Contents lists available at Science-Gate

International Journal of Advanced and Applied Sciences

Journal homepage: https://www.science-gate.com/IJAAS.html

# Determinants of elderly travelers' use of health-oriented tourism applications: Evidence from Thailand

Tassin Srivarapongse, Sarakul Sukortpromme, Chotima Jotikasthira *

*Faculty of Business Administration, Rajamangala University of Technology Thanyaburi, Pathum Thani, Thailand*

ARTICLE INFO

*Article history:*
Received 4 September 2025
Received in revised form
25 March 2026
Accepted 5 June 2026

*Keywords:*
Health tourism applications
Elderly travelers
Determinant factors
Application operability
Decision

ABSTRACT

This study investigates the factors that influence elderly travelers' decisions to use health-oriented tourism applications in Thailand. Data were collected from 400 elderly tourists in Bangkok and the central region using a structured questionnaire and analyzed with Partial Least Squares Structural Equation Modeling. The results show that key factors—namely tourist attractions, safety, connectivity with emergency and public health systems, health and first aid services, and weather—have both direct and indirect effects on the decision to use the application through application operability. Specifically, these factors directly influence the decision to use the application ($\beta = 0.458$, $p < 0.001$) and strongly affect application operability ($\beta = 0.889$, $p < 0.001$). In turn, application operability significantly influences the decision to use ($\beta = 0.368$, $p < 0.001$), indicating a meaningful mediating effect. To provide further practical insights, the study employs Importance–Performance Map Analysis, which identifies connectivity with emergency and public health systems and health and first aid services as the most important drivers of both application operability and user adoption. Application operability is also found to play a central role in translating these factors into actual usage behavior. The measurement model demonstrates acceptable reliability and validity, with Heterotrait–Monotrait ratios ranging from 0.775 to 0.888 and average variance extracted values between 0.597 and 0.735. Overall, the findings suggest that elderly travelers' adoption of health-oriented tourism applications depends not only on the availability of health and safety information but also, more importantly, on the quality and usability of the application, offering useful implications for developers, tourism managers, and policymakers.



## 1. Introduction

Worldwide, health tourism is considered one of the fastest-growing industries globally, and this trend will only continue since the baby boom generation continues to age. They want their travel experiences to be not only fun but also good for the body and mind. With abundant natural resources, traditional culture, and quality medical services to meet the demands of the international market at reasonable costs, Thailand is one of the leading health tourism destinations. Elderly tourists have a growing need for holistic healthcare, particularly in health-promoting activities like Thai massage, meditation, and food markets (Wuttithantawee and Taweepornpathomgul, 2015; Setsri, 2017; Simasathiansophon et al., 2020; Onputtha et al., 2025). One of the key activities is promoting long-term stays in Thailand by offering various health and wellness programs, such as yoga or specialized healthcare services. The long-stay tourism program actively supports these activities to attract this target group. Thailand is strong in these capabilities when it comes to available infrastructure and healthcare services, as well as the ability to develop an experience that relates to Thai culture in the international market. Information and health tourism technology have very high potential in the industry; however, it remains extremely difficult for service providers to develop, particularly for seniors who may struggle with using digital technology. Because of this, research on the factors that affect older people's decisions to use travel technology applications is crucial for travel service providers in developing different segments of applications based on their needs and the willingness among older

* Corresponding Author.
Email Address: chotima_j@rmutt.ac.th (C. Jotikasthira)
https://doi.org/10.21833/ijaas.2026.06.006
Corresponding author's ORCID profile:
https://orcid.org/0009-0005-0800-4086

adults to participate in using technology or not as they render a complete travel experience (Aphisavadh, 2024).

Regarding the use of travel applications, factors that influence older tourists' decision-making are multidimensional, and security is a major factor they value most when traveling. Using applications that are connected to emergency health service systems, such as an emergency phone number, hospital site plan, and emergency assistance services, can also enhance travel safety by increasing elderly people's trust to do extra activities in terms of travel growth and unfamiliar locations (Strange et al., 1992; Agarwal et al., 2015).

On the other hand, having health information available can reduce pre-travel anxiety and increase confidence in the amount of knowledge about anything from first-aid advice to managing chronic diseases during travel, e.g., hypertension or diabetes, that may enable elderly travelers to feel more prepared (Schindler, 2005; Leitner, 1999; Qiao et al., 2022). Apart from safety and health, weather data also contributes to travel planning, especially where senior citizens are concerned, as they cannot tolerate harsh climates. By providing this target group with comprehensive information, including, for example, about the local air quality, weather forecasts, or recommendations on how to deal with the effects of health-relevant weather situations before and during travel, they can react and plan their trip more efficiently. Additionally, another critical issue is the existence of visitor attractions and places to visit with adequate information in terms of reasonable prices, proximity to good distances, and health-appropriate activities that are affordable for the seniors, especially some activities that suit their health needs, like a fatigue-free trip or active recreation (Bauer, 2012; Setsri, 2017; Nimrod, 2012). Hence, the applications that satisfy these requirements can aid in making travel for elderly tourists more secure and better.

Nevertheless, the practical features of the application can successfully enhance the main determinants of use by elderly tourists. Applications may prove to immensely increase the confidence level of users when they can smartly integrate and display health information, navigate trips, inform of emergency services, and other functions, like associating with emergency service systems to trigger alerts and provide necessary information during the emergency, or features designed for specific targeted users, i.e., customizing menus or changing language settings (Nejati et al., 2016; Tajudeen et al., 2022).

Agency features, such as providing real-time health information, for instance, air quality status monthly reports, or the warning of health hazards in certain tourist sites, for personal user customization, are perceived to be an effective means to increase satisfaction and trust in the system among the elderly, who are reluctant at different stages to travel due to lack of confidence (Paiva et al., 2020; Liu et al., 2021). Furthermore, the user interface and user experience design that enable screen compatibility with smartphones, tablets, and other types of multiple-use digital devices are essential too, as they will add extra comfort and availability, making the application universal in use. This can reduce complexity in the steps in use, for example, by only filling out necessary information or designing large buttons to press. It also improves user experience and makes apps more accessible and efficient for seniors (Wildenbos et al., 2019; Kim et al., 2024).

Likewise, in a specific sense, the use of personalized applications, like individual-specific reminders about flight schedules or giving different health information depending on the situation, can promote service efficiency and guarantee application quality. In an age where digital technology is increasingly important in our daily lives, it is essential to improve and integrate travel applications to better meet the needs of elderly users.

A significant gap in the research context of travel application usage for older tourists is the lack of in-depth understanding of the mechanisms through which determinants influence application usage decisions, particularly through system operational capabilities. Although previous research has provided preliminary information on determinants, such as safety. While the literature has begun to consider substantive determinants, specifically safety, convenience, and the integration of application features, as well as the influence of digital technology on user experience (Nejati et al., 2016; Tajudeen et al., 2022), a broader connectivity within these factors for generating a complete picture that can be used toward building systems with proficient training compatibility to fulfill end-users' requirements has yet to receive attention. This study corrects this tendency by demonstrating the need to examine the interaction of factors at play in a structural sense, rather than in individual terms; for example, how design characteristics and specific features relate together to cause discrimination or breakdown.

Additionally, senior tourists in Thailand have their own unique traits that help differentiate them from other tourist groups when it comes to health requirements, travel risk perception, and experience using technology. Today, more studies are encouraged to demonstrate how the factors combine to safely lead to user confidence. Reducing anxiety or real-time health data integration alleviates stress, while a delightfully fun user interface improves satisfaction. Consequently, this is of the utmost importance (Paiva et al., 2020; Liu et al., 2021; Wildenbos et al., 2019). Specifically, research on the structure of this dimension can identify in what way it influences the decision to use (directly or indirectly), and which factors affect users; it should be used for both the development of applications that are more efficient, and at the same time, it will help those older tourists of Thailand that are engaged in health tourism (Kim et al., 2024). This

study is theoretically grounded in the unified theory of acceptance and use of technology (UTAUT), which develops the idea that technology adoption can be explained by performance expectancy, effort expectancy, facilitating conditions, and behavioral intention, specifically from older users, as their adoption intention is shaped by perceived usefulness, usability, and risk-related concerns (Momani, 2020). The proposed determinants (tourist attractions, safety, emergency connectivity, health and first aid, and weather) are in line with fundamental performance expectancy factors contributing to the UTAUT construct and facilitating conditions, while application operability reflects effort expectancy and system usability in a healthy tourism context. Such theoretical grounding can offer a consistent explanation for how elderly travelers adopt technology in the context of health tourism.

Given the importance of determinants influencing the decision to use health tourism applications among elderly tourists and the related educational gaps, the researcher focused on the study titled "Determinants of elderly travelers' use of health-oriented tourism applications: Evidence from Thailand." This work will develop an understanding of the mechanisms and relationships of determinants of applications usage based on the specifics of older tourists in Thailand. As safety and accessibility of the required health information and a perception of ease of use are of high relevance among the target group, the results of this study will assist developers integrating features with usage patterns more adequate to the group's needs. Furthermore, the study is also crucial for the understanding of the role of technology specifically in the currently developing health tourism market in Thailand to ensure older tourists become more confident and satisfied, promoting the sustainability of the strategic sector in the future. Therefore, the study can have both academic and practical value, contributing to increasing success in the health tourism business in Thailand.

## 2. Literature review

### 2.1. Determinant factors of elderly health tourism

Consistent with UTAUT, performance expectancy and facilitating conditions are central drivers of technology adoption among elderly users (Momani, 2020). In health tourism contexts, these drivers are operationalized through destination attributes, safety provisions, emergency support, health services, and environmental conditions, which collectively influence perceived usefulness and adoption intention. Elderly health tourism has gained significant worldwide attention, with Thailand emerging as a key destination due to its natural resources, distinctive culture, and quality yet affordable health services. Results from Setsri's (2017) study revealed that the most frequently visited health promotion activities among older people are Thai massage, meditation, and healthy dining, while Wuttithantawee and Taweepornpathomgul (2015) identified the long-stay tourism project as a successful tool for boosting recreational activity, which contributes to improved health standards and quality of life. For more efficient communication, business health tourism presents comprehensive marketing approaches. For example, modern elderly health tourism heavily relies upon technology at various service access levels—for booking tour packages, accessing tourist information, and connecting with service providers. Other advanced applications include elderly health monitoring during travel and AI systems that allow service providers to provide tailored services to a particular tourist (Aphisavadh, 2024). There are five key drivers influencing the health tourism and technology adoption decisions of the elderly. As a result of this complex set of needs, tourist attractions need to offer rounded information, economic pricing, decent accessibility, nearby facilities, and parking, all in one single text with clear pathways to reach them. Health needs can be served by health alert services that help to reduce the anxiety of elderly people (Adami et al., 2021).

Similarly, safety is also implied by the deployment of emergency preparedness information and accident risk assessment together with evacuation planning and an appropriate supply of personal safety tools for patients in need (NFPA, 1979; Bell et al., 2021). Emergency telephone numbers, personal alert devices, and health facility information close to a tourist attraction should be in the hands of elderly travelers for easy accessibility and connectivity with emergency services and public health systems (Strange et al., 1992; Crane et al., 2010), as randomly losing one's way during a trip can be disabling if not fatal. Attractions should be located near accredited hospitals so tourists can have confidence when visiting these places. The health and first-aid factors may include the provision of holistic health advice; a management plan for chronic disease; guidance on suitable physical activities; stress strategies to manage anxiety or panic attacks; dietetic control to regulate food intolerances/allergies with menu-appropriate choices at meals regardless of preparation by self, parent, or caterer; and simply first-aid training, which can help increase safety confidence (Bauer, 2012; Patterson et al., 2021).

Larriva and Higueras (2020), Bunker et al. (2016), and Schneider and Mücke (2024) suggested providing current temperatures, air quality data, and weather change predictions, as well as behavioral recommendations for elderly tourists to adapt safely to varying environmental conditions. All these integrated factors contribute not only to an enriched travel experience, but also to the increase in health and well-being through tourism activities, also promoted in this way, requiring a holistic mobile application to offer comprehensive amounts of

information that assist elderly health tourists in making informed choices.

### 2.2. Application operability

Effort expectancy and system quality, key constructs of UTAUT, emphasize the importance of usability and operational reliability in shaping technology acceptance (Momani, 2020). Application operability, therefore represents the functional mechanism through which elderly users evaluate ease of use and trustworthiness of health tourism applications. As the elderly health tourism application works, its operational capability is also an important part of the user experience by being implemented effectively and safely. This is because the elderly need to trust information and services, especially health information or accurate and precise information on health.

The research of Paiva et al. (2020), Liu et al. (2021), and Nappi and Kelly (2021) emphasized the fundamental need to create a system that can deliver practical, understandable recommendations relevant to both the specific singular audience and the wide audience. Furthermore, speed and accuracy in processing data are key to preventing user anxiety stemming from inconvenient applications. This is consistent with the finding of Androutsou et al. (2020) that an adequate response improves user satisfaction and trust. Moreover, the amount of health and travel data can be more comprehensive and diverse to help make the right decision, which is supported well in selecting suitable places for activities that match physical condition management and appropriate needs if performed. The research of Tajudeen et al. (2022) showed that applications meeting these requirements increased both user efficiency and overall user experience. Of course, data security and the prevention of data theft are also must-have features of health-tourism applications. The research by Nejati et al. (2016) is even better for senior citizens, who are concerned about where their personal data is shared and how it should be kept safe. Also, to accommodate multi-device use, such as for smartphones and tablets, it can be done to increase convenience and improve access to services (Kim et al. 2024; Morey et al. 2019).

According to Segun-Falade et al. (2024), one of the needs of these applications is that they should be able to run on multiple devices efficiently, which will reduce development time and give users more flexibility. Also, reducing confusion for the elderly is addressed by Paiva et al. (2020), whose research found that displaying content in the format and size expected on each device fits well and reduces difficulties with reading content, such as fonts. Simultaneously, designing applications that are simple and easy to use will help enhance satisfaction among the elderly who may not be so familiar with technology. The work of Wildenbos et al. (2019), Tajudeen et al. (2022), and Gronphet and Onputtha (2025) indicated that if the application is designed considering the real needs of older users, it can optimally enhance the user experience and reduce suspicions in its use.

### 2.3. Decision to use the tourism application

Behavioral intention, the core outcome variable in UTAUT, corresponds to elderly tourists' decision to use tourism applications, reflecting their overall evaluation of usefulness, usability, and perceived support in managing travel and health-related activities (Momani, 2020). The decision to use tourism applications among elderly tourists is influenced by multiple interconnected factors that collectively determine adoption and usage patterns. Perceived safety is especially an important basis for application acceptance, since older users may be concerned about the security of personal information; therefore, privacy and transparent usage policies are essential measures to create trust (Balapour et al., 2020; Klaver et al., 2021). The disclosure of personal health information is a major factor that determines whether an application will be accepted or not, because only users who are willing to provide personal and sensitive data enable applications to provide more personalized services (Kim and Choi, 2019).

One of the important determinants is perceived usefulness, which means aged tourists who perceive that this application would enhance their health management and travel planning are more inclined to adopt the technology (Ko et al., 2016; Park et al., 2012). Secondary factors, such as family help, professional advice, and user experience, lower technology anxiety and support confidence in adoption. The feature development in successful application planning must consider the specific needs and restrictions, such as visual impairment and mobility, of the elderly user (Chu and Chu, 2013).

Emergency alert systems, medical facility maps, and real-time health monitoring will contribute greatly to a user who has increased confidence that the overall safety of those in care is handled at an opportune instance (Roberto et al., 2001). The design of applications is critical, considering that many elderly individuals have some limitations in their age (Sak et al., 2017; Green et al., 1983), and it simplifies the interface and increases text size for improved accessibility. Benefits perceived as direct, such as increased travel convenience and risk mitigation, play a role in the promise of technological solutions for elderly users. Other motivational factors, which have been emphasized in recent research, include cognitive factors and expectations about the positive consequences of usage in terms of safety benefits, increased confidence in safety, and fewer concerns from family for unaccompanied travel (Roberto et al., 2001). To conclude, for effective tourism application adoption and use by older adults, a multi-dimensional approach to safety issues, usability, willingness of information sharing, and support seems necessary because none of these

elements alone is appropriate to explain implementation success and sustained usage.

### 2.4. Conceptual framework and hypothesis development

Factors that influence the decision to use travel apps by older adults include safety, connection to emergency services, health and first aid information, weather information, and user-centered application design. The elderly are particularly concerned with convenience, reliability, and safety. Research by Balapour et al. (2020) and Klaver et al. (2021) indicated perceived safety and privacy, however, greatly increased users' trust in an application. Furthermore, Sak et al. (2017) and Green et al. (1983) found that usage will increase if the technology itself is user-friendly or is easy to learn and use, and meets the specific needs of elderly people. Other studies point out that older tourists favor destinations with health activities (massage, meditation) and programs devoted to the promotion of mental and physical health; according to Leitner (1999), these activities can be a great contribution for the elderly to get motivated to use health travel apps.

When combining all these factors, there is value in an application that meets the full needs of people who are looking for solutions around their travels and explorations, especially if one were able to get information through an application about such things as safety enroute or availability of emergency services pre-departure and with functions targeted for ease of use by the elderly. Not only that, but it also makes the application more interesting and cultivates a sense of confidence in traveling among the elderly group. Drawing on UTAUT (Momani, 2020), this study conceptualizes determinant factors as performance and facilitating conditions that influence behavioral intention both directly and indirectly through application operability, which captures effort expectancy and system usability. Therefore, the hypothesis is written as:

**H1:** Determinant factors influence the decision to use the tourism application.

The efficient operation of a travel application is influenced by several factors. Integration of safety measures, health tracking abilities, and emergency services provides key benefits to the end user, making the application more efficient as well as reliable. According to research by Paiva et al. (2020) and Liu et al. (2021), providing the right health information and custom recommendations will ultimately increase the effectiveness of the application and, additionally, earn the trust of users. Integration with healthcare and emergency services, including notifications/alerts or sharing the location of hospitals/trauma centers, as reported by Strange et al. (1992) and Dwyer et al. (2015), allows the application to react in time to critical situations. The management of weather updates is another factor to note which may include advance warnings of weather that could interfere with users' travel or health in line with the findings by Bauer (2012) and Schneider and Mücke (2024). According to Bastani et al. (2025), this also has implications for user trust, particularly with populations for which safety and security need to be robust features, especially the elderly or those who have specific health conditions. In combining these features, the application has a good operational base to work on. It leads to trust among users and contributes to sustainable use by responding adequately and responsibly to both the needs of individuals and the needs arising through situations in question. Therefore, the hypothesis is written as:

**H2:** Determinant factors influence application operability.

Application functionality is a significant factor that can play an important role in the decision-making process of using an application. It should add features of high usability by the users; for example, emergency alerts and real-time health information are needed to build trust and usefulness. Research by Androutsou et al. (2020) and Nejati et al. (2016) indicated that the ability of an application to respond quickly and accurately not only increases user satisfaction but also significantly reduces concerns about system security and reliability. These features are important tools that help users feel confident and ready to rely on the application in a timely manner. Moreover, a design that supports personalization of information for each user, like recommendations or adapted information to fit an individual's needs, also contributes positively to building a relationship between users and applications.

Kim et al. (2024) and Morey et al. (2019) stated that the customization functions enhance the user experience and keep application users engaged over time. When users feel that using an application is part of their daily life, their confidence and satisfaction will increase continuously, leading to a sustainable decision to use the application. Overall, good application functionality, including fast response, customizable features, and effective notifications, is a key factor that helps promote long-term user trust, satisfaction, and application selection. Therefore, the hypothesis is written as:

**H3:** Application operability influences the decision to use the tourism application.

The relationship between determinants and application usage decisions is significantly influenced by the operational capabilities of the application that mediate determinants such as safety, health tracking, and weather information, which significantly influence usage decisions. Safety-focused features, such as emergency alerts or links to healthcare services, help users feel more confident, especially among older adults who place particular

importance on safety. Similarly, health tracking and personalized recommendations are important features that help users meet their individual needs. Research by Nejati et al. (2016) and Tajudeen et al. (2022) indicated that designing an application that meets and is consistent with user behavior not only increases satisfaction but also promotes long-term usage decisions.

Moreover, offering weather information makes the application more appealing to users, significantly diminishing their apprehension and facilitating their perception that it is a suitable app. Providing push notifications about possible adverse weather conditions coming in advance of travel or some suggestions according to the prevailing weather at any given moment increases comfort as well. Operational factors such as data accuracy, key performance indicators, timeliness, and usability act as a bridge to directly influence the application usage decision for some of the stakeholders, with a nexus when it comes to reliability and safety, particularly the aging populations. Proper integration of these features into the application will convince users that the system is trustworthy, which will foster continued long-term adoption in the market. Therefore, the hypothesis states:

**H4:** Determinant factors influence decisions to use the tourism application through application operability.

## 3. Research methodology

This research takes a quantitative approach to studying elderly tourists aged 60 years and over who travel for health tourism. The target population of the study comprised elderly tourists in Bangkok and the central region, namely Bangkok, Ratchaburi, Nakhon Pathom, Phetchaburi, and Prachuap Khiri Khan. The sample group was set at 400 people, which is consistent with the recommendations of Yuan et al. (2000) and Savalei and Bentler (2005), who stated that the use of structural equation statistics requires a sample size of not less than 400 people. Furthermore, the areas chosen for this study are tourist locations that offer a wide range of activities conducive to older adults, like natural relaxation areas, spas, and treatment-oriented health centers. Related provinces are these 3 regions that are not far away, including Ratchaburi, Phetchaburi, and Prachuap Khiri Khan, which have good natural features, and quiet places can provide relaxation and peace for mental health and other physical problems of elders.

The study used convenience sampling as a method to quickly access the target group and collect data. The areas and samples selected were the result of careful thinking by the researcher, while designing the study, to be enough for meeting this research objective. The tool used for data collection was a questionnaire, which was divided into 4 parts: 1) personal information such as gender, age, education level, career before retirement, and savings after retirement; 2) determinant factors including tourist attraction, safety, connectivity with emergency services/public health systems, health and first aid, and weather; 3) application operability; and 4) decision to use the tourism application using a 5-point Likert scale ranging from 1 (least agree) to 5 (extremely agree).

The measures used in this study came from various sources. For the study of determinant factors in the context of health tourism for the elderly, various dimensions were measured, such as tourist attraction, safety, connectivity with emergency services/public health systems, health and first aid, and weather. The variable “tourist attraction” was measured by general information about the tourist attraction, prices related to the tourist attraction, distance to the tourist attraction, travel time, nearby souvenir shops, nearby accommodations, nearby parking areas, interesting activities, and tourist attraction contact information. Example sentences used were “The application must be able to display general information about the tourist attraction with pictures,” or “The application must be able to display various prices related to the tourist attraction,” or “The application must be able to display the distance to the tourist attraction.” The variable “safety” was measured by information on prepared safety equipment, accident risk level, and emergency evacuation route maps. Example sentences used were “The application must be able to display information on safety equipment provided by the tourist attraction for elderly tourists,” or “The application must be able to display information on safety equipment that elderly tourists must prepare before traveling,” or “The application must be able to display information on the risk level of accidents that may occur to elderly tourists.” The variable “connectivity with emergency services/public health systems” was measured by emergency telephone numbers of hospitals, emergency alert systems, hospital information links, emergency public health services, nearby hospital locations, emergency service details, and hospital quality certification. Example sentences included “The application must be able to display information such as emergency phone numbers or hospital call numbers,” or “The application must have an emergency/accident alert system,” or “The application must have a link to standard hospital information.”

The variable “health and first aid” was measured by systematic health care advice, appropriate exercise advice, stress management advice, chronic disease information and prevention, travel health advice, dietary control advice at tourist attractions, and basic first aid advice. Example sentences included “The application must have systematic health care advice,” or “The application must have appropriate exercise advice,” or “The application must have stress management advice.” Finally, the variable “weather” was measured by current and forecasted temperature information, current weather information, air quality pollution information, weather changes during travel, and

advice on how to behave according to the weather. Example sentences included "The application must be able to display information about the current temperature and the forecast for the next day," or "The application must be able to display information about the current weather conditions, such as rain, cloudy or sunny, strong wind, etc.," or "The application must be able to display information about air quality, such as air pollution levels."

Meanwhile, the variable "application operability" was measured by displaying accurate, complete, and diverse information; processing quickly without delay; security to prevent data theft; supporting various devices; displaying appropriate sizes and formats; and being easy to use and not complicated. Example sentences used in the study were "The application must be able to display accurately," or "The application must be able to process quickly without delay" or "The application must be able to display complete and diverse information necessary for users." Finally, the variable "decision to use the tourism application" was measured by the feeling of using the application for safety, the willingness to use the application for safety, planning to use the application for safety, and deciding to use the application for safety. Example sentences used were "You have a feeling that you will use the tourism application to facilitate the safety of the elderly," or "You are willing to use the tourism application to facilitate the safety of the elderly," or "You plan to use the tourism application to facilitate the safety of the elderly," etc.

The assessment of the reliability and validity of the measurement instruments in this research used convergent validity and discriminant validity testing methods to ensure that the dimensions used in the measurement can be clearly distinguished and indicated by each other. The convergent validity test uses the average variance extracted (AVE) and the composite reliability coefficient (CR), with the criteria that the AVE value should be no lower than 0.50 and the CR should be higher than 0.70 to confirm that each dimension can explain the variable of interest appropriately. Meanwhile, the discriminant validity test uses the Heterotrait-Monotrait Ratio (HTMT) criterion, which states that the HTMT should be lower than the 0.85 to 0.90 criterion. In addition, data analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM) helps to study the complex relationships between determinant factors, application operability, and the decision to use the tourism application (Hair et al., 2011; Kline, 2023). After the structural model was estimated, an importance–performance map analysis was conducted to provide a complementary interpretation of the results. This analysis simultaneously considers each construct's total effect on the target construct (importance) and its average latent variable score (performance), allowing the identification of areas where improvements may yield the greatest practical gains. The analysis was performed for application operability and for the decision to use the tourism application by decomposing the second-order determinant factors into their first-order dimensions.

## 4. Results

### 4.1. Profile of respondents

From Table 1, it was found that most respondents were female (67.00%), while only 33.00% were male. The largest age group was 60-69 years old (87.50%), followed by 70-79 years old (9.25%) and 80 years old and above (3.25%). In terms of education level, most respondents had less than a bachelor's degree (82.00%), while only 15.50% had a bachelor's degree, and only 2.50% had a higher degree. For pre-retirement occupations, the most common occupations were private company employees (39.50%), followed by civil servants (20.50%), and registered business owners (17.50%). In terms of post-retirement finances, it was found that respondents with savings between 500,000 and 1,000,000 baht (36.25%) dominated, and only 11.25% had savings of more than 1,000,000 baht. These data reflect the social and economic characteristics of the elderly tourist group. Most of them have an educational level lower than a bachelor's degree and are in the post-retirement age, where they are still healthy and able to travel.

### 4.2. Descriptive statistics and measurement validation

In the descriptive analysis of the three groups of variables, consisting of determinant factors, application operability, and the decision to use the tourism application, the researcher used the mean, standard deviation (S.D.), CV, kurtosis, and skewness. In addition, in the model development, the researcher assessed the reliability of the analytical variables by considering various indices, such as Loading and t-value, which indicate the relationship between the observed variables and the latent variables, rho_c (CR) and rho_a (Reliability of Average Variance Extracted) measured the internal consistency of the variables, AVE reflected the amount of variance in the variables explained by the latent variables, and α (Cronbach's Alpha), which is a measure of reliability in terms of consistency within the groups of variables of the first-order and second-order confirmatory factor analysis. These are shown in Tables 2 and 3. In addition, the discriminant validity was assessed separately. Discriminant validity uses the HTMT criterion, which states that HTMT should be lower than the 0.85 to 0.90 criterion, as shown in Table 4.

From Table 2, it was found that the various components affecting the use of the travel application had a mean value between 4.112 and 4.285, reflecting a high level of opinion. The S.D. was between 0.802 and 0.902, indicating a low level of data dispersion. The CV had a minimum value of

0.188 and a maximum value of 0.218, reflecting the consistency of the questionnaire responses. The kurtosis and skewness values were not high, indicating a relatively symmetrical data distribution. In addition, in terms of loading values and t-values, all indicators had loading values between 0.787 and 0.875 and t-values between 28.948 and 62.633, all of which were statistically significant.

**Table 1:** Respondents' profile

| Profile | Person (s) | % | Profile | Person (s) | % |
|---|---|---|---|---|---|
| Gender | | | Occupation before retirement | | |
| Male | 132 | 33.00 | Civil servant | 82 | 20.50 |
| Female | 268 | 67.00 | State enterprise employee | 47 | 11.75 |
| Age | | | Private company employee | 158 | 39.50 |
| Age 60-69 | 350 | 87.50 | Business owner (registered) | 70 | 17.50 |
| Age 70-79 | 37 | 9.25 | Freelance | 43 | 10.75 |
| Age 80+ | 13 | 3.25 | Saving after retirement | | |
| Education level | | | Less than 500,000 baht | 30 | 7.50 |
| Lower than a bachelor's degree | 328 | 82.00 | 500,000 – 1,000,000 baht | 145 | 36.25 |
| Bachelor's degree | 62 | 15.50 | More than 1,000,000 baht | 45 | 11.25 |
| Higher than a bachelor's degree | 10 | 2.50 | | | |

**Table 2:** Descriptive statistics, loading, and t-value of first-order confirmatory factor analysis

| Measure | Mean | S.D. | CV | Kur | Skew | Loading | t-value | rho_c | rho_a | AVE | α |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOUR1 | 4.235 | 0.812 | 0.192 | 1.024 | -0.989 | 0.810 | 37.936 | | | | |
| TOUR2 | 4.173 | 0.823 | 0.197 | 0.014 | -0.735 | 0.804 | 36.676 | | | | |
| TOUR3 | 4.255 | 0.803 | 0.189 | 0.185 | -0.843 | 0.789 | 35.305 | | | | |
| TOUR4 | 4.185 | 0.872 | 0.208 | 0.521 | -0.936 | 0.787 | 31.863 | | | | |
| TOUR5 | 4.152 | 0.897 | 0.216 | 0.087 | -0.848 | 0.790 | 33.884 | 0.944 | 0.933 | 0.651 | 0.933 |
| TOUR6 | 4.175 | 0.880 | 0.211 | 0.320 | -0.879 | 0.840 | 45.169 | | | | |
| TOUR7 | 4.138 | 0.902 | 0.218 | 0.284 | -0.849 | 0.810 | 39.272 | | | | |
| TOUR8 | 4.160 | 0.827 | 0.199 | 0.408 | -0.811 | 0.811 | 38.963 | | | | |
| TOUR9 | 4.195 | 0.835 | 0.199 | 0.522 | -0.897 | 0.821 | 40.183 | | | | |
| SAFE1 | 4.220 | 0.823 | 0.195 | 0.397 | -0.861 | 0.863 | 48.879 | | | | |
| SAFE2 | 4.185 | 0.840 | 0.201 | 0.626 | -0.894 | 0.862 | 52.693 | 0.917 | 0.880 | 0.735 | 0.879 |
| SAFE3 | 4.207 | 0.836 | 0.199 | 0.761 | -0.947 | 0.867 | 50.354 | | | | |
| SAFE4 | 4.188 | 0.864 | 0.206 | 0.630 | -0.955 | 0.836 | 41.783 | | | | |
| EMER1 | 4.285 | 0.805 | 0.188 | 0.038 | -0.851 | 0.823 | 39.015 | | | | |
| EMER2 | 4.220 | 0.861 | 0.204 | 0.725 | -1.006 | 0.833 | 44.425 | | | | |
| EMER3 | 4.255 | 0.815 | 0.192 | 1.163 | -1.056 | 0.855 | 49.748 | | | | |
| EMER4 | 4.205 | 0.835 | 0.199 | 0.727 | -0.969 | 0.782 | 28.948 | 0.938 | 0.924 | 0.685 | 0.923 |
| EMER5 | 4.210 | 0.867 | 0.206 | 0.201 | -0.883 | 0.848 | 54.594 | | | | |
| EMER6 | 4.168 | 0.866 | 0.208 | 0.141 | -0.818 | 0.831 | 41.877 | | | | |
| EMER7 | 4.235 | 0.824 | 0.195 | 0.102 | -0.837 | 0.821 | 40.953 | | | | |
| AID1 | 4.202 | 0.822 | 0.196 | 0.339 | -0.824 | 0.831 | 43.189 | | | | |
| AID2 | 4.157 | 0.841 | 0.202 | 0.312 | -0.811 | 0.805 | 33.703 | | | | |
| AID3 | 4.188 | 0.841 | 0.201 | -0.038 | -0.771 | 0.800 | 41.919 | | | | |
| AID4 | 4.218 | 0.828 | 0.196 | 0.513 | -0.902 | 0.829 | 44.313 | 0.933 | 0.917 | 0.664 | 0.916 |
| AID5 | 4.183 | 0.857 | 0.205 | 0.558 | -0.910 | 0.837 | 42.573 | | | | |
| AID6 | 4.207 | 0.842 | 0.200 | 0.183 | -0.862 | 0.782 | 32.007 | | | | |
| AID7 | 4.223 | 0.856 | 0.203 | 1.080 | -1.068 | 0.820 | 37.186 | | | | |
| WEAT1 | 4.215 | 0.802 | 0.190 | 0.026 | -0.787 | 0.826 | 32.967 | | | | |
| WEAT2 | 4.188 | 0.853 | 0.204 | 0.119 | -0.806 | 0.817 | 33.538 | | | | |
| WEAT3 | 4.230 | 0.844 | 0.200 | 0.922 | -1.033 | 0.856 | 52.782 | 0.926 | 0.900 | 0.715 | 0.900 |
| WEAT4 | 4.133 | 0.872 | 0.211 | 0.272 | -0.806 | 0.852 | 53.486 | | | | |
| WEAT5 | 4.185 | 0.858 | 0.205 | 0.479 | -0.890 | 0.875 | 59.625 | | | | |
| OPER1 | 4.197 | 0.811 | 0.193 | -0.117 | -0.743 | 0.848 | 48.651 | | | | |
| OPER2 | 4.223 | 0.814 | 0.193 | -0.169 | -0.764 | 0.824 | 39.605 | | | | |
| OPER3 | 4.197 | 0.851 | 0.203 | -0.102 | -0.781 | 0.848 | 49.584 | | | | |
| OPER4 | 4.235 | 0.863 | 0.204 | 0.440 | -0.942 | 0.847 | 46.530 | 0.946 | 0.934 | 0.716 | 0.934 |
| OPER5 | 4.197 | 0.888 | 0.212 | 0.044 | -0.892 | 0.832 | 44.279 | | | | |
| OPER6 | 4.192 | 0.834 | 0.199 | 0.176 | -0.790 | 0.855 | 49.358 | | | | |
| OPER7 | 4.265 | 0.845 | 0.198 | 0.660 | -1.033 | 0.869 | 55.051 | | | | |
| DECI1 | 4.207 | 0.827 | 0.197 | 0.575 | -0.908 | 0.844 | 41.998 | | | | |
| DECI2 | 4.160 | 0.845 | 0.203 | -0.160 | -0.710 | 0.872 | 57.114 | 0.919 | 0.882 | 0.738 | 0.882 |
| DECI3 | 4.112 | 0.877 | 0.213 | -0.022 | -0.734 | 0.846 | 43.313 | | | | |
| DECI4 | 4.122 | 0.887 | 0.215 | 0.186 | -0.803 | 0.874 | 62.633 | | | | |

TOUR1-9: Tourist attraction; SAFE1-4: Safety; EMER1-7: Connectivity with emergency services/public health systems; AID1-7: Health and first aid; WEAT1-5: Weather; OPER1-7: Application operability; DECI1-4: Decision to use the tourism application

This indicates the appropriateness of the indicators to the model. In addition, the rho_c and rho_a values, which represent the reliability of the latent variables and the explained variance, are high (more than 0.8) in all groups. The AVE values range from 0.651 to 0.738, reflecting the ability to explain the overall variance of the latent variables. Meanwhile, the α is higher than 0.8 in all dimensions, indicating a high level of reliability. In conclusion, the indicators of tourist attractions, safety, emergency system connectivity, health and first aid services, weather, application usage, and application usage decisions are appropriate and can be used to reliably assess the factors affecting the use of tourism applications.

From Table 3, it was found that the mean of the variables, namely TOUR, SAFE, EMER, AID, and WEAT, which are the second components of FACT, were in the range of 4.185-4.225, reflecting the high level of opinions of the respondents. The standard

deviation (S.D.) was in the range of 0.686-0.721, indicating low to moderate data dispersion. The loading values of all variables were in the range of 0.913-0.952, and the t-value was high (73.582-149.346), which was statistically significant, reflecting the appropriateness and importance of these indicators in the model. In terms of reliability, the rho_c and rho_a values were high (more than 0.9), as was the AVE value, which was 0.597, indicating that the indicators could explain the variance of the latent variables effectively. The reliability value (α) as high as 0.978 confirmed the consistency and reliability of the questionnaire.

**Table 3:** Descriptive statistics, loading, and t-value of second-order confirmatory factor analysis

| Measure | Mean | S.D. | CV | Kur | Skew | Loading | t-value | rho_c | rho_a | AVE | α |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOUR | 4.185 | 0.687 | 0.164 | 0.415 | -0.781 | 0.931 | 73.582 | 0.979 | 0.978 | 0.597 | 0.978 |
| SAFE | 4.200 | 0.721 | 0.172 | 1.619 | -1.017 | 0.913 | 88.702 | | | | |
| EMER | 4.225 | 0.695 | 0.164 | 0.518 | -0.849 | 0.952 | 149.346 | | | | |
| AID | 4.197 | 0.686 | 0.163 | 0.735 | -0.826 | 0.949 | 142.960 | | | | |
| WEAT | 4.189 | 0.719 | 0.172 | 0.597 | -0.874 | 0.922 | 84.095 | | | | |

**Table 4:** Construct reliability, validity, and Heterotrait-Monotrait ratio (HTMT)

| Variables | FACT | OPER | DECI |
|---|---|---|---|
| Determinant factors (FACT) | - | | |
| Application operability (OPER) | .888 | - | |
| Decision to use the tourism application (DECI) | .784 | .775 | - |

From Table 4, it was found that FACT had a high relationship with OPER, with the HTMT value being 0.888, which reflected a strong relationship between the two variables. In addition, FACT had a moderate to high relationship with DECI, with the HTMT value being 0.784, while OPER and DECI had a close relationship with the HTMT value being 0.775. These correlation values indicated a link between the determinants, the usability of the application, and the decision to use it, which supported the strong structural relationship in the model. However, the HTMT value of less than 0.9 reflected the absence of differences between the variables and confirmed the validity and reliability of the model.

### 4.3. Finalized model and hypothesis analysis

From Table 5 and Fig. 1, it is found that hypothesis H1 (FACT → DECI) has a standardized estimate of 0.458, a t-value of 4.645, and a p-value of 0.000, indicating that the determinants have a direct effect on the decision to use the application significantly. While hypothesis H2 (FACT → OPER) has a high influence value of 0.889 and a t-value of 55.681, indicating that the determinants have a significant influence on the application usage. In addition, for hypothesis H3 (OPER → DECI), the influence value is 0.368, the t-value is 3.66, and the p-value is 0.000, confirming that the application usability has a significant effect on the decision to use the application. And in hypothesis H4 (FACT → OPER → DECI), the indirect influence value is 0.327, the t-value is 3.653, and the p-value is 0.000, indicating that the determinants affect the decision to use the application through application usage.

From Table 6, it was found that the FACT had a direct influence on OPER with a DE value of 0.889, which was equal to the TE value because there was no indirect influence in this case. Meanwhile, FACT had a direct influence on DECI with a DE value of 0.458 and an indirect influence on OPER with an IE value of 0.327, resulting in a TE of 0.785. As for OPER, it was found that it had a direct influence on DECI with a DE value of 0.368, without an indirect influence, resulting in a TE value equal to the DE value, indicating an important role of the use of the application in supporting the decision to use the application. To provide more nuanced and actionable insights beyond statistical significance, this study further applies an Importance–Performance Map Analysis (IPMA). IPMA allows the simultaneous evaluation of each construct's total effect (importance) on the target variable and its corresponding performance level, thereby identifying high-impact areas where improvement efforts can generate the greatest practical benefits. This additional analysis enables the unpacking of the second-order FACT construct and offers clear guidance for prioritizing the development of health-oriented tourism applications for elderly users. The importance–performance map analysis for OPER in Table 7 and for DECI in Table 8.

From Table 7, it was found that the analysis indicated distinct levels of importance and performance among the examined first-order constructs. The importance values, represented by total effects on OPER, range from 0.913 to 0.952, while the corresponding performance scores range from 78.403 to 80.648. The constructions are further classified according to their respective priority implications, providing a structured overview of their relative roles in supporting the operational effectiveness of the application.

**Table 5:** Hypothesis testing

| Hypotheses | Standardized estimates | t-value | P-values | Result |
|---|---|---|---|---|
| H1: FACT → DECI | 0.458 | 4.645 | 0.000 | Accepted |
| H2: FACT → OPER | 0.889 | 55.681 | 0.000 | Accepted |
| H3: OPER → DECI | 0.368 | 3.660 | 0.000 | Accepted |
| H4: FACT → OPER → DECI | 0.327 | 3.653 | 0.000 | Accepted |

From Table 8, the analysis revealed varying degrees of importance and performance across the examined constructs. The importance values, expressed as total effects on DECI, range from 0.368

to 0.952, while the corresponding performance scores range from 78.457 to 80.648. The constructions are subsequently categorized according to their respective priority implications, offering a systematic representation of their relative contributions to the decision-making process within the proposed model.

**Table 6:** Direct effect, indirect effect, total effect

| Variables | OPER | | | DECI | | |
|---|---|---|---|---|---|---|
| | DE | IE | TE | DE | IE | TE |
| FACT | 0.889*** | - | 0.889*** | 0.458*** | 0.327*** | 0.785*** |
| OPER | - | - | - | 0.368*** | - | 0.368*** |

DE: Direct effect; IE: Indirect effect; TE: Total effect; ***: $p < 0.001$

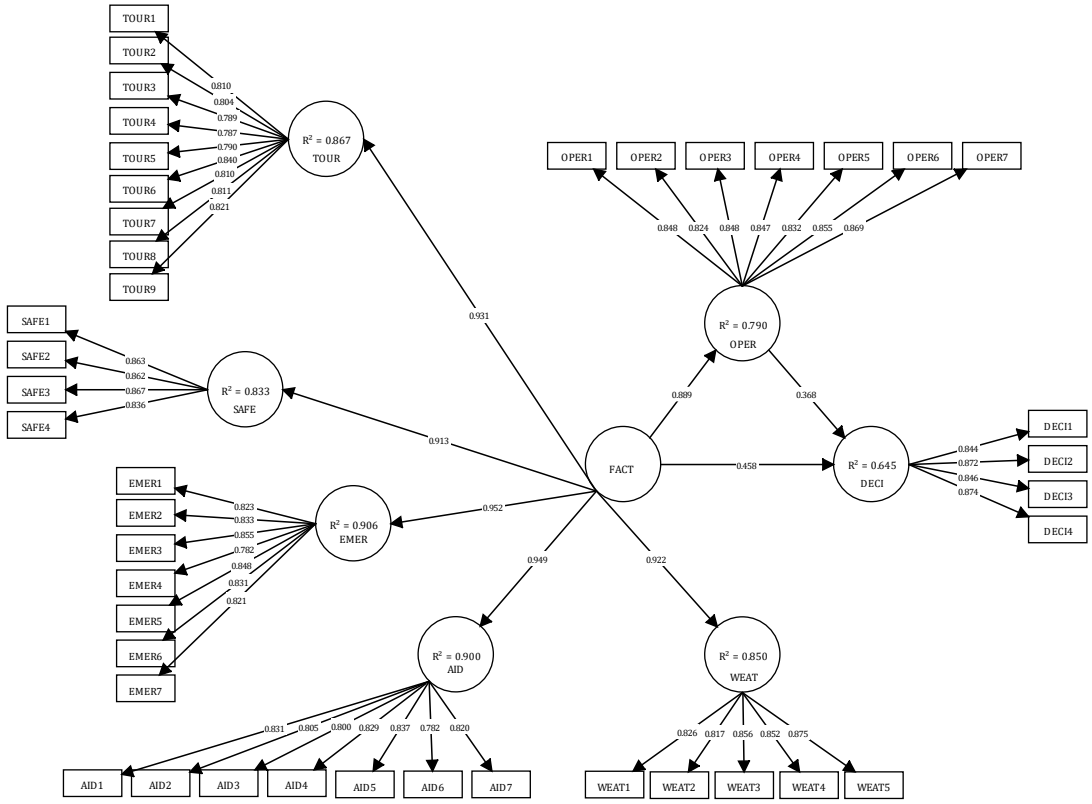


**Fig. 1:** Analyzed model

**Table 7:** IPMA results for application operability (OPER)

| Construct | Importance | Performance | Priority Implication |
|---|---|---|---|
| EMER | 0.952 | 80.648 | Maintain strength; a critical core feature for system reliability |
| AID | 0.949 | 79.919 | High priority for enhancement; expanding health and first-aid support functions |
| TOUR | 0.931 | 79.660 | High priority for enhancement; improve attraction and activity information |
| WEAT | 0.922 | 78.403 | Secondary improvement; strengthen weather and air-quality services |
| SAFE | 0.913 | 80.005 | Maintain strong performance; continue safety feature development |

**Table 8:** IPMA results for decision to use (DECI)

| Construct | Importance | Performance | Priority Implication |
|---|---|---|---|
| EMER | 0.952 | 80.648 | Maintain strong performance; a critical core driver of usage decision |
| AID | 0.949 | 79.919 | Top priority for enhancement; strengthen health and first-aid service functions |
| TOUR | 0.931 | 79.660 | High priority; improve attraction and activity information |
| WEAT | 0.922 | 78.403 | Secondary improvement; upgrade weather and air-quality features |
| SAFE | 0.913 | 80.005 | Maintain strength; ensure the continued reliability of safety services |
| OPER | 0.368 | 78.457 | Operational enabler; focus on usability and responsiveness improvements |

## 5. Discussion

The results of this research presented robust empirical evidence for theoretical structural relationships and demonstrated an especially strong mediating presence of application operability in influencing older adult tourists' decision to adopt a health-conscious tourism application. Findings of the analysis suggest that significant determinants have a substantial indirect effect via the decision to use and a stronger influence through the applicability of use, which positively determines the decision about usage. More crucially, the significant mediating role confirms that system usability operates as a primary mediation channel whereby antecedents are channeled into final adherence behavior. This trend reveals that the older users do not react to safety information, health services, weather, emergency communication, and tourist spots separately; rather, their behavioral intention develops only if these factors are optimally integrated in a system that is dependable, user-friendly, and responsive. Such

thematic composition is consistent with the UTAUT model that highlights that behavioral intention is collectively determined by performance expectancy, effort expectancy, and facilitating conditions, especially amongst older users who are extremely sensitive to usability and perceived support (Momani, 2020). Determinants in this research are performance expectancy and facilitating conditions; application operability is the operationalization of effort expectancy and system usability. The powerful role of mediation indicates that proactive utilization, even of well-regarded health and safety information, requires a system that provides these features with smoothness and high trust. This commonality reconciles why isolated determinants have frequently yielded partial understanding in previous studies. With the structural nature of adoption depending on usage, the current results provide insights into technology acceptance by elderly travelers as a system rather than information.

When compared to the existing literature, these results validate and expand upon previous research in significant ways. Previous studies have found that safety, health information, emergency support, and weather awareness all significantly impact both elderly travelers' confidence and their travel behavior (Bauer, 2012; Schindler, 2005; Strange et al., 1992; Agarwal et al., 2015; Bunker et al., 2016; Schneider and Mücke, 2024). Similarly, the usability of systems and responsive application design are considered critical elements to trust building and mitigation of technology anxiety by older people (Paiva et al., 2020; Liu et al., 2021; Wildenbos et al., 2019; Tajudeen et al., 2022). However, in most previous research, these factors have been considered as parallel predictors of membership, rather than examining their structural interplay. This analysis contributes to the literature by showing that application operability is not another determinant but the underlying mechanism for how all other factors exert their influence. This is somewhat surprising, as it implies that improvements in content quality alone can only deliver partial changes of behavior that are equal to, or less than, the standard against which they are being measured. This insight is further supported by the Importance–Performance Map Analysis, which reveals that urgency of connection and health, and first aid have been shown to be highly important in application operability as well as decision to use with relatively high-performance levels for both, yet there is still some room for strategic improvements. This nuanced perspective transcends reductive variable-centered explanations and provides a system-based rationale for elderly technology adoption in health tourists.

Exploration of the reasons for these associations seems to be anchored in cognitive and emotional attributes of older technology users. Older people generally show more sensitivity to risk, uncertainty, and cognitive load, especially in unfamiliar travel settings (Nimrod, 2012; Sak et al., 2017). Facets such as being connected in an emergency, access to health and first-aid information, and safety features called out earlier have direct implications for these psychological concerns by reducing perceived vulnerability or enhancing situational control (Schindler, 2005; Leitner, 1999; Agarwal et al., 2015). However, the value of such information only arises if the application interface permits elderly people easy access to this, allowing them to process the data and take appropriate action. Previous studies have shown that even when high-quality information is available, behaviors may not be influenced because the system complexity can exceed one's ability to understand it (Paiva et al., 2020; Liu et al., 2021). Thus, the current findings imply that application operability both minimizes cognitive friction to enable determinant factors to receive a full share of their motivational influence. Safety and survival actions become psychologically comforting when they are not just present but within direct reach, visible, and commensurate. Similarly, confidence in weather reports and tourist site information is increased only if their presentation allows for the decreasing visual acuity, memory resources, and motor precision of elderly users (Wildenbos et al., 2019; Kim et al., 2024). Therefore, the mediating effect of operability represents the essence of the relationship between their information value and cognitive accessibility.

Herewith, the results demonstrate that content relevance and system performance are intricately interwoven in elderly tourists' intentional decision to utilize a health-oriented tourism application. User needs and values inform determining factors, while the capabilities of the application structure decide whether they can fulfill user demands when installed. The structural preponderance of the progression from determinant variable to operability to decision to use suggests that adoption is not a rational act of consideration but instead an ongoing transaction that is affected by trust, emotional comfort, and interaction quality. This unified perspective explains why technological application is commonly found unsuccessful among elderly people, although containing full functionality: when execution does not catch up with intention from both operational and informational aspects, perceived usefulness decreases. On the other hand, high operating quality may offer very complex health and safety systems that enhance elderly users' autonomy and travel confidence (Paiva et al., 2020; Tajudeen et al., 2022).

## 6. Research implications

The findings from this study have three implications. First, as for the practical implications for tourism businesses, the ordering of features in application development shall concentrate not only on system functioning but also on how elderly consumers make technology adoption decisions. Special attention should be given to strengthening relations with emergency and public health services because they are the solid foundation on which

reliability and user trust are based. Health services and first aid should also be massively improved, by providing on-the-spot personal health advice, advice to support the management of chronic diseases, and clear instructions for first aid. Furthermore, detailed and well-organized data concerning tourist spots, money issues, health care services, lodging places, and auxiliary facilities should be emphasized to enable efficient travel planning for elderly users. Although safety features are already highly efficient, ongoing improvement with emergency notifications, evacuation directions, and safety reminders is critical to ensure trustworthiness and a sense of security. Meteorological and air-quality activities, which hold somewhat less priority, should be stepwise improved for guiding health-aware travel decisions. On the user side, elderly-friendly application interfaces that feature large font sizes, easy navigation support, prompt system responses, and cross-platform compatibility need to be made available. Taken together, this integrated approach to development allows tourism providers to improve the quality of their services, increase user satisfaction, and enhance competitiveness in the market of health tourism.

For theoretical contributions and managerial implications, secondly, this study not only contributes to the enrichment of literature by empirically testing an extended model to explain elderly tourists' choice of using technology when planning health tourism, but also explains how these various factors can be linked together. The results provide a structured foundation to develop models and metrics for comparison of the relative impact of key dimensions such as security, touristic points of interest, health and first aid support services, connectivity with emergency and public health systems structure, and environmental conditions. These dimensions can be used to develop a sophisticated evaluation tool to compare tourism applications among destinations and user contexts. More important is that, the findings also endorse interdisciplinary expansions to tourism technology education and health tourism management, especially in curriculum or training design in line with real determinants of elderly users' decision-making behavior. They also have significant implications for theory development in both the area of tourism management and health technology, demonstrating how user needs as regards health, safety, and environmental assurance dovetail with system functionality. Moreover, the implications provide avenues for comparative or cross-country research on the application use of seniors and across technology-based services in other innovation-driven industries such as tourism, healthcare, and education.

Regarding policy implications for government agencies, finally, the public institutions should be strongly encouraged to take a proactive role in sponsoring integrated health tourism applications for elderly users and to engage in such product development through cooperative frameworks with tourism enterprises or application developers. These initiatives must cater to the core components required of an application service, namely the integration of health, safety, emergency support, and travel information in integrated platforms that suit elderly tourists' needs. Meanwhile, national service standards should be set up for health tourism applications of the elderly, and stringent access to services needs to be enforced in terms of quality: basic functions, including emergency communications, health and medical first aid attention, weather conditions monitoring, and environmental circumstances, as well as the provision of reliable security resources, are required. Authorities should also maintain the development of healthcare and digital infrastructure in tourism destinations that will contribute to strengthening emergency response and raising overall public health preparedness. Equitable diffusion and continued use to promote adoption that is equitable, as well as continued use and policies to widen access among older adults, such as application-training programs and provision of suitable devices, will also be needed. Finally, strategic marketing for health tourism, such as specific incentives and preferential programs regarding application use, may increase market resources and enhance the national sector of health tourism.

## 7. Future research suggestions

This research shows the multi-relationship among determinants, usability, and use of the application in the case of aged health tourism. Subsequent research might also examine in more detail the mediatory mechanisms through which these factors impact system usability and user trust, with a focus on the older adults' psychological response to design interventions, such as intuitive interfaces, adaptive functions, and personalized interaction features. Further studies could investigate cultural and regional differences in the use of health tourism applications by old people with different healthcare systems, travel experiences, and technology readiness, which contribute to the design context-aid for region-specific applications.

Furthermore, the growing adoption of advanced digital technologies, for instance, artificial intelligence and big data analytics, should be a subject for closer scrutiny, and personalized health information and travel advisories should be more effectively and safely delivered to elderly users in varying case scenarios. There is also a need for a longitudinal evaluation to determine the long-term impact of system upgrades, protections from data breaches, and interoperability with public health information systems on user satisfaction, trust, and continued use. Finally, forthcoming research should also pay close attention to the ethical guidelines for the use of health-related data so that technology advances on par with user privacy emulation and public trust building.

## 8. Conclusion

The theoretical contribution of the present study is to illustrate how, in contrast with web-based behavioral usage intentions, elderly citizens' health-oriented tourism application use is not guided mainly by individual informational determinants; rather, it is predominantly determined by application operability as a fundamental factor capable of translating the influence of health and safety factors at the destination into actual use processes. The strong indirect effect of operability suggests that system functionality, usability, and reliability are the primary influences on elderly users' behavioral adoption. Exploiting this observation, the study presents a prioritized list of guidelines for application developers. The most critical development priority is to strengthen connections with emergency services and public health facilities, which are the foundation of user confidence and system safety. The second class focuses on improving health and first aid, such as personalized health guidance, chronic disease management help, and clear emergency treatment instructions that directly decrease the perceived danger of the product but increase user confidence. Thirdly, there must be better access to and quality of information relating to tourist attractions that are health-specific, including activities suitable for those with the condition, handicap adaptations, and proximity to medical resources to facilitate informed travel planning. The fourth objective, which is to keep on maintenance and upgrading the safety functions in operation, such as emergency alarms, evacuation guidance, and safety reminders, was a very important point for maintaining customer trust. The fifth high priority is the structured development of weather and environmental data to aid older travelers in making health-sensitive travel choices. Finally, the interface design should be elderly-centered, making all system components accessible with simpler, more readable, and more responsive multi-device support. Taken together, the results present an integrity groundwork for future sustainable and effective health tourism applications, such as encouraging seniors' autonomy and confidence levels as well as better elderly travelers' travel destination experiences while simultaneously supporting the long-term competitiveness of Thailand's health tourism industry.

## List of abbreviations

| | |
|---|---|
| AI | Artificial intelligence |
| AID | Health and first aid |
| AVE | Average variance extracted |
| CR | Composite reliability coefficient |
| CV | Coefficient of variation |
| DE | Direct effect |
| DECI | Decision to use the tourism application |
| EMER | Connectivity with emergency services/public health systems |
| FACT | Determinant factors |
| HTMT | Heterotrait–Monotrait ratio |
| IE | Indirect effect |
| IPMA | Importance–Performance Map Analysis |
| Kur | Kurtosis |
| NFPA | National Fire Protection Association |
| OPER | Application operability |
| PLS-SEM | Partial least squares structural equation modeling |
| rho_a | Dijkstra–Henseler's rho_A reliability coefficient |
| rho_c | Composite reliability (rho_c) |
| S.D. | Standard deviation |
| SAFE | Safety |
| Skew | Skewness |
| TE | Total effect |
| TOUR | Tourist attraction |
| UTAUT | Unified theory of acceptance and use of technology |
| WEAT | Weather |
| α | Cronbach's alpha |

## Acknowledgment

This research was supported by the Science, Research and Innovation Promotion Fund, Thailand Science Research and Innovation (TSRI), through Rajamangala University of Technology Thanyaburi (FR867E0507I.3) (Grant No.: FRB670027/0168).

## Compliance with ethical standards

## Ethical considerations

Ethical considerations were carefully addressed throughout this research. All participants provided informed consent prior to survey completion. The study involved minimal risk, collecting only anonymous responses about tourism experiences without any personal identifying information. Participation was entirely voluntary, and participants could withdraw at any time. Data collection and handling procedures followed established ethical guidelines for human subjects research.

## Conflict of interest

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

## References

Adami I, Foukarakis M, Ntoa S, Partarakis N, Stefanakis N, Koutras G, Kutsuras T, Ioannidi D, Zabulis X, and Stephanidis C (2021). Monitoring health parameters of elders to support independent living and improve their quality of life. Sensors, 21(2): 517. https://doi.org/10.3390/s21020517 **PMid:33450904 PMCid:PMC7828366**

Agarwal G, McDonough B, Angeles R, Pirrie M, Marzanek F, McLeod B, and Dolovich L (2015). Rationale and methods of a multicentre randomised controlled trial of the effectiveness of a community health assessment programme with emergency medical services (CHAP-EMS) implemented on residents aged 55 years and older in subsidised seniors' housing buildings in Ontario, Canada. BMJ Open, 5(6): e008110.

https://doi.org/10.1136/bmjopen-2015-008110
**PMid:26068514 PMCid:PMC4466604**

Androutsou T, Kouris I, Anastasiou A, Pavlopoulos S, Mostajeran F, Bamiou DE, Genna GJ, Costafreda SG, and Koutsouris D (2020). A smartphone application designed to engage the elderly in home-based rehabilitation. Frontiers in Digital Health, 2: 15. https://doi.org/10.3389/fdgth.2020.00015
**PMid:34713028 PMCid:PMC8521815**

Aphisavadh S (2024). Medical tourism and healthcare trends in Thailand. World Journal of Advanced Research and Reviews, 24(1): 1627–1637. https://doi.org/10.30574/wjarr.2024.24.1.3188

Balapour A, Nikkhah HR, and Sabherwal R (2020). Mobile application security: Role of perceived privacy as the predictor of security perceptions. International Journal of Information Management, 52: 102063. https://doi.org/10.1016/j.ijinfomgt.2019.102063

Bastani S, Hosseini Shakib M, and Khamseh A (2025). Service innovation model in the health tourism industry with a focus on the post-corona era. Journal of Tourism Management Studies, 19(68): 241-288. https://doi.org/10.22054/tms.2024.80502.2961

Bauer I (2012). Australian senior adventure travellers to Peru: Maximising older tourists' travel health experience. Travel Medicine and Infectious Disease, 10(2): 59-68. https://doi.org/10.1016/j.tmaid.2012.03.002
**PMid:22459635**

Bell SA, Singer D, Solway E, Kirch M, Kullgren J, and Malani P (2021). Predictors of emergency preparedness among older adults in the United States. Disaster Medicine and Public Health Preparedness, 15(5): 624-630. https://doi.org/10.1017/dmp.2020.80
**PMid:32475374 PMCid:PMC7704536**

Bunker A, Wildenhain J, Vandenbergh A, Henschke N, Rocklöv J, Hajat S, and Sauerborn R (2016). Effects of air temperature on climate-sensitive mortality and morbidity outcomes in the elderly; A systematic review and meta-analysis of epidemiological evidence. EBioMedicine, 6: 258-268. https://doi.org/10.1016/j.ebiom.2016.02.034
**PMid:27211569 PMCid:PMC4856745**

Chu AZ and Chu RJ (2013). Service willingness and senior tourists: knowledge about aging, attitudes toward the elderly, and work values. The Service Industries Journal, 33(12): 1148-1164. https://doi.org/10.1080/02642069.2011.628659

Crane SJ, Tung EE, Hanson GJ, Cha S, Chaudhry R, and Takahashi PY (2010). Use of an electronic administrative database to identify older community dwelling adults at high-risk for hospitalization or emergency department visits: The elders risk assessment index. BMC Health Services Research, 10: 338. https://doi.org/10.1186/1472-6963-10-338
**PMid:21144042 PMCid:PMC3019201**

Dwyer R, Stoelwinder J, Gabbe B, and Lowthian J (2015). Unplanned transfer to emergency departments for frail elderly residents of aged care facilities: A review of patient and organizational factors. Journal of the American Medical Directors Association, 16(7): 551-562. https://doi.org/10.1016/j.jamda.2015.03.007
**PMid:25933726**

Green SK, Keith KJ, and Pawlson LG (1983). Medical students' attitudes toward the elderly. Journal of the American Geriatrics Society, 31(5): 305-309. https://doi.org/10.1111/j.1532-5415.1983.tb04876.x
**PMid:6841859**

Gronphet S and Onputtha S (2025). The impact of supplier-customer collaboration on sustainability-oriented capability: The mediating role of communication effectiveness and technology adoption in micro-enterprises. Journal of Applied Data Sciences, 6(3): 1921-1939. https://doi.org/10.47738/jads.v6i3.725

Hair JF, Ringle CM, and Sarstedt M (2011). PLS-SEM: Indeed a silver bullet. Journal of Marketing Theory and Practice, 19(2): 139-152. https://doi.org/10.2753/MTP1069-6679190202
**PMCid:PMC8753572**

Kim SB, Tae HC, Lee CG, Moon JK, Yoo OS, and Kim JH (2024). Usability study of mobile healthcare application for the elderly. In the 2024 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, IEEE, Chiang-mai, Thailand: 17-20. https://doi.org/10.1109/ECTIDAMTNCON60518.2024.10480065

Kim TK and Choi M (2019). Older adults' willingness to share their personal and health information when adopting healthcare technology and services. International Journal of Medical Informatics, 126: 86-94. https://doi.org/10.1016/j.ijmedinf.2019.03.010
**PMid:31029268**

Klaver NS, Van de Klundert J, and Askari M (2021). Relationship between perceived risks of using mHealth applications and the intention to use them among older adults in the Netherlands: Cross-sectional study. JMIR Mhealth and Uhealth, 9(8): e26845. https://doi.org/10.2196/26845
**PMid:34459745 PMCid:PMC8438611**

Kline RB (2023). Principles and practice of structural equation modeling. Guilford Publications, New York, USA.

Ko E, Lee J, and Hong Y (2016). Willingness to complete advance directives among low-income older adults living in the USA. Health & Social Care in the Community, 24(6): 708-716. https://doi.org/10.1111/hsc.12248 **PMid:25939688**

Larriva MTB and Higueras E (2020). Health risk for older adults in Madrid, by outdoor thermal and acoustic comfort. Urban Climate, 34: 100724. https://doi.org/10.1016/j.uclim.2020.100724

Leitner MJ (1999). Enabling tourism for low-functioning elders and their spouses. Tourism Recreation Research, 24(1): 77-79. https://doi.org/10.1080/02508281.1999.11014860

Liu N, Yin J, Tan SSL, Ngiam KY, and Teo HH (2021). Mobile health applications for older adults: A systematic review of interface and persuasive feature design. Journal of the American Medical Informatics Association, 28(11): 2483-2501. https://doi.org/10.1093/jamia/ocab151
**PMid:34472601 PMCid:PMC8510293**

Momani AM (2020). The unified theory of acceptance and use of technology: A new approach in technology acceptance. International Journal of Sociotechnology and Knowledge Development (IJSKD), 12(3): 79-98. https://doi.org/10.4018/IJSKD.2020070105

Morey SA, Stuck RE, Chong AW, Barg-Walkow LH, Mitzner TL, and Rogers WA (2019). Mobile health apps: Improving usability for older adult users. Ergonomics in Design, 27(4): 4-13. https://doi.org/10.1177/1064804619840731

Nappi V and Kelly K (2021). Measuring knowledge management in the innovation process: A systematic literature review. International Journal of Knowledge Management Studies, 12(2): 161-182. https://doi.org/10.1504/IJKMS.2021.10036192

Nejati H, Pomponiu V, Do TT, Zhou Y, Iravani S, and Cheung NM (2016). Smartphone and mobile image processing for assisted living: Health-monitoring apps powered by advanced mobile imaging algorithms. IEEE Signal Processing Magazine, 33(4): 30-48. https://doi.org/10.1109/MSP.2016.2549996

NFPA (1979). Emergency evacuation planning guide for people with disabilities. National Fire Protection Association, Quincy, USA.

Nimrod G (2012). Online communities as a resource in older adults' tourism. The Journal of Community Informatics, 8(1): 1-11. https://doi.org/10.15353/joci.v8i1.3062

Onputtha S, Iamsomboon N, Rasadaraksa M, and Li LY (2025). Competencies of health tourism logistics service providers and their impact on elderly tourists' decision-making and satisfaction: A structural equation modeling analysis. International Journal of Advanced and Applied Sciences, 12(8): 223-236. https://doi.org/10.21833/ijaas.2025.08.021

Paiva JO, Andrade RM, de Oliveira PA, Duarte P, Santos IS, Evangelista AL, Theophilo RL, de Andrade LO, and Barreto IC (2020). Mobile applications for elderly healthcare: A systematic mapping. PLOS ONE, 15(7): e0236091. https://doi.org/10.1371/journal.pone.0236091 **PMid:32730266 PMCid:PMC7392241**

Park NS, Jang Y, Lee BS, Schonfeld L, and Molinari V (2012). Willingness to use mental health services among older residents in assisted living. Journal of Applied Gerontology, 31(4): 562-579. https://doi.org/10.1177/0733464810392373

Patterson I, Balderas-Cejudo A, and Pegg S (2021). Tourism preferences of seniors and their impact on healthy ageing. Anatolia, 32(4): 553-564. https://doi.org/10.1080/13032917.2021.1999753

Qiao G, Ding L, Xiang K, Prideaux B, and Xu J (2022). Understanding the value of tourism to seniors' health and positive aging. International Journal of Environmental Research and Public Health, 19(3): 1476. https://doi.org/10.3390/ijerph19031476 **PMid:35162499 PMCid:PMC8834913**

Roberto KA, Weeks LE, and Matheis-Kraft C (2001). Health care decisions of older adults: Underlying influences, cognitive status, and perceived outcomes. Journal of Applied Gerontology, 20(1): 74-90. https://doi.org/10.1177/073346480102000105

Sak G, Rothenfluh F, and Schulz PJ (2017). Assessing the predictive power of psychological empowerment and health literacy for older patients' participation in health care: A cross-sectional population-based study. BMC Geriatrics, 17: 59. https://doi.org/10.1186/s12877-017-0448-x **PMid:28219334 PMCid:PMC5319152**

Savalei V and Bentler PM (2005). A statistically justified pairwise ML method for incomplete nonnormal data: A comparison with direct ML and pairwise ADF. Structural Equation Modeling, 12(2): 183-214. https://doi.org/10.1207/s15328007sem1202_1

Schindler KJ (2005). Travel counseling for the elderly traveler. In Nursing Forum, Blackwell Publishing Inc., Malden, USA, 40(3): 107-115. https://doi.org/10.1111/j.1744-6198.2005.00015.x **PMid:16271122**

Schneider S and Mücke HG (2024). Sport and climate change—how will climate change affect sport? German Journal of Exercise and Sport Research, 54: 12-20. https://doi.org/10.1007/s12662-021-00786-8

Segun-Falade OD, Osundare OS, Kedi WE, Okeleke PA, Ijomah TI, and Abdul-Azeez OY (2024). Developing cross-platform software applications to enhance compatibility across devices and systems. Computer Science & IT Research Journal, 5(8): 2040-2061. https://doi.org/10.51594/csitrj.v5i8.1491

Setsri P (2017). The pattern of elderly health tourism in Bangkok, Thailand. International Journal of Social Science and Humanity, 7(2): 72-75. https://doi.org/10.18178/ijssh.2017.V7.798

Simasathiansophon N, Jotikasthira C, Onputtha S, and Tiwasing A (2020). Tourist's decision to travel to Thai cultural tourism destination in central part of Thailand. E3S Web of Conferences, 164: 10002. https://doi.org/10.1051/e3sconf/202016410002

Strange GR, Chen EH, and Sanders AB (1992). Use of emergency departments by elderly patients: Projections from a multicenter data base. Annals of Emergency Medicine, 21(7): 819-824. https://doi.org/10.1016/S0196-0644(05)81028-5 **PMid:1610039**

Tajudeen FP, Bahar N, Tan MP, Peer Mustafa MB, Saedon NI, and Jesudass J (2022). Understanding user requirements for a senior-friendly mobile health application. Geriatrics, 7(5): 110. https://doi.org/10.3390/geriatrics7050110 **PMid:36286212 PMCid:PMC9602267**

Wildenbos GA, Jaspers MW, Schijven MP, and Dusseljee-Peute LW (2019). Mobile health for older adult patients: Using an aging barriers framework to classify usability problems. International Journal of Medical Informatics, 124: 68-77. https://doi.org/10.1016/j.ijmedinf.2019.01.006 **PMid:30784429**

Wuttithantawee C and Taweepornpathomgul S (2015). A proposed recreational program management model for the elderly long stay tourists in Thailand. Asian Journal of Social Sciences & Humanities, 4(3): 73-82.

Yuan KH, Chan W, and Bentler PM (2000). Robust transformation with applications to structural equation modelling. British Journal of Mathematical and Statistical Psychology, 53(1): 31-50. https://doi.org/10.1348/000711000159169 **PMid:10895521**