework that emphasizes the design and implementation of an e-health risk assessment system. The system focuses on the development of a structured health database for measuring and assessing the health risks of CMU personnel in alignment with the university's health information infrastructure. The e-health system is designed to support efficient data processing and systematic storage with a high level of data structure, integrity, and security. In addition, the system enables the retrieval, analysis, and visualization of relevant statistical health data to generate meaningful health risk assessment information. The information obtained can be utilized to support management processes and evidence-based decision-making, facilitating strategic planning and the effective use of health data to advance CMU toward becoming a healthy university. Furthermore, the system is designed to enable continuity and integration with subsequent health promotion activities and related projects.

CONCEPTUAL FRAMEWORK

The concept of health information system development for CMU personnel to drive towards a health university has been developed to systematically promote the health of personnel. The e-Health Risk Assessment system is developed for using the information on health-related impacts in order to promote or formulate policies or strategies that address health problems. This health information system for CMU personnel is studied and developed with an emphasis on the health assessment of personnel for positive impacts under 3 indicators related to health assessment: 1) health risk assessment, 2) health-related quality of life (WHOQOL-BREF-Thai), and 3) health-promoting behaviors. These three assessment instruments are developer-licensed and have been validated for use. They are integrated into an e-health assessment system in which data are systematically stored and managed, with capabilities for data integration and the generation of both individual-level and aggregate health feedback. The system also supports follow-up processes through the developed e-health risk assessment framework, enabling continuous monitoring and evidence-based health management.

The overall data will be of great use for health processing that can assess the physical and mental disease risk based on further project indicators. This study has words that have specific meanings, so that those who come to study or gain knowledge from this study will understand the meaning in the same direction, which consists of the following words: 1) Personnel health promotion means taking actions to enhance the physical, social, psychological, organizational, and economic environments to enhance the quality of working life, the population's health, and the wellbeing of all workers. This

includes personal empowerment and progress^[10]. 2) Healthy university means promoting and developing the potential of personnel at Chiang Mai University to participate in the development of the university to be a health university, focusing on empowering people to participate under the Whole University Approach, covering five key dimensions: 1) Underpinning principles; 2) High University Drivers; 3) Public Health Drivers; 4) Whole University Approach; and 5) Deliverables and Impacts^[11–13]. A healthy society will result from encouraging creativity, sharing, and organizing all parties. 3) Chiang Mai University personnel means personnel CMU who are academic personnel (government officials and university personnel) and support personnel (government officials, supportive university personnel, and employees) who work at Chiang Mai University.

DEVELOPMENT OF THE E-HEALTH RISK ASSESSMENT (CMU I-HEALTH)

This study employed an agile system development approach to support the design and implementation of the e-Health Risk Assessment system (CMU i-Health web-application). The agile approach facilitates flexibility and responsiveness, allowing the system to be continuously refined and adapted in accordance with research objectives, user requirements, and evolving tasks throughout the research and development process. The system development process comprised nine sequential steps, as outlined below:

1. Planning: This step involved the collection and review of health system development plans and policy directions from the CMU Health Promotion Committee and the project committee of Chiang Mai University. The planning process focused on identifying system objectives, defining functional requirements, and aligning the e-health risk assessment framework with institutional strategies for personnel health promotion and healthy university development.
2. Requirements analysis: The data collected during the planning phase are analyzed to define system requirements and configurations for the e-Health Risk Assessment system. This process includes determining system functionalities, data structures, and protocols for personal data collection, use, and protection. The proposed system design and data management procedures are subsequently submitted for ethical review and approval by the Research Ethics Committee of the Faculty of Nursing, Chiang Mai University to ensure compliance with ethical standards for research involving human participants.

3. Design: The reliability of the three questionnaire-based assessment instruments is evaluated following expert review of the assessment content and structure. Upon confirmation that the instruments meet the required reliability criteria, the system design phase focuses on the development of the database architecture, user interface, and user experience design to support effective e-Health risk assessment. In addition, user groups and sample characteristics are clearly defined at each stage of system development and testing to ensure usability, accuracy, and relevance of the assessment outputs.
4. Development: The e-Health Risk Assessment system is developed in accordance with the defined functional components and system requirements. An initial system prototype is constructed to reflect the intended assessment functions, data processing workflows, and user interactions. The prototype undergoes technical evaluation to assess system performance, functionality, and stability. Subsequently, the system is submitted to experts in computer science and information technology for quality assessment, with a focus on system architecture, security, usability, and overall technical reliability.
5. Testing: At this stage, the system will be revised according to the experts' recommendations along with technical testing and re-testing. When the comments and parts that need to be corrected are obtained, they will be edited for further adjustments. If there are still bugs in the system, they will be fixed before the 2nd testing.
6. 2nd Development: This phase focuses on refining and enhancing system functions and components that do not yet fully meet the defined technical objectives or operational constraints. The system is improved based on identified limitations prior to evaluation by qualified computer science experts, after which it undergoes further testing to verify performance, functionality, and compliance with technical requirements.
7. 2nd Testing: This step is for re-testing the modified system (semi-final version). If there are defects in various aspects, they will be corrected before actual use in the next step.
8. Deployment Phase 1: This step will be the actual implementation of the system with the sample group of CMU personnel who applied to join the project, by publicizing the project through various channels. It will be processed to summarize the overall picture and sent to the Human Resource Management Division. There may be some minor errors that need to be corrected for the sample to take the first health assessment and spaced approximately 3 months. The system will invite users to assess their health risks a second time. The first and second datasets are processed into reports in the form of quantitative and qualitative statistics.
9. Deployment Phase 2: This step involves the actual implementation of the system with a sample group of CMU personnel who applied to participate in the project after it was publicized through various channels. It will be processed to summarize the overall picture and sent to the Human Resource Management Division. This includes issuing relevant health promotion activities or summaries for providers to formulate health promotion strategies and policies. In addition, it may be a comparison of health assessments at the start of the project and at the end of the program including, for example, weight data, BMI, and lifestyle assessment scores to recognize the positive impact when participating in the subsequent project activities.

E-HEALTH RISK ASSESSMENT (CMU I-HEALTH) SYSTEM ARCHITECTURE

The system architecture of the e-Health Risk Assessment (CMU i-Health web-application) in Fig. 1 is designed to support secure, integrated, and scalable health risk assessment for university personnel. The architecture follows a modular, service-oriented approach that enables interoperability between institutional health databases, self-monitoring platforms, and multiple user access channels. At the user access layer, the system supports multiple user groups, including administrators, faculty administrators, CMU personnel, and external users. System access is managed through a centralized authentication and registration module, which verifies user identity and enforces role-based authorization. For CMU personnel, authentication can be linked to the university's human resource database via secure OAuth mechanisms to ensure institutional consistency. Users interact with the system through several interfaces, including a responsive web application, mobile devices, standard web browsers, and the official Healthy CMU account on the LINE platform using the LINE API. These interfaces allow users to enter personal health data, complete health risk assessments, and receive individualized feedback in a flexible and user-friendly manner.

At the data management layer, all health assessment data, quality-of-life measures, and health promotion behavior records are securely stored in the CMU Health Data Server, supported by a structured relational database. A dedicated data extraction and synchronization component enables bidirectional data exchange between system modules, ensuring data integrity, consistency, and timely updates. The architecture also integrates with the Smart Self-Monitoring system, which allows users to record real-time health indicators via smart devices. Upon obtaining explicit user consent, selected self-monitoring data can be accessed and incorporated into the health risk assessment process, thereby enhancing the accuracy and continuity of health monitoring. At the institutional level, aggregated and anonymized health data can be retrieved by authorized units, such as the Human Resource Management Division, for statistical reporting, health promotion planning, and policy formulation. In addition, the system supports evidence-based decision-making and provides a robust digital foundation for advancing Chiang Mai University toward a sustainable healthy university model. Health reports and statistical summaries for institutional planning, health promotion strategy development, and policy formulation.

METHODS

Population

The population group to be studied are personnel at CMU, including a group of academic personnel (government officials and university employees) and support personnel (government officials, supportive university personnel, and employees) who were working at CMU between January and December 2021. The personal types and sample group were explained in Table 1 and 2 below;

Samples used at each stage of the study were calculated based on population size using Yamane with an error of .05. However, this sample size was not restricted to user groups, gender, faculty, or type of workforce, as the researcher emphasizes the voluntariness of users to assess their health risks.

In addition, the sample group will be invited through the Chiang Mai University Personnel Health Potential Development Program to become 'Healthy Chiang Mai University' by the Faculty of Nursing, Chiang Mai University. Participants in the program were CMU personnel, and they will be provided project information via <https://healthycmu.com/> or online public relations media and various CMU channels, for example, newsletters, e-mails, and invitations to join the faculty, as well as the leaders in each faculty to which the project committee is affiliated. When samples have been selected, they will coordinate with the network leaders in each faculty to inform the research data and provide information from the informed consent information sheet. The criteria for the sample selection are as follows:

Table 1
Chiang Mai University personnel

Personnel type	Number of personnel
Government officials	931
Full-time university personnel	5,736
Temporary university personnel	5,140
Full-time employees	368
Total	12,175

Source: Human Resource Management Division, Chiang Mai University (24 April 2020).

Table 2
The sample group

Sample group	
Chiang Mai University personnel (all groups)	3,653
System usage time	6 months
Project duration	12 months

University' by the Faculty of Nursing, Chiang Mai University. When samples have been selected, they will coordinate with the network leaders in each faculty to inform the research data and provide information from the informed consent information sheet. The criteria for the sample selection are as follows:

Inclusion criteria: 1) Personnel at Chiang Mai University who are civil servants, full-time university employees, temporary university employees, or temporary university employees between 25 and 65 years old 2) Be able to always participate in this study, have perfect consciousness, and could read and

write in Thai. 3) Be willing to participate in this study. 4) Proficient with information systems and can access them by smartphone, computer, or tablet.

Exclusion criteria: 1) The participants can withdraw from the research project at any time without any negative repercussions. 2) The participants are retired or deceased. 3) The participants do not log in for a health assessment for three consecutive months. 4) The participants are patients. And 5) The participants are currently participating in a research project related to health promotion, or it is not later than 3 months after their participation in a program.

Withdrawal or termination criteria: 1) The participants are retired or reduced 2) The participants feel insecure or uneasy. 3) The participants feel uncomfortable. 4) The participants are expelled from government service, studying at a higher education level, or suspended from government service. 5) The participants are patients.

Research Instruments

This study employed a descriptive correlational research design that aimed to study and develop an applied information system to assess the health of CMU personnel by using 3 main questionnaires including (1) the health risk assessment, (2) the WHOQOL-BREF Thai version, and (3) the health promotion lifestyle profile. And to develop an applied e-health risk assessment information system capable of presenting individual, faculty, and university-level health information to support health monitoring and institutional health planning at Chiang Mai University.

This study can be used to present the preliminary general health information for the development of a health promotion activities to promote the potential of personnel in CMU, to enable them to take care of themselves, prevent the occurrence of common chronic non-communicable diseases, and reduce the incidence of health problems and disabilities when entering old age, leading to an increase in the potential and efficiency of personnel in CMU in their work and supporting them appropriately as they approach retirement age.

CMU i-Health web-application is an e-health risk assessment system designed from the three assessments designed and developed to enable assessment in a database format using the PHP Framework and Laravel in development. It contains questions from the assessment forms. All three research tools will be reviewed for reliability analysis with Cronbach's alpha coefficient prior to research.

1) The health risk assessment was developed by the National Health Security Office (NHSO) and is used to screen the general public's health risk when assessing the health risk of cardiovascular disease. It consists of 1) general information, 2) personal information, 3) family history, 4) risk behaviours or health, 5) exercise, 6) diet, 7) taking medicine, 8) substance abuse, 9) stress behaviour, 10) physical exam and preliminary summary, 11) cardiovascular risk assessment, and 12) conclusions. Health risk screening tools developed as assessments are of acceptable quality and meet standards of reliability. The National Health Security Office uses it to paint a broader picture of Thailand's public health system. It consists of

simple, easy-to-respond-to questions, although it is not a practice scale, and it will be used for preliminary assessment only. As a result, this assessment will be taken into consideration ^[14].

2) Health promotion and lifestyle profile is based on questions from Suwanarup and Sihiranwong, Thai version (2004) ^[15]. The purpose of this study is to measure the health-enhancing behaviors of students and nurses in six areas: 1) health responsibility (HR), 2) physical activity (PA), 3) nutrition (NT), 4) interrelation (IR), 5) spiritual growth (SG), and 6) stress management (SM). This scale is a 4-level Likert scale with 50 questions. The questions are both positive and negative. For the positive questions, 1 point means never performing the activity, and 4 points mean performing the activity consistently. For the negative questions, 1 point means performing the activity regularly, and 4 points mean never performing the activity at all. The overall score is between 50 and 200 points. The criteria for interpreting scores are as follows: 150–200 points mean that health promotion behaviors are at a high level of good behavior, followed by a score of 100–149, which means moderate level; and lastly, 50–99 points mean low level or poor health promotion behaviors ^[15].

3) The WHOQOL-BREF Thai version, from the Department of Mental Health, has a reliability level of 0.8434. It consists of two sections: 1) General information; and 2) One of the 26 experiences of the past 2 weeks of self-exploration. The answer has five options: 1) Not at all means that you do not have such feelings at all; 2) Little means you have little of that feeling; 3) Moderate means you have a moderate feeling; 4) High means you have that feeling often; and 5) The highest means you always have that feeling. Overall scores are between 26 and 130 points, and the criteria for interpreting scores are as follows: 26–60 points mean poor quality of life, 61–95 points mean moderate quality of life, and 96–130 points mean good quality of life ^[16–18].

Data collection and research management

General health assessment data from e-Health Risk Assessment (CMU i-Health web-application) are collected and compiled in a database located at Chiang Mai University. This collected data is processed by computer systems and research project administrators. It will be under the supervision of the CMU Personnel Development Potential Development Project Committee for further driving Healthy CMU. The 650 samples are participated to use the CMU i-Health web-application through the Healthy CMU portal website. The subjects are separated by roughly three months and were evaluated for the first time. The report was processed the initial data. Then, the participants were evaluated their general health assessment data for the second time, which has been spaced for not less than 3 months and does not qualify for system exclusion. System users can know their health trends. Data visualizations were displayed in the system, as well as summary data. The overview, done by the administrator, were summarized, and scientifically reported without reference to names or any other identifiers of the user. It is only for reporting the overall results. The Table 3 outlines the structured implementation plan of the CMU i-Health web-application, including requirement analysis, system development, pilot testing, public

engagement, data administration, and technology transfer to support sustainable health information management at the institutional level.

Table 3
Implementation plan and details

Activities	Details
Activity 1: Analysis and brainstorming of requirements for the e-Health Risk Assessment (CMU i-Health web-application) system.	A brainstorming session was conducted with representatives from the health sciences faculties to develop a health data collection model, define the expected outcomes of health data processing, identify appropriate approaches for health outcome analysis, determine the pilot target group, and establish communication mechanisms between users and personnel management.
Activity 2: Preparation of the e-Health Risk Assessment (CMU i-Health web-application) system development plan.	The project team coordinated with the Human Resource Management Division to obtain relevant information, clarify data formats, collect feedback, and summarize the system development requirements. The system was also assessed and implemented in alignment with the university's strategic plan.
Activity 3: Development of the health risk assessment system.	A centralized health information system was developed to assess and monitor health risks among CMU personnel.
Activity 4: System testing.	During the initial phase, the system was tested and implemented among a pilot group comprising personnel from several network partners over a period of 1–3 months.
Activity 5: Public relations and promotion of health surveillance and health information use through CMU-MIS.	A public relations campaign was developed to increase awareness of the initiative among the CMU community and improve understanding of the importance of providing health information and participating in activities that support health promotion and healthcare.
Activity 6: System administration and data export.	Health reports were generated and presented to the working group, personnel responsible, and the Human Resource Management Division. These reports supported health monitoring, database maintenance, and information security.
Activity 7: Technology transfer to the Human Resource Management Division and monthly health data compilation (2nd year, 4th quarter).	Analytical health reports and summary information were prepared, and knowledge regarding system operation was transferred to the Human Resource Management Division to ensure that the system could continue to be used effectively after the completion of the project.

Data analysis

The demographic data form was analysed using the Statistical Package for the Social Sciences (SPSS) (version 17). The COVID-19 health risk behaviours assessment was analysed using Chi-square test. The data was analysed from participants in both the student and staff groups.

Ethic issues

And the last thing about samples is protecting the rights of sample groups. The researcher will defend the rights of the sample by submitting a research proposal to the Research Ethics Committee, Faculty of Nursing, Chiang Mai University, IRB No. 111/2020, and Research ID:2020-054; Study Code:2020-EXP045, before the process of data collection began. The committee reviewed and approved this project for the period between 24 September 2020 and 23 September 2021. When the researcher has been granted permission, they will select the sample to join the project according to the criteria and explain the objectives, benefits, and research methodology to them, as well as their right to accept or decline to participate in the research without any impact. They must sign a consent form to participate in the research and explain to the participants that they have the right to request to stop participating in the research without any effect. In addition, the researcher must consider confidentiality and personal information. The information obtained from the research is presented as an overview only. If the sample group has questions, the sample group can ask the researcher at any time.

RESULTS

From the description of the study method, it is said that both qualitative and quantitative analysis were used. Therefore, the results of the study are divided into five topics: Demographic data, Health Risk Assessment Results, Health promotion and lifestyle profile Results, Quality of Life Results, and Relationship between Quality of Life and Health Promotion Behaviors.

Demographic data

Of 650 participants, 453 people were female and 197 were male (representing 69.7% and 30.3% of the participants, respectively) (please see Table 4).

Table 4
Demographic characteristics of the participants (n = 650)

Participants	Number	%
Sex		
Female	453	69.7
Male	197	30.3

Health Risk Assessment results

The most common risk category was high-moderate health risk (302 people, 46.6%), followed by 212 people (32.8%) at high health risk, and 115 people (17.7%) at low health risk. The very high-risk group accounted for 19 people (2.9%) (please see Table 5).

Table 5
Health risk group of participants (n = 648)

Health risk	Number	%
Low health risk	115	17.7
High-moderate health risk	302	46.5
High health risk	212	32.6
Very high health risk	19	2.9

Table 6
Noncommunicable disease risks and associated risk factors (n = 650)

NCDs and risk factors	Risk		No risk	
	Number	%	Number	%
Noncommunicable disease risk				
Diabetes	8	1.2	642	98.8
Cardiovascular diseases	18	2.8	632	97.2
Hypertension	86	13.2	564	86.8
Risk Factors				
Family history	67	10.3	583	89.7
Hyperlipidemia	86	13.2	564	86.8
Taking medicine	123	18.9	527	81.1
Excess BMI*	186	28.7	462	71.3
Excess waist–hip ratio**	249	57.4	185	42.6
Dietary	637	98.0	13	2.0
Stress	276	42.5	374	57.5
Exercise	196	30.2	454	69.8
Smoking behavior	16	2.5	634	97.5
Alcohol drinking behavior	179	27.5	471	72.5
*Total sample of 648				
**Total sample of 434				

The health risk group contained 86 people with hypertension (13.2%), followed by the cardiovascular diseases (CVD) risk group with 18 people (2.8%), and 8 people (1.2%) who were at risk of developing

diabetes (please see Table 6).

There were many risk factors for developing noncommunicable diseases (NCDs), including family history, taking medicine, food consumption, stress, exercise, smoking behavior, alcohol drinking behavior, body mass index (BMI), and excess waist-hip ratio. Among the total of 650 people, it was found that the most reported risk factors affecting NCD development were dietary factors (637 people, 98%), followed by stress factors and waist and hip ratio (276 people, 42.5%; 249 people, 38.3%, respectively). The least commonly reported risk factor was smoking behavior (16 people, 2.5%).

Health Promotion Lifestyle Profile results

Tables 7 and 8 represented 774 responses to the Health Promoting Lifestyle Profile questionnaire. Participants who answered the questionnaire more than once within 3 months or more response interval (pre-post screening) were chosen (n = 28). We observed a 69.54 average total lifestyle profile score which can be interpreted that the majority of the sample group had low-level or poor health promotion behaviors. When we compared differences between pre and post Lifestyle Profile scores in each area and total scores, no statistically significant differences were found.

Table 7
Tests of normality for lifestyle profile scores (n = 28)

Lifestyle profile score	Kolmogorov–Smirnov ^a			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-LStyle	0.120	28	0.200*	0.974	28	0.698
Post-LStyle	0.151	28	0.200*	0.932	28	0.070

**This is a lower bound of the true significance. ^aLilliefors significance correction.*

Table 8
Lifestyle profile scores before and after the intervention (n = 28)

Lifestyle profile score	Pre-score (n = 28)		Post-score (n = 28)	
	Mean	S.D.	Mean	S.D.
Health responsibility	6.36	1.162	6.46	1.232
Physical activity	12.36	1.929	12.25	2.171
Nutrition	15.29	2.800	15.11	2.601
Interrelation	12.39	1.892	12.21	2.079
Spiritual growth	11.04	2.715	11.14	2.321
Stress management	12.11	2.558	12.07	2.071
Total score	69.54	10.348	69.25	10.875

Quality of Life results

From total 891 responses to the Quality of Life (QoL) questionnaire, those who answered the questionnaire more than one time with a more than 3-month interval (pre-post screening) were selected. As a result, we had a sample group of 44 people.

Table 9
Descriptive statistics of quality of Life scores (n = 44)

QoL domain	Min	Max	Mean	S.D.	Skewness		Kurtosis	
					Statistic	SE	Statistic	SE
Pre								
Physical	19	33	26.84	3.362	-0.406	0.357	-0.482	0.702
Mental	13	28	22.27	3.098	-0.410	0.357	0.414	0.702
Social relation	7	14	11.59	1.560	-0.697	0.357	0.500	0.702
Environment	21	34	27.68	3.934	0.052	0.357	-1.322	0.702
Overall	68	115	95.41	11.046	-0.542	0.357	-0.210	0.702
Post								
Physical	18	34	26.86	3.366	-0.708	0.357	0.305	0.702
Mental	14	28	22.16	3.497	-0.659	0.357	-0.371	0.702
Social relation	6	15	11.34	1.569	-0.675	0.357	2.135	0.702
Environment	16	35	27.89	4.194	-0.642	0.357	0.396	0.702
Overall	58	120	95.05	11.873	-0.861	0.357	1.166	0.702

Table 10
Comparison of pre- and post-quality of Life scores (n = 44)

Differences	Mean	S.D.	S.E.	95% Confidence interval of the difference		t	df	Sig. (2-tailed)
				Lower	Upper			
HR	-0.107	1.641	0.310	-0.743	0.529	-0.346	27	0.732
PA	0.107	2.558	0.483	-0.885	1.099	0.222	27	0.826
NT	0.179	4.056	0.766	-1.394	1.751	0.233	27	0.818
IR	0.179	2.722	0.514	-0.877	1.234	0.347	27	0.731
SG	-0.107	3.947	0.746	-1.638	1.423	-0.144	27	0.887
SM	0.036	3.372	0.637	-1.272	1.343	0.056	27	0.956
LStyle	0.286	15.384	2.907	-5.679	6.251	0.098	27	0.922

The results showed that the mean of pre and post overall QoL scores were 95.41 and 95.05, respectively, which means participants had a moderate quality of life (please see Table 9). There were no statistically

significant differences between pre and post overall QoL scores (please see Table 10).

Relationship between quality of life and health promotion behaviors

To analyze the relationship between QoL and health promotion behaviors, 418 of participants' responses to both lifestyle and QoL questionnaires more than one time were selected. The result suggested that the correlation between quality-of-life variables and health promoting behaviors was statistically significant at the $p < 0.001$ level with a Pearson correlation value of .358 (please see Table 11, 12 and Fig. 2).

Table 11
Tests of normality for QoL and health promoting behaviors (n = 418)

Variable	Kolmogorov–Smirnov ^a			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
QoL	0.065	418	< 0.001	0.978	418	< 0.001
Health promotion behaviors	0.036	418	0.200*	0.986	418	0.001

*This is a lower bound of the true significance. ^aLilliefors significance correction.

Table 12
Correlations between QoL and Health promotion behaviors scores

Variable	Statistic	QoL	Lifestyle
QoL	Pearson correlation	1	0.358**
	Sig. (2-tailed)	–	< 0.001
	Sum of squares and cross-products	65971.438	21836.641
	Covariance	158.205	52.366
	N	418	418
Health promotion behaviors	Pearson correlation	0.358**	1
	Sig. (2-tailed)	< 0.001	–
	Sum of squares and cross-products	21836.641	56428.622
	Covariance	52.366	135.320
	N	418	418

**Correlation is significant at the 0.01 level (two-tailed).

DISCUSSIONS

This study assessed health risks for non-communicable diseases (NCDs), quality of life (QoL), and health promotion behaviors among Chiang Mai University (CMU) personnel using e-Health Risk Assessment (CMU i-Health web-application). The findings highlight the dual challenges faced by working-age university employees: a relatively high prevalence of NCD risk factors combined with moderate levels of QoL and health-promoting behaviors. These results emphasize the need for integrated digital and organizational strategies to prevent and manage chronic disease risks within higher education institutions.

The results from 650 participants (453 females; 197 males) showed that the high-moderate health risk was the most prevalent risk category. The health risk group was comprised of the hypertension group, the cardiovascular disease (CVD) risk group, and the diabetes risk group. There were several risk factors for the development of non-communicable diseases (NCDs), including family history, medicine, food consumption, stress, exercise, smoking behavior, alcohol drinking behavior, body mass index (BMI), and excess waist-to-hip ratio. Dietary factors, followed by stress factors and waist-to-hip ratio, were the most frequently reported risk factors for the development of noncommunicable diseases (NCD) among 650 participants, whereas smoking behavior was the least frequently reported risk factor. These results are associated with a study by Al-Jawaldeh and Marwa in 2022 ^[19] which reported that, in the Eastern Mediterranean Region (EMR), the most prevalent nutrition-related NCDs risk factors included obesity, hypertension, high fasting plasma glucose, and increased intake of unhealthy diets. The NCDs share the same four modifiable behavioral risk factors: tobacco use, unhealthy diet, physical inactivity, and excessive alcohol consumption. These risk factors, in turn, lead to nutritional-physiological risk factors, such as overweight/obesity, high blood pressure, high fasting blood glucose, and high blood cholesterol. The relationship between NCDs and their related risk factors is complex, and the risk factors are also interconnected ^[19].

The health risk assessment revealed that nearly half of the participants fell into the moderate risk category, with hypertension, obesity (excess BMI and waist-to-hip ratio), and stress reported as leading risk factors. These findings are consistent with national data showing that NCDs remain the leading causes of morbidity and mortality in Thailand, with lifestyle-related risk factors contributing heavily to the disease burden ^[20]. The predominance of dietary issues, stress, and physical inactivity among CMU staff suggests that occupational demands and limited time for self-care may exacerbate unhealthy lifestyle patterns. This is in line with Al-Jawaldeh and Abbass ^[19], who found that poor diet, obesity, and physical inactivity remain major determinants of NCDs in the Eastern Mediterranean Region, and these factors are equally relevant in Thai university settings. Importantly, the web-based tool enabled early identification of such risks, reinforcing the utility of digital health systems for workplace health surveillance.

The analysis of QoL indicated that most participants reported moderate levels, with no statistically significant improvement across the follow-up period. This result points to a stagnation of perceived well-

being despite the availability of the CMU i-Health platform. Research on occupational health consistently demonstrates that work-related stress, heavy workload, and insufficient work-life balance are strongly associated with diminished QoL among university employees^[21]. Our findings resonate with those of Lee, Ko, and Lee^[20], who reported that exercise, blood pressure monitoring, and abstinence from alcohol were significant predictors of QoL among elderly Koreans. Although our study population was younger, the parallels suggest that regular engagement in health-promoting behaviors is necessary to translate risk awareness into improved life satisfaction and well-being.

According to the Health promotion behaviors results, based on the majority of the average total Health promotion behaviors scores, we determined that most of the sample group exhibited low-level or inadequate health promotion behaviors. We found no statistically significant differences between each area's pre-and post- Health promotion behaviors scores and the total scores. For Quality-of-Life results, we had a sample size of 44 individuals. There were no statistically significant differences between the pre-and post-QoL scores, indicating that the participant's quality of life was moderate. Regarding the relationship between quality of life and health promotion behaviors, the correlation between quality of life variables and health promoting behaviors was statistically significant at the $p < 0.001$.

In terms of health-promoting behaviors, the results showed that the majority of participants engaged at low to moderate levels, with little change over time. This finding highlights a gap between awareness of health risks and actual behavior modification. Alaeenejad et al.^[22] similarly observed that stress management and lifestyle practices were weak domains among middle-aged women, significantly influencing QoL. Pender's Health Promotion Model^[23] provides a useful lens here: it posits that behavioral change is influenced by perceived benefits, barriers, and self-efficacy. In the CMU context, while personnel had access to digital risk assessment tools, external barriers such as limited time, workload stress, and lack of institutional reinforcement may have prevented meaningful behavioral change. Thus, technology alone is insufficient without a supportive environment and targeted interventions.

The moderate but significant correlation between QoL and health promotion behaviors observed in this study reinforces the notion that lifestyle practices are essential determinants of well-being. This relationship echoes findings from diverse populations, including elderly cohorts^[24] and postmenopausal women^[22]. For CMU personnel, this suggests that promoting small, sustainable changes in behaviors—such as stress management techniques, regular exercise, and balanced nutrition—could yield improvements in overall QoL. Importantly, our results demonstrate that while digital systems can raise awareness and track progress, active engagement strategies are necessary to bridge the gap between knowledge and sustained behavioral change.

Our study relates with a study by Tae Wha Lee et al. of the elderly population in Korea. The relationship between health promotion behaviors and QoL among community-dwelling elderly Koreans was reported. The descriptive-correlational study explored the relationship between health promotion behaviors and quality of life among Korea's community-dwelling elderly. Korea's 32 senior and 242 public health centers

were used to select a convenience sample of 2,000 cognitively intact community members over 65. Following the exclusion of 80 incomplete questionnaires and subject refusals, a total of 1920 was included in the analyses. The results of the study revealed statistically significant differences in the quality of life (QoL) of the elderly regarding exercise, alcohol abstinence, and blood pressure (BP) monitoring ($p .05$). In addition, a multiple regression analysis revealed that perceived health status, number of chronic illnesses, activities of daily living, blood pressure screening, physical activity, and gender were statistically significant predictors of QoL for the entire regression model was 0.412, indicating that the linear combination of these variables accounted for approximately 41.2% of the variance in QoL [24].

Moreover, the study of Amine Alaeenejad et al. in postmenopausal women. Since postmenopausal women's health status and quality of life are the main challenges in several health fields. The previous reported a relationship between health promotion behaviors and postmenopausal women's quality of life. Results indicated that the average score for health promotion behaviors was at a moderate level. More than half of the participants had a high quality of life. The overall score for health promotion behaviors and quality of life was higher among married women, younger, in good economic standing, employed, and had earned a college degree. The Pearson correlation test revealed a significant inverse correlation ($P = 0.013$) between the quality of life and health promotion behaviors in the dimension of stress management. Therefore, educational programs are recommended as an efficient, cost-effective, and risk-free method for reducing menopause-related issues and enhancing the quality of life [22].

This study contributes to the knowledge regarding QoL. Health promotion behaviors become increasingly important as people live longer, particularly for preserving functional independence and enhancing life quality. To improve the quality of life as individuals and the health of the community, the nurses should promote health promotion behaviors through formal nursing interventions. In order to improve the quality of life, we should facilitate health promotion behaviors through formal nursing interventions that maintain and enhance a healthy and active lifestyle [24].

Considering the significance and necessity of health issues affecting CMU employees of working age, the working group recognizes the significance of developing and enhancing the potential of CMU personnel to contribute to the transformation of the university into a university of good health by analyzing academic and support staffs' health status and health promotion behaviors. As preliminary information on the development of health promotion activities and the capacity of personnel at CMU to take care of themselves to prevent the occurrence of chronic noncommunicable diseases that are common in working-aged people and to reduce the incidence of health problems such as age-related incapacity, this program increases the potential and effectiveness of CMU's workforce personnel and can appropriately prepare them for retirement [23].

A central contribution of this study lies in demonstrating the feasibility of deploying e-Health Risk Assessment for continuous health risk assessment and health promotion in a large university. The CMU i-Health web-application enabled personnel to self-monitor their risks for NCDs, assess their QoL, and

evaluate health behaviors, while also providing administrators with aggregate data for policy and program planning. Previous reviews of digital health applications suggest that such platforms are increasingly valuable for real-time health monitoring, individualized feedback, and data-driven decision-making [4, 5]. In organizational settings, these tools offer an efficient way to integrate personal health promotion with institutional health strategies. However, the absence of significant short-term improvements in behaviors and QoL in our study suggests that web-based monitoring should be paired with structured interventions, such as targeted health education, coaching, or group-based programs, to drive sustainable change.

From an institutional perspective, these findings have significant implications for CMU's aspiration to become a health-promoting university. A healthy workforce not only benefits individuals but also contributes to organizational productivity, reduced absenteeism, and improved retention [21]. Digital platforms such as CMU i-Health web-application can serve as a backbone for long-term monitoring, enabling administrators to identify priority areas, allocate resources effectively, and tailor interventions to the specific needs of staff. For example, given the high prevalence of stress and poor dietary habits, CMU may consider developing workplace wellness initiatives that incorporate stress reduction workshops, healthy food environments, and flexible scheduling to support work-life balance. Linking these activities to the i-Health platform would create a feedback loop between individual monitoring and organizational action. Despite its contributions, this study also highlights challenges. First, the reliance on self-reported data may have introduced bias, particularly in health promotion behaviors and QoL assessments. Second, the relatively short observation period may not have been sufficient to capture meaningful changes in health promotion behaviors or QoL, which often require long-term engagement. Third, while the web-application was accessible, engagement levels may vary depending on user motivation and digital literacy. Future studies should therefore explore strategies to increase sustained use of the platform, such as incorporating gamification, personalized reminders, or integration with wearable devices to enhance user experience and motivation.

CONCLUSIONS

This study underscores the importance of combining digital health technologies with comprehensive health promotion strategies in higher education settings. e-Health Risk Assessment, CMU i-Health web-application proved effective for assessing risks and providing institutional data, but the limited changes in health promotion behaviors and QoL highlight the need for multi-level interventions. A holistic approach linking individual empowerment, supportive work environments, and policy-level initiatives will be critical for reducing NCD risks, enhancing QoL, and fostering sustainable health promotion behaviors among CMU personnel. These insights contribute to the growing body of evidence supporting the role of digital health applications in advancing workplace health promotion, particularly in academic institutions transitioning toward health-promoting university models.

Incorporating health measurement and assessment systems is imperative, particularly for large organizations, as they serve as valuable tools for monitoring and identifying prevalent health issues

among employees. These systems help detect health problems resulting from the demands of the job. Hence, the implementation of this research project aims to assist universities and agencies in recognizing and monitoring health issues that may arise among personnel as a result of job-related factors. Thus, CMU personnel should be encouraged to practice appropriate health promotion behaviors in order to reduce risk factors and prevent the occurrence of non-communicable chronic diseases in the working-age population leading to wellness, good quality of life, and efficiency of work at university.

Declarations

i Ethical Approval and consent to participate.

The study protocol was approved by the Research Ethics Committee of the Institutional Review Board of the Faculty of Nursing and the Faculty of Medicine, Chiang Mai University, Thailand, Institutional Review Board No.111/2020 (date of approval: September 24, 2020; date of expiry: September 23, 2021, and Research ID:2020-054; Study Code:2020-EXP045), before the process of data collection began.

After approval was granted, the researchers informed the potential research subjects about the purpose of the research, its possible benefits, and the research process. Potential subjects were told that their participation was voluntary, that they had the right to choose whether to participate or not, and that their decision would not affect the treatment they were receiving in the hospital. They were given clear information, and they expressed their clear understanding and decision to participate before signing an informed consent form. The researchers considered each patient's confidentiality and reassured them the data from the research results would be presented as a whole, not broken down by each individual. The researchers were available to the participants if they had any further questions. All experiments were performed in accordance with relevant guidelines and regulations.

ii. Consent to Publication. - Not applicable

iii. Data Availability statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request. The statistics were checked prior to submission by an expert statistician and state their name and email address.

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request. The statistics were checked prior to submission by an expert statistician and state their name and email address.

Data available on request due to privacy/ethical restrictions: The data that support the findings of this study are available on request from the corresponding author, [Pungchompoo Wanicha: wanicha.p@cmu.ac.th]. The data are not publicly available due to [restrictions e.g. their containing information that could compromise the privacy of research participants].

Data generated at a central, large-scale facility, available upon request: Raw data were generated at [facility name]. Derived data supporting the findings of this study are available from the corresponding author [Pungchompoo Wanicha: wanicha.p@cmu.ac.th] on request.

Data available within the article or its supplementary materials: The authors confirm that the data supporting the findings of this study are available within the article.

Data available on request from the authors: The data that support the findings of this study are available from the corresponding author, [Pungchompoo Wanicha: wanicha.p@cmu.ac.th], upon reasonable request.

iv. Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, or publication of this study.

Author statement: The authors would like to confirm that:

1. The manuscript has not been published or submitted for publication elsewhere.
2. All authors approved the content of the manuscript and have contributed significantly to the research involved in the process of protocol development, data collection and analysis, discussion and writing for manuscript publication and process of manuscript's revision.
3. The protocol for the research project has been approved by the Research Ethics Committees of the Institutional Review Board of Faculty of Nursing (IRB) and,
4. by the Research Ethics Committees of the Institutional Review Board of the Faculty of Medicine, Chiang Mai University, Thailand.
5. All participants gave informed consent for the research, and that their anonymity was preserved according to the Declaration of Helsinki (as revised in Brazil 2013).
6. We declare not to have any financial support or relationships that may pose a conflict of interest by disclosing any financial arrangements they have with a company whose product figures prominently in the submitted manuscript or with a company making a competing product, or any conflict relating to technology or methodology.
7. This research was funded by the Office of Research Administration and Chiang Mai University, Thailand.
8. The researchers have received permission to use the instruments utilized in the study.

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Author contribution

W.P.¹, O.T.² and R.U.³ contributed to the concept and the design of the study, as well as provided supervision. O.T.² and W.P.¹ were also involved in the development of the web-application (CMU i-Health) design and development. O.T.², W.P.¹ and R.U.³ were involved with the data materials and data collection processing. W.P.¹, O.T.², P.C.⁴, P.K.⁵, and U.M.⁶ provided analysis and/or interpretation for the study. W.P.¹, P.C.⁴ and U.M.⁶ conducted the search of the literature. W.P.¹, O.T.², P.C.⁴ and P.K.⁵ wrote the manuscript, and W.P.¹ provided a critical review of the manuscript, revisions for important intellectual content, and other work. All authors read and approved of the final manuscript.

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Figures

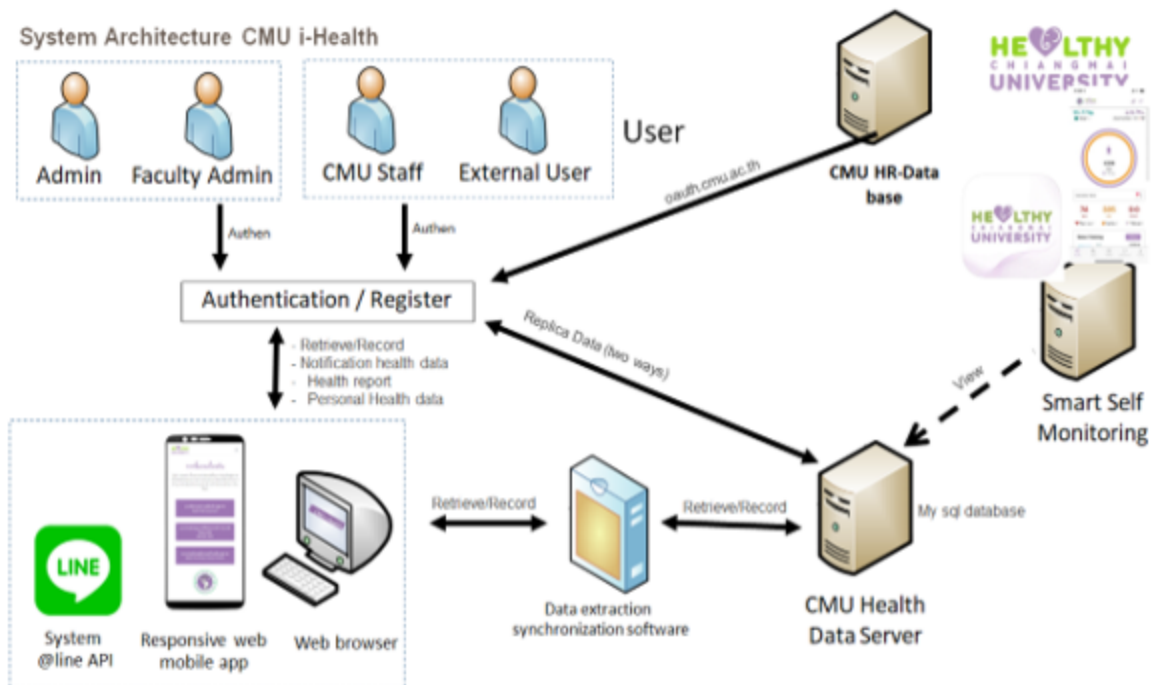


Figure 1

System Architecture of the e-Health Risk Assessment (CMU i-Health web-application)

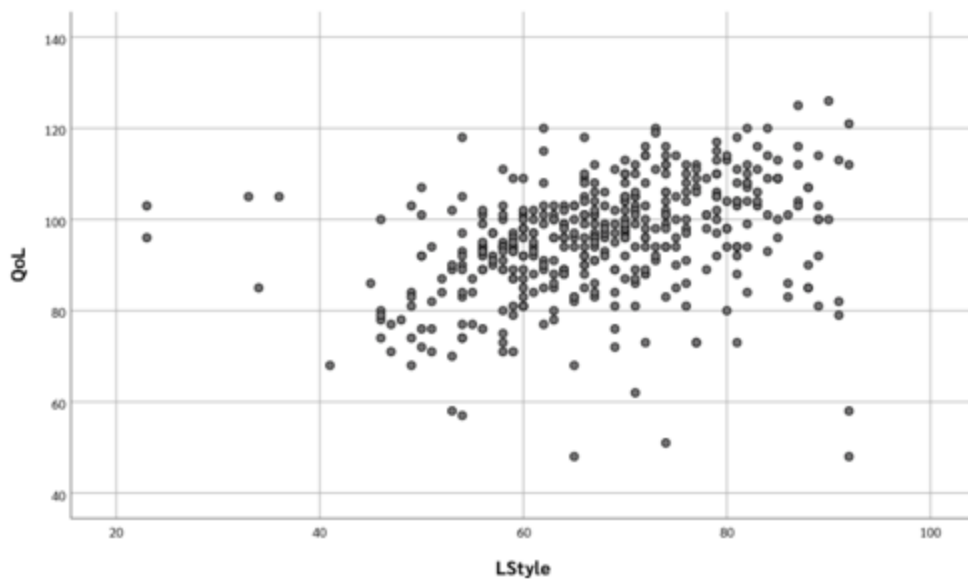


Figure 2

Correlation between QoL and Health promotion behaviors