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An Integrative Investigation of Travel Satisfaction, Streetscape Perception, and Mental Health in Urban Environments

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Abstract: A significant connection exists between mental health, particularly depression, and travel. This study aims to explore the relationship between travel satisfaction, perception of the streetscape, and depression by comparing non-older adults and older adults. Subjective well-being serves as a concept for measuring mental health derived from travel satisfaction and perception of the streetscape across age groups. Additionally, the Geriatric Depression Scale (15-item GDS) was employed to specifically assess depression. The survey was conducted among respondents residing in the Bangkok Metropolitan Region (BMR) with a sample size of 3600 which is segmented into three age groups for the study model: early adulthood (18–34 years), middle adulthood (35–59 years), and later maturity (60 years and above). Multiple regression analysis was employed to investigate the relationship between travel satisfaction, perception of the streetscape, and mental health. The results suggest that both travel satisfaction and perception of the streetscape have a statistically significant impact on mental health, particularly in relation to depression. Additionally, the analysis highlights variations in stressors among different age cohorts. Particularly noteworthy is the finding that ease of access to the city center and openness of the streetscape emerged as statistically significant factors influencing depression within the later maturity age group. Conclusively, the study reveals the variations in stressors across diverse age cohorts, highlighting the imperative for tailored interventions to mitigate mental health concerns throughout different life stages.

Keywords: geriatric depression scale; mental health; quality of life; travel satisfaction; users' perception; well-being

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1. Introduction

Travel is one of the most frequent activities in a city, playing a fundamental role in facilitating access to the various opportunities inherent in urban life, including employment, access to clientele, and suppliers [1,2]. However, despite its benefits, travel also poses numerous challenges, including traffic congestion, pollution, and road accidents [3,4]. These issues parallel those arising from inadequacies in transportation system planning. Furthermore, these immediate issues are intricately connected to ramifications for both physical and mental well-being. Daily commuting for purposes such as work, education, or shopping often entails navigating through traffic congestion, resulting in significant time wastage and the accumulation of stress. This not only wastes valuable time but also exerts detrimental effects on long-term physical and mental health [5–7]. Extended exposure to traffic congestion and noise creates a stressful environment, perpetuating feelings of stress, fatigue, irritability, and anger among commuters. Moreover, it can induce anxiety, diminish emotional regulation capabilities, increase susceptibility to frustration at work, and engender various other adverse outcomes [8,9]. The issue of traffic congestion on the roads of Bangkok, Thailand has persisted for an extended duration, significantly impacting

the daily lives of Bangkok residents. From the moment they awaken in the morning, individuals in Bangkok contend with the challenge of navigating through traffic jams as they commute to work or school or return home. According to the 2022 Global Traffic Scorecard Report, Bangkok ranks as the 32nd most congested city globally and the 2nd in Asia [10]. These circumstances exacerbate concerns regarding the potential adverse effects of lengthy time spent on the road on both physical and mental health. Presently, there is a growing emphasis on examining the interplay between transportation systems, urban planning, and mental well-being, particularly in the context of assessing subjective well-being [11]. Additionally, there is increasing recognition of the importance of establishing a travel environment helpful to alleviating stress and travel-related anxiety, as part of efforts to foster optimal physical and mental health among urban residents [9,12].

Mental health problems, in particular, can have enduring effects and lead to physical health complications. Thus, creating a favorable travel environment requires not only encompasses considering driver characteristics (e.g., age, gender, etc.) and travel satisfaction derived from access to diverse activities and opportunities within daily life, including access to public transport services, but also the physical aspects of the road and its surroundings (e.g., the presence of greenery, spatial openness, degree of enclosure, etc.). Significantly, there is a noticeable trend in the changing demographics of construction projects due to the aging population [13,14]. Consequently, commuters are increasingly likely to belong to the older adult demographic. Thus, mental health concerns associated with travel demand considerable attention and call for comprehensive plans to address them, especially in countries undergoing transitions to aging societies like Thailand. This is essential to effectively support the elderly population in the foreseeable future. Finally, considering that mental health significantly impacts overall quality of life, it is crucial to recognize and prepare for the challenges arising from demographic shifts. As populations age, the importance of addressing mental health concerns becomes even more pronounced. This necessitates proactive measures to anticipate and accommodate the needs of older adults, particularly in areas such as transportation. Regarding prioritizing mental health in our planning and infrastructure development, it is not only about enhancing the well-being of individuals, but also contributing to the sustainability of our communities. Ensuring that infrastructure and services are inclusive and supportive of mental health promotes a more resilient and equitable society, capable of adapting to demographic changes while maintaining a high quality of life for all and fostering long-term sustainability.

2. Literature Review

2.1. Quantitative Assessment of Depression's Influence on Mental Health

Threats to the mental health of urban dwellers arise from the demanding lifestyle prevalent in large cities, where individuals contend with time constraints, extensive responsibilities, and exposure to daily pollution. These factors directly impact the mental well-being of urban residents, constituting a latent health issue within their population, whether consciously acknowledged or not. Of particular concern are stress-related disorders, which more gravely, can precipitate depression. Depression represents a significant mental health concern prevalent across various age groups [15]. Several studies emphasize specific concerns among the elderly [16,17]. While the etiology of depression is multifaceted, encompassing factors beyond a singular cause, it may stem from various influences, including those associated with the living environment and travel. This remains a topic of ongoing debate, warranting further attention and comprehension. There are numerous tools available for assessing depression. However, three depression scales are widely employed for depression screening: the Geriatric Depression Scale (GDS), the Center for Epidemiologic Studies Depression Scale (CES-D), and the SelfCARE(D). Notably, the Geriatric Depression Scale (GDS) and the Center for Epidemiologic Studies Depression Scale (CES-D) place less emphasis on somatic symptoms of depression [18].

The Geriatric Depression Scale (15-item GDS) is widely utilized as a primary instrument for evaluating depression. The strength of the GDS lies in its self-assessment format

which utilizes a simple yes–no structure, rendering it easily accessible for users. Moreover, it can be effectively utilized in both hospital and community settings [19]. The original GDS long version comprised 30 items, from which a shorter version containing 15 items was developed, focusing on mood, motivation, and physical symptoms [20–22]. The depression scale is classified into three ranges which are as follows: depression likely present (10 to 15 points), depression possible (6 to 9 points), and depression unlikely (0 to 5 points) [21]. However, some studies define the prevalence of depression using a cut-off point of 8 [23]. For instance, Lam et al. [24] applied the GDS to assess depressive symptoms within neighborhood environments among the elderly. The results of this study highlight the importance of fostering a supportive neighborhood environment for promoting good mental health, such as by encouraging walking and enhancing access to various activities. Some studies indicate the presence of depression on the GDS with a cut-off point of 5 or more [21,25,26]. Additionally, some studies have abbreviated the questionnaire to measure depression, such as the study by Hoyl et al. [27], which developed and tested a 5-item version of the GDS. Typically, the GDS is utilized to assess depression by using 15 items (GDS-15). For example, Wang et al. [28] applied the GDS-15 to improve mental health in older community-dwelling adults. Similarly, Das et al. [26] applied the Geriatric Depression Scale short version (GDS) and the Geriatric Anxiety Inventory Hindi version (GAI) to assess the presence and severity of anxiety and depressive symptoms among the elderly. Previous evidence regarding the reliability and validity of the GDS instrument is robust, particularly within hospital and primary care settings, including community settings [29–31]. Nonetheless, the reliability and validity metrics may vary depending on the scale's deployment and the setting [30]. Shorter versions of the GDS (GDS 15, GDS 10) demonstrate superior diagnostic accuracy compared to the GDS 30 [31]. Based on the provided information, it is noted that a considerable number of studies have utilized the GDS-15 scale to assess depression, with evaluations typically considering a score range of 5 or higher. This range is regarded as an appropriate tool and criterion for measuring depression.

2.2. Streetscape Perception, Depression, and Mental Health

The perception of the streetscape is a crucial factor in shaping a pleasant travel environment. Conversely, an unsuitable road environment and streetscape can have adverse effects on mental health during travel. Numerous studies have employed the Geriatric Depression Scale (GDS-15 item) as a tool to evaluate mental health alongside road environmental factors. For instance, Wang et al. [32] investigated the correlation between neighborhood street walkability and mental health (assessed using GDS and GAI) among older adults by employing street view images. Their findings revealed a negative association between neighborhood street walkability and both GDS and GAI scores. The factors utilized to estimate the perception of the streetscape vary across studies. It can be categorized into two main measurement components, which are objective measurements derived from street view images, and individual perceptions of the streetscape. Subjective measurements encompass various factors, including greenery [33,34], enclosure [32,35], openness [36,37], street wall continuity [38,39], and cross-sectional proportion [38], among others.

2.3. Differences in Mental Health across Age Groups: A Focus on Depression

As individuals age, they encounter a series of physical and mental health challenges [40,41]. Depression can be classified as a non-communicable disease which represents a significant aspect of the overall disease burden faced by aging populations [42]. Depression is prevalent among older adults who constitute a vulnerable demographic. Consequently, numerous studies have concentrated on investigating mental health issues within this age cohort [16,41,43]. However, the manifestation of mental health issues associated with depression varies across the lifespan. Some studies suggest that younger adults are more susceptible to depression than their older counterparts [44]. Furthermore, Nolen-Hoeksema and Ahrens [45] examined the correlation between age groups (young adults, middle-aged adults, and older adults) and depressive symptoms. Their findings

highlight the relationships between various factors unique to each age group and the consistent association of these factors with depressive symptoms across different age groups. Presently, depression stands as a prevalent mental disorder affecting an estimated 5% of adults, profoundly impacting various dimensions of life [46]. Despite existing knowledge, ongoing research persists, exploring a broader spectrum of causal relationships. Mental health problems are understood to arise from multiple factors rather than a singular cause.

2.4. The Relationship between Travel Satisfaction, Quality of Life, and Mental Health with a Focus on Depression

The study of mobility and its implications for health and well-being is gaining prominence, particularly as traffic issues escalate in countries undergoing urbanization. This trend is concurrent with urban expansion, population growth, and an increase in travel volume, driven by the reliance on personal vehicles. The correlation between daily travel, mental health, and quality of life is crucial [47,48]. For example, Jemal et al. [25] investigated the association between depression and quality of life by using the GDS. The assessment of quality of life focused on overall evaluation utilizing the World Health Organization Quality of Life (WHOQOL)-BREF. The study's findings revealed a statistically significant relationship between depression and quality of life. Similarly, Demura, and Sato [49] explored the correlation between depression (measured with the GDS-15 item) and lifestyle, as well as quality of life through a comparison across gender and age groups. The results highlighted differences in the manifestation of depression between gender and age groups. In terms of transportation-specific quality of life (QOL), it is commonly assessed through travel satisfaction, which is grounded in goal theory [50]. Travel satisfaction comprises elements that relate to the connection between travel and well-being by constituting a subjective evaluation of quality of life. Subjective well-being encompasses various perspectives, including the eudaimonic as cognitive views which involve an overall assessment of a trip by considering life goals, self-growth, and other relevant factors [51,52]. Moreover, the hedonic or affective perspective pertains to the emotional experiences during a trip by focusing on one's feelings about life and experiences in terms of mood [52,53]. In summary, travel satisfaction encompasses both cognitive evaluations and affective experiences during travel. The choice of perspective in evaluating travel satisfaction varies across studies, with some selecting one or the other to align with study objectives, although most studies commonly integrate both perspectives.

Numerous studies have substantiated the connection between travel satisfaction and quality of life. For example, Hudakova [54] investigated mobility and quality of life, drawing comparisons between older adults and younger individuals. Delbosc and Currie [55] explored the relationship between quality of life and travel by focusing on dimensions of accessibility and exclusion. Accessibility holds significant implications for enhancing social interaction by facilitating access to activities within the city, thereby potentially contributing to improved well-being [56]. Some studies focus on the availability of public transportation (such as public bus services) to define quality of life in relation to transportation. For example, Kim et al. [57] utilized public transport travel, a component of travel satisfaction, to explore the relationship between travel satisfaction and quality of life by comparing non-older adults and older adults. Additionally, travel satisfaction and travel well-being are associated with mental health problems. For instance, Zhu et al. [58] investigated the well-being of older individuals in relation to travel and health. Moreover, Syahputri et al. [59] examined the relationship between travel satisfaction and activity-travel patterns on health. The findings revealed a positive correlation between travel satisfaction and both social and mental health. Prolonged exposure to traffic congestion and noise can create a stressful situation that may persistently affect mental health [8,9].

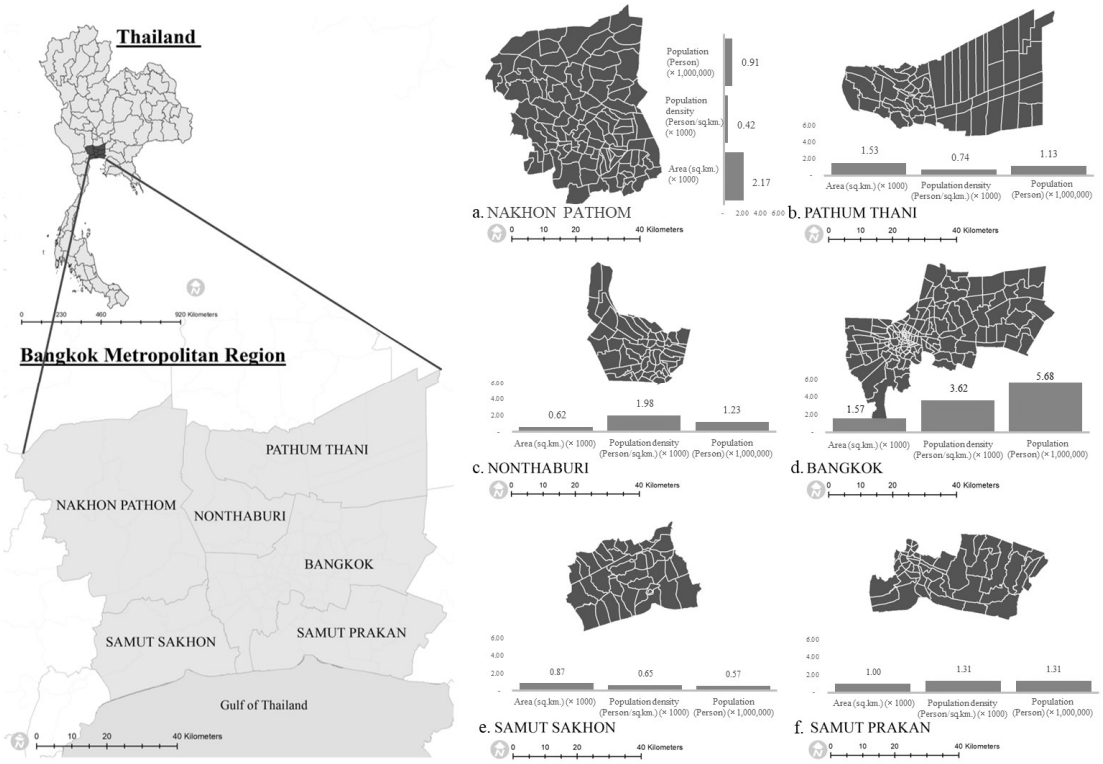
Through a review of the literature, it becomes evident that mental health problems stem from a multitude of factors rather than a single cause. Each age group confronts the possibility of experiencing depression, influenced by various environmental risk factors. While many studies have concentrated on life satisfaction and overall quality of life, another

significant aspect worthy of consideration is the domain of travel-related experiences. Living in a city, particularly in metropolitan areas, often involves a significant portion of one's daily life being consumed by travel-related activities. This includes planning journeys, commuting to various destinations, and integrating daily tasks with travel time. Transportation plays a vital role in urban environments, particularly concerning accessibility issues that impact essential life pursuits such as work and education, as well as facilitating social interactions within society. While our understanding of how the travel environment influences mental health remains incomplete, and studies examining the impact of road environments on satisfaction across various age groups are limited, there is an increasing acknowledgment of its significance. This ongoing debate merits further attention and understanding. Hence, this study aims to investigate the relationship between travel satisfaction and perceptions of the streetscape on mental health by focusing on depression with a comparative analysis across different age groups. Addressing this gap represents the primary objective of our research.

3. Methodology

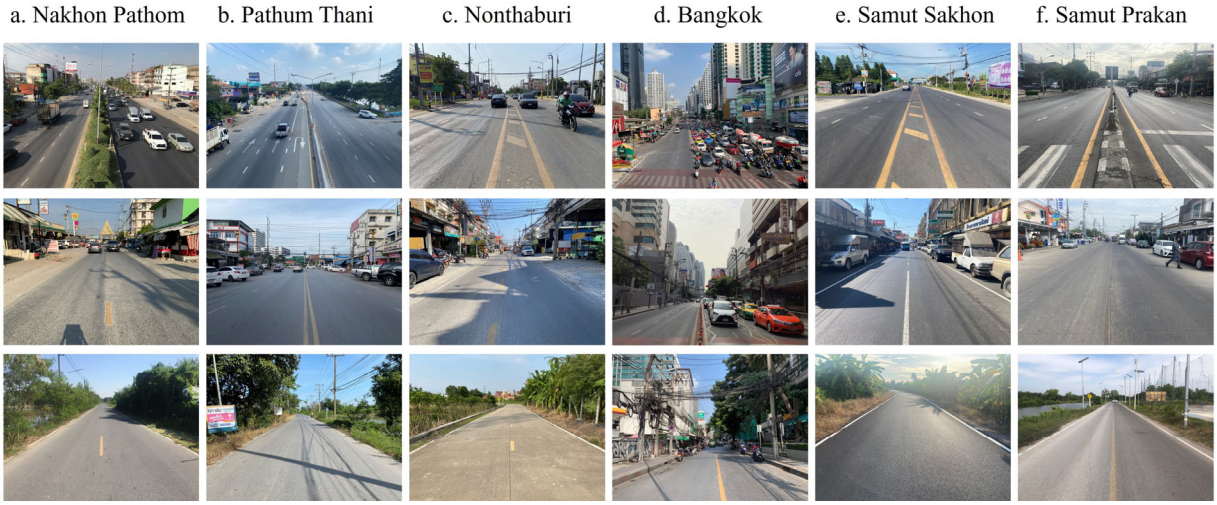
3.1. Study Area

This study was carried out in the Bangkok Metropolitan Region, delineated as the study area in Figure 1. The Bangkok Metropolitan Region encompasses Bangkok and the five adjacent provinces of Nakhon Pathom, Pathum Thani, Nonthaburi, Samut Prakan, and Samut Sakhon.



(**A**)

Figure 1. *Cont.*



(**B**)

Figure 1. Study area: The Bangkok Metropolitan Region (BMR). (**A**) General information of the study area. (**B**) The diverse road environments in the study area.

The Bangkok Metropolitan Region encompasses an area exceeding 7761.60 sq. km. and houses a population of over 15 million people. This metropolitan region is recognized as a hub for diverse activities, including commerce, education, public health, and more. Primarily, the Bangkok Metropolitan Region features a comprehensive transportation system encompassing various travel modes, notably including public buses, a rail mass transit system, rail transport, water transportation, and an air transportation system. Consequently, due to the density and diversity of activities within the city, there is a higher volume of travel compared to other provinces in Thailand. This has resulted in long-standing issues of traffic congestion within the city. Traveling in traffic jams results in significant time wastage and the accumulation of stress which can have detrimental effects on both mental and physical health. Notably, data from a health examination policy involving one million people, with over 100,000 individuals examined, reveal that more than 70% of the individuals experience stress [60]. Given such statistics, it becomes crucial for city planners and administrators to prioritize addressing mental health issues. While these problems may stem from various factors in daily life, Bangkok residents notably identify spending considerable time commuting as a significant concern, highlighting the need for further understanding. The correlation between travel and mental health issues highlights the significance of selecting an appropriate study area. Consequently, the chosen study area is considered suitable, as it will effectively capture various travel-related concerns. This comprehensive understanding of the issues is essential for improving overall quality of life.

3.2. Study Design

This study aims to investigate the correlation between travel satisfaction and perceptions of the streetscape concerning mental health, comparing non-older adults and older adults (refer to Figure 2). Travel satisfaction (TS) serves as a proxy for subjective well-being in the travel domain in this study [59]. Hence, subjective well-being serves as a conceptual framework for assessing mental health through the lenses of travel satisfaction and perception of the streetscape across various age demographics. The survey was conducted between December 2022 and January 2023, spanning a two-month period and involving a sample of 3600 participants. Probability sampling techniques were employed, utilizing a simple random sample method. The sample size was determined using Taro Yamane's formula with a confidence level set at 98% [61]. The samples encompassed individuals residing in and commuting within the BMR including all individuals aged 18 years and above. The questionnaire structure can be divided into four parts, namely (1) socioeco-

nomic characteristics of respondents (including gender, age, education level, and income level), (2) the GDS-15 items (covering feelings of satisfaction with life, diminished interest in activities, a sense of emptiness, boredom, mood fluctuations, apprehension, happiness, helplessness, preferences for staying at home versus going out, memory concerns, perceptions of life's wonder, self-worth, energy levels, hopelessness, and comparative assessments of one's situation against others), (3) travel satisfaction items (including daily mobility, availability of travel opportunities, ease of access to the city center, transportation environment, quality of public transportation services, and satisfaction with travel for leisure activities, daily shopping, and medical appointments), and (4) perception of the streetscape items (comprising cross-sectional proportion, street wall continuity, greenery, openness, and enclosure). The questionnaire underwent design and pilot testing before finalization. Importantly, the study documents were submitted for ethical review and approval by the Human Research Ethics Committee of Thammasat University Social Sciences (certificate of approval number 146/2021, dated 9 June 2022) prior to the commencement of data collection. Data were collected through face-to-face interviews.

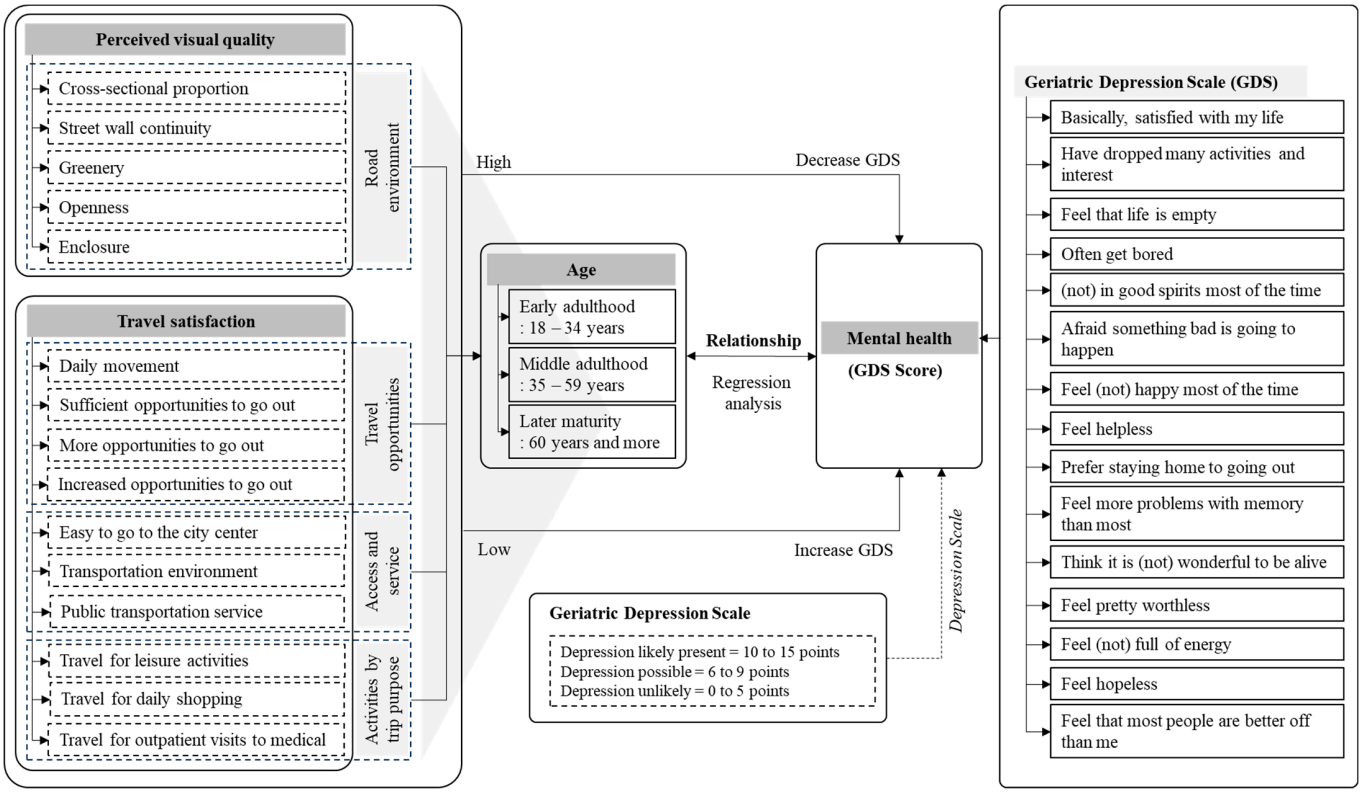


Figure 2. Analytical framework.

3.3. Assessment Instruments

3.3.1. Assessing Mental Health Using the Geriatric Depression Scale

The Geriatric Depression Scale (15-item GDS) was employed to assess mental health. This scale consists of 15 items [20–22]. The GDS-15 item prompts respondents to select the best answer regarding "how they felt over the previous week". The items include feelings of satisfaction with life, diminished interest in activities, a sense of emptiness, boredom, fluctuations in mood, apprehension, happiness, helplessness, preferences for staying at home versus going out, memory concerns, perceptions of life's wonder, self-worth, energy levels, hopelessness, and comparative assessments of one's situation against others [28,62]. It demonstrates high internal consistency with Cronbach's alpha calculated at 0.83. The average score across all items in the GDS was utilized to determine depression. The depression scale is categorized into three ranges which include the following: depres-

sion likely present (10 to 15 points), depression possible (6 to 9 points), and depression unlikely (0 to 5 points) [21].

3.3.2. Exploring Travel Satisfaction and Perception of the Streetscape

Travel satisfaction was utilized to assess travel well-being, reflecting quality of life in relation to transportation. The travel satisfaction questionnaire comprised 10 items assessing the level of satisfaction during travel. These items included aspects such as daily mobility, availability of opportunities to travel, ease of access to the city center, transportation environment, quality of public transportation services, and satisfaction with travel for leisure activities, daily shopping, and medical appointments. It exhibits high internal consistency with Cronbach's alpha calculated at 0.87. Each item was scored on a 6-point Likert scale, ranging from 1 (not satisfied) to 6 (most satisfied). These items were designed to capture aspects related to travel opportunities, accessibility, service quality, and trip purposes. The perception of the streetscape was employed to assess the perceived visual quality of the road environment. This perception comprised five items based on the level of awareness of the quality of the environment during travel. These items include the following. (1) Cross-sectional proportion: evaluating whether the proportions of roads and buildings are appropriate for the activities of the area. (2) Street wall continuity: assessing whether the road is continuous, with no traffic obstructions. (3) Greenery: determining if the road environment is shaded by trees and provides a suitable atmosphere for all types of travel. (4) Openness: examining whether the roads are open and offer clear visibility for navigation. (5) Enclosure: assessing if the road is bordered by buildings at a reasonable distance. It demonstrates high internal consistency with Cronbach's alpha calculated at 0.70. Furthermore, each item was rated on a 6-point Likert scale, ranging from 1 (not perceived) to 6 (most perceived) which were designed to capture aspects related to the perceived quality of the environment during travel.

3.3.3. Differences across Age Groups: A Comparative Analysis

Data were gathered regarding the social and economic characteristics of the sample. In this study, the data on social and economic characteristics served two purposes: (1) to describe and comprehend the social and economic makeup of the sample, and (2) to incorporate age information into the testing according to the model. The age range was categorized into three periods: early adulthood (18–34 years), middle adulthood (35–59 years), and later maturity (60 years and above). This categorization is based on the understanding that while mental health issues are prevalent among the general elderly population, their incidence tends to increase with advancing age [16,41]. However, mental health issues related to depression can manifest at any age. Some studies suggest that younger adults are more susceptible to depression than older adults [44]. In summary, the prevalence of depression varies across the lifespan. Furthermore, traffic conditions also impact commuters across various age groups. Comparing differences across age groups can enhance understanding of diverse needs, thereby reducing gaps in policy recommendations for the planning and management of cities and transportation systems to achieve greater comprehensiveness.

3.4. Data Analysis

This research categorized participants into three age groups: early adulthood (18–34 years), middle adulthood (35–59 years), and later maturity (60 years and above). Therefore, given the multifaceted nature of the factors comprising travel satisfaction and perception of the streetscape, multiple regression analysis was employed. Statistical analyses were conducted by using SPSS Statistics version 28.0. Multiple regression analysis enables evaluation of the strength of the relationship between an outcome (the dependent variable) and multiple predictor variables. It also allows for assessing the significance of each predictor in the relationship, while controlling for the effects of other predictors. This study designs a framework for analysis comprising four different models which exhibit mental health problems, identified by GDS values meeting the cut-off point of 5. Model 1

represents individuals within the early adulthood age group (18–34 years). Model 2 comprises individuals in the middle adulthood age group (35–59 years). Model 3 consists of individuals in the later maturity age group (60 years and above). Model 4 encompasses individuals across all age groups.

4. Results

4.1. Socioeconomic Characteristics and Mental Health-Related Aspects

Before conducting an in-depth analysis, considering the social and economic characteristics of the sample is essential for comprehending the inherent attributes of the individuals, especially considering the variations in context, geographical area, and demographics across previous studies. Thus, understanding the sample data aids in comparing results within similar contexts. Table 1 reveals that more than 69 percent of the sample comprised females, while 31 percent were males by an additional 1 percent identifying with alternative gender identities. The majority of the sample had attained a bachelor's degree (92 percent), representing a foundational level of education. Approximately 4 percent had completed secondary education, while 3 percent had attended vocational college. Regarding economic characteristics, the data on income ranges revealed that over 77 percent of respondents earned approximately THB 10,000 to 25,000 per month, followed by 16 percent earning between THB 25,001 to 40,000 per month, and 4 percent earning between THB 40,000 to 55,000 per month. When considering each age group, it was observed that the majority of individuals across all three age groups held a bachelor's degree level of education (76–93 percent). However, the elderly group exhibited a lower level of education compared to the other groups, with a higher proportion of individuals having an education level below a bachelor's degree; there were no individuals in the sample who had completed a bachelor's degree. In terms of economic characteristics, assessed through monthly income levels, similar trends were observed across each age group. Most income levels fell within the range of THB 10,000–40,000, though some individuals in the middle adulthood age group exhibited a trend towards incomes exceeding THB 85,000. Moreover, the study identified a high prevalence of depression among respondents, exceeding 96.14%. In terms of travel satisfaction, the collected data indicate a notably high average score of 5.17. However, the middle adulthood group reported a slightly lower average score of 5.05 compared to the overall average. Conversely, when examining perceptions of the streetscape, the data revealed a lower average score of 3.97. Specifically, the early adulthood group exhibited an even lower average score of 3.96.

Table 1. Socioeconomic characteristics of respondents and mental health-related aspects.

Main Aspect	Aspect	Age Group							
		Early Adulthood		Middle Adulthood		Later Maturity		All	
		N	%	N	%	N	%	N	%
Gender	Male	388	27.15	723	33.83	4	11.76	1115	30.97
	Female	1033	72.29	1410	65.98	30	88.24	2473	68.69
	Others	8	0.56	4	0.19	0	0.00	12	0.33
Education level	Lower primary school	0	0.00	0	0.00	0	0.00	0	0.00
	Primary school	0	0.00	1	0.05	0	0.00	1	0.03
	Junior high school	7	0.49	21	0.98	2	5.88	30	0.83
	High school	50	3.50	76	3.56	3	8.82	129	3.58
	Vocational college	40	2.80	59	2.76	3	8.82	102	2.83
	Bachelor's degree	1329	93.00	1970	92.19	26	76.47	3325	92.36
	Postgraduate	3	0.21	10	0.47	0	0.00	13	0.36

Table 1. *Cont.*

Main Aspect	Aspect	Age Group							
		Early Adulthood		Middle Adulthood		Later Maturity		All	
		N	%	N	%	N	%	N	%
Income level (baht/month)	Less than 10,000	3	0.21	11	0.51	2	5.88	16	0.44
	10,000–25,000	1096	76.70	1653	77.35	20	58.82	2769	76.92
	25,001–40,000	250	17.49	325	15.21	7	20.59	582	16.17
	40,000–55,000	61	4.27	87	4.07	4	11.76	152	4.22
	55,001–70,000	17	1.19	49	2.29	1	2.94	67	1.86
	70,001–85,000	2	0.14	8	0.37	0	0.00	10	0.28
	More than 85,000	0	0.00	4	0.19	0	0.00	4	0.11
Geriatric Depression Scale (GDS)	Depression unlikely	66	4.62	71	3.32	2	5.88	139	3.86
	Depression possible	999	69.91	1308	61.21	25	73.53	2332	64.78
	Depression likely present	364	25.47	758	35.47	7	20.59	1129	31.36
Travel satisfaction ($\overline{TS}$)			5.33		5.05		5.39		5.17
Perception of the streetscape ($\overline{PS}$)			3.96		3.98		4.11		3.97

4.2. Difference Travel Satisfaction, Perception of the Streetscape and Mental Health by Age Group

Table 2 presents the results of the ANOVA test conducted by the age group. This section aims to analyze the disparities in travel satisfaction, perception of the streetscape, and mental health across different age groups. The analysis revealed significant differences in the average values of travel satisfaction across age groups, with $p < 0.001$ observed in eight factors (TS1–TS6, TS9–TS10) and $p < 0.05$ in two factors (TS7–TS8). Overall, these findings indicate that all factors were statistically significant. The mean difference in geriatric depression was significantly different across age groups at a significance level of <0.001. However, when examining the mean difference in perception of the streetscape, differences across age groups were observed in only two factors, which are street wall continuity (PS2) and openness (PS4), at a significance level of <0.05. Conversely, the factors of cross-sectional proportion (PS1), greenery (PS3), and enclosure (PS5) did not demonstrate statistical significance.

When considering the factors of travel satisfaction, perception of the streetscape, and mental health by age group, as illustrated in Figure 3, it was observed that the later maturity age group exhibited a higher total average of travel satisfaction factors compared to other age groups ($\overline{x}$ = 5.39). Conversely, the middle adulthood age group had the lowest average overall travel satisfaction ($\overline{x}$ = 5.05). Overall, the average satisfaction level was considered to be moderate to high. Additionally, in terms of perception of the streetscape, the later maturity age group presented a higher total average of travel satisfaction factors compared to other age groups ($\overline{x}$ = 4.11). The early adulthood age group exhibited the lowest average overall satisfaction with travel ($\overline{x}$ = 3.96). The summary of data in Table 3 demonstrates the overall level of satisfaction which is considered to be moderate. Additionally, when considering the depression scale, it was observed that the middle adulthood group had the highest depression values, while the later maturity age group had the lowest depression values compared to other age groups.

Table 2. ANOVA test results comparing mental health as assessed by GDS with travel satisfaction and perception of the streetscape across different age groups.

Variables		Sum of Squares	Mean Square	F	*p*-Value
Mental health (GDS)	Geriatric Depression Scale (GDS)	11.485	5.743	20.987	0.000 ***
Travel satisfaction (TS)	Daily movement (TS1)	49.547	24.774	24.700	0.000 ***
	Sufficient opportunities to go out (TS2)	67.801	33.900	35.205	0.000 ***
	More opportunities to go out (TS3)	99.309	49.654	46.948	0.000 ***
	Increased opportunities to go out (TS4)	100.086	50.043	44.453	0.000 ***
	Easy to go to the city center (TS5)	122.324	61.162	52.549	0.000 ***
	Transportation environment (TS6)	53.339	26.670	23.792	0.000 ***
	Public transportation service (TS7)	11.984	5.992	4.935	0.007 **
	Travel for leisure activities (TS8)	18.552	9.276	7.448	0.001 **
	Travel for daily shopping (TS9)	104.050	52.025	56.689	0.000 ***
	Travel for outpatient visits to medical (TS10)	113.343	56.672	45.212	0.000 ***
Perception of the streetscape (PS)	Cross-sectional proportion (PS1)	3.013	1.506	0.834	0.434
	Street wall continuity (PS2)	14.899	7.449	4.728	0.009 **
	Greenery (PS3)	5.731	2.866	1.643	0.193
	Openness (PS4)	27.079	13.539	6.266	0.002 **
	Enclosure (PS5)	6.751	3.375	1.324	0.266

*** < 0.001, ** < 0.05.

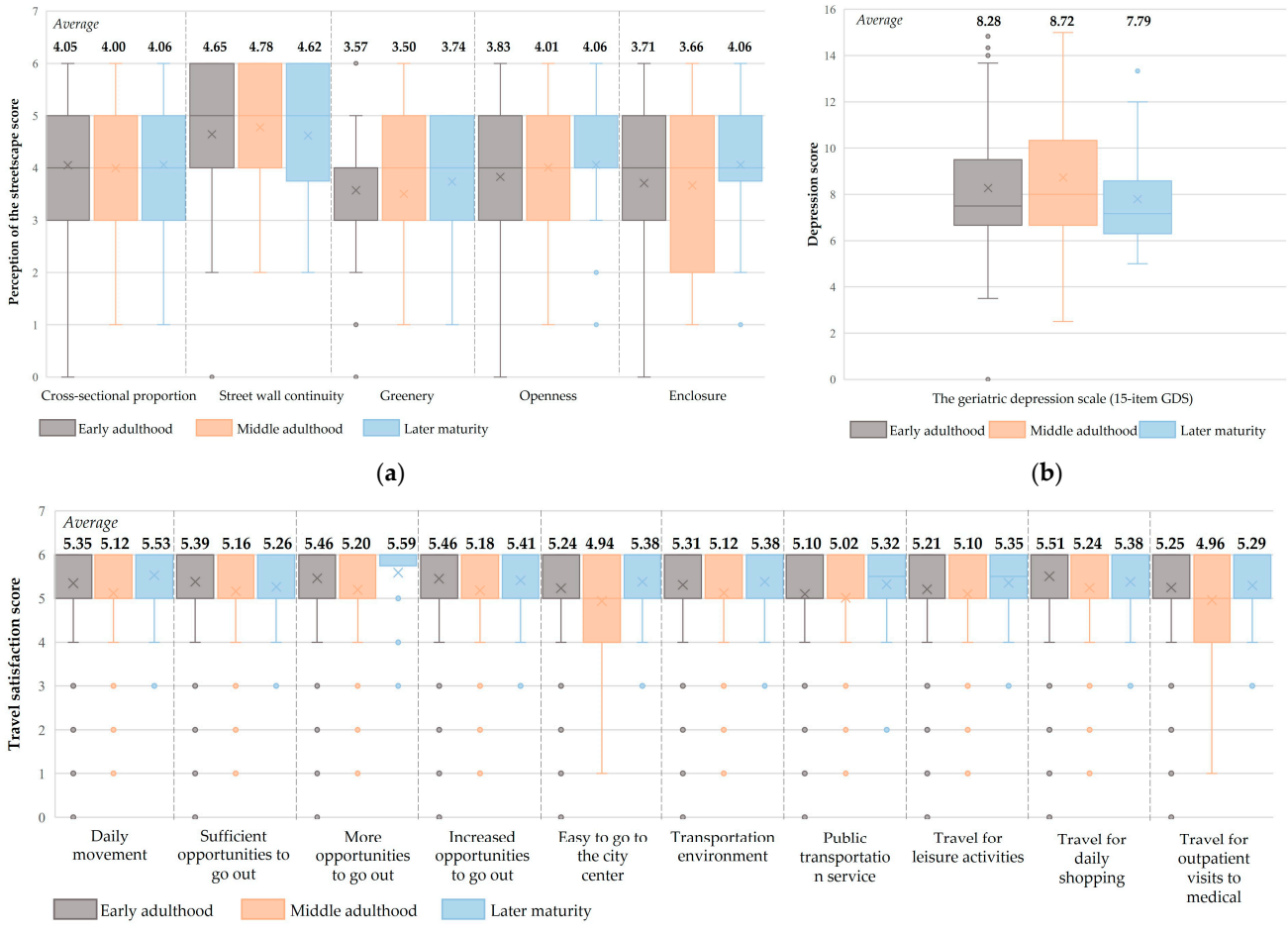


Figure 3. Travel satisfaction, perception of the streetscape, and mental health by depression across age groups. (**a**) Travel satisfaction; (**b**) perception of the streetscape; (**c**) mental health.

Table 3. Mean value of travel satisfaction and perception of the streetscape by age group, and its relationship with mental health with a focus on depression.

Variables		Geriatric Depression Scale (GDS)								
		Early Adulthood			Middle Adulthood			Later Maturity		
		A	B	C	A	B	C	A	B	C
Travel satisfaction (TS)	TS1	5.61	5.49	4.93	5.48	5.28	4.81	5.00	5.76	4.86
	TS2	5.59	5.49	5.06	5.49	5.29	4.76	5.50	5.40	4.71
	TS3	5.71	5.61	5.01	5.63	5.33	4.73	5.50	5.72	5.14
	TS4	5.85	5.61	4.96	5.70	5.33	4.69	6.00	5.64	4.43
	TS5	5.65	5.36	4.81	5.65	5.02	4.52	5.00	5.68	4.43
	TS6	5.42	5.44	4.94	5.37	5.23	4.76	5.00	5.52	5.00
	TS7	5.24	5.17	4.90	4.94	5.05	4.92	5.00	5.36	5.29
	TS8	5.42	5.31	4.91	5.30	5.19	4.86	5.50	5.44	5.00
	TS9	5.77	5.66	5.07	5.73	5.40	4.71	5.50	5.56	4.71
	TS10	5.64	5.40	4.79	5.51	5.06	4.55	5.50	5.48	4.57
Perception of the streetscape (PS)	PS1	4.17	4.08	3.95	4.31	4.06	3.85	5.00	4.24	3.14
	PS2	4.62	4.56	4.90	4.48	4.71	4.92	6.00	4.48	4.71
	PS3	3.82	3.59	3.47	3.83	3.58	3.34	3.50	4.00	2.86
	PS4	3.76	3.74	4.08	4.07	3.93	4.13	5.00	4.36	2.71
	PS5	3.85	3.73	3.63	4.14	3.72	3.52	4.00	4.36	3.00
N		66	999	364	71	1308	758	2	25	7
%		1.83	27.75	10.11	1.97	36.33	21.06	0.06	0.69	0.19

Average High Low

Remark: A = depression unlikely (0 to 5 points), B = depression possible (6 to 9 points), and C = depression likely present (10 to 15 points).

Regarding the mean values of travel satisfaction, perception of the streetscape by age group, and mental health, as shown in Table 3, the Geriatric Depression Scale (GDS) was categorized into "depression likely present" (10 to 15 points) and "depression possible" (6 to 9 points), indicating the presence of depression on the GDS by a cut-off point of 5 or more. Overall, it was observed that the sample group's average travel satisfaction exceeded their perception of the streetscape. Specifically, over 64.78 percent were classified as "depression possible", followed by "depression likely present" at 31.36 percent, with only 3.86 percent classified as "depression unlikely". Analysis of the data revealed that individuals with higher mean levels of travel satisfaction and a positive perception of the streetscape were less likely to experience depression, whereas those with lower mean satisfaction levels and a less favorable perception of the streetscape were more likely to experience varying degrees of depression, ranging from possible to probable.

4.3. Travel Satisfaction, Perception of the Streetscape, and Mental Health with a Focus on Depression

In this section, we examine the relationship between travel satisfaction, perception of the streetscape, and mental health, as depicted in the results presented in Table 4. Analysis of Model 1 data revealed 10 statistically significant factors which include the following: daily mobility (TS1), enhanced accessibility (TS3), increased opportunities for mobility (TS4), ease of access to the city center (TS5), transportation infrastructure (TS6), travel for daily necessities (TS9), cross-sectional proportion (PS1), continuity of street walls (PS2), openness (PS4), and enclosure (PS5). The result of Model 2 revealed 12 statistically significant factors, encompassing the following: daily mobility (TS1), increased opportunities for outings (TS4), ease of access to the city center (TS5), transportation infrastructure (TS6), public transportation services (TS7), leisure travel (TS8), daily shopping routines (TS9), cross-sectional proportion (PS1), continuity of street walls (PS2), presence of greenery (PS3), openness (PS4), and enclosure (PS5). From Model 3, two statistically significant factors emerged: ease of access to the city center (TS5) and openness (PS4). Analysis from Model 4 revealed 13 statistically significant factors which include the following: daily mobility (TS1),

enhanced opportunities for outings (TS3), increased opportunities for outings (TS4), ease of access to the city center (TS5), transportation infrastructure (TS6), public transportation services (TS7), leisure travel (TS8), daily shopping routines (TS9), cross-sectional proportion (PS1), continuity of street walls (PS2), presence of greenery (PS3), openness (PS4), and enclosure (PS5).

Table 4. The relationship between travel satisfaction, perception of the streetscape, and mental health with a focus on depression.

Variables		Mental Health by Age Group											
		Model 1			Model 2			Model 3			Model 4		
		Early Adulthood			Middle Adulthood			Later Maturity			All Ages		
		Beta	Std. Error	Sig.	Beta	Std. Error	Sig.	Beta	Std. Error	Sig.	Beta	Std. Error	Sig.
Travel satisfaction (TS)	TS1	−0.071	0.079	**	−0.043	0.065	*	−0.301	0.805		−0.054	0.050	**
	TS2	0.030	0.087		−0.005	0.070		−0.006	0.728		0.006	0.054	
	TS3	−0.064	0.094	*	−0.033	0.073		0.304	0.815		−0.043	0.057	*
	TS4	−0.130	0.090	**	−0.094	0.068	**	−0.450	0.606		−0.107	0.054	***
	TS5	−0.071	0.075	**	−0.052	0.061	*	−0.083	0.931	*	−0.063	0.047	**
	TS6	−0.086	0.077	**	−0.179	0.066	***	−0.028	0.781		−0.143	0.049	***
	TS7	0.038	0.063		0.135	0.056	***	0.164	0.682		0.096	0.042	***
	TS8	0.031	0.064		0.055	0.058	**	0.018	0.752		0.040	0.043	**
	TS9	−0.157	0.085	***	−0.246	0.065	***	−0.068	0.761		−0.212	0.051	***
	TS10	−0.004	0.075		0.038	0.065		−0.090	0.931		0.024	0.049	
Perception of the streetscape (PS)	PS1	−0.112	0.060	**	−0.072	0.045	**	−0.094	0.699		−0.082	0.035	***
	PS2	0.103	0.053	***	0.090	0.050	***	0.304	0.457		0.097	0.036	***
	PS3	0.015	0.053		−0.056	0.038	**	0.528	0.818		−0.031	0.031	*
	PS4	0.067	0.052	**	0.083	0.040	**	−0.850	0.478	**	0.074	0.031	***
	PS5	−0.051	0.051	*	−0.079	0.036	**	0.282	0.710		−0.068	0.029	***
R		0.433			0.451			0.598			0.448		

*** < 0.001, ** < 0.05, * < 0.1.

5. Discussion

Travel and mobility are crucial elements contributing to an enhanced quality of life [62,63]. Moreover, they significantly impact both physical and mental well-being, particularly in the context of mental health issues which are increasingly prevalent in developing countries [64]. Mental health stands out as a key dimension through which urban residents' quality of life can be assessed [65]. Hence, the relationship between travel and mental health is complex and reciprocal, capable of yielding both positive and negative outcomes on individuals' overall well-being. Regarding the result of the analysis of travel satisfaction, perception of the streetscape, and mental health with a focus on depression across different age groups, this study's findings reveal notable distinctions. Mean variations in travel satisfaction and perceptions of the urban environment vary significantly among age cohorts. While all factors demonstrate statistical significance, attributes linked to public transportation services and leisure travel exhibit comparatively lower levels of statistical significance within the domain of travel satisfaction. This underlines the persistent challenges associated with fostering and enhancing public transport usage, particularly concerning bus services. Despite offering more extensive coverage compared to other modes of public transportation, the quality and reliability of public bus services remain significant areas requiring further enhancement to facilitate overall improvement. The examination of Geriatric Depression Scale (GDS) scores revealed that over 96 percent fell within the depression category, with over 31 percent classified as potentially experiencing significant depressive symptoms, indicated by scores exceeding 10 points. Notably, twice as many individuals were classified under the category of possible depression, characterized by scores of 5 or higher, suggesting an indication of depressive symptoms. Numerous

studies have identified a cut-off point of 5 or more on the GDS as indicative of depression [21,25,26]. When considering the age groups collectively, it was observed that all three cohorts exhibited an average depression score surpassing 7. A threshold commonly presents as an indicative of elevated depressive symptoms with many studies proposing a threshold of 5 or higher for suggestive depression. These findings emphasize the significance of travel planning aimed at fostering living and transportation environments supportive of alleviating travel-induced depression, a condition prevalent across all age groups. Such interventions are particularly crucial for working individuals burdened with multiple responsibilities as they endeavor to create a more positive future.

Regarding exploring the relationship between travel satisfaction and perception of the streetscape on mental health, comparing among difference age group. The R values for each model indicated that Model 3, which focused on the later maturity age group, exhibited higher values compared to the other models, while the remaining models showed similar values. The findings of this study align with previous studies, such as those conducted by Nolen-Hoeksema and Ahrens [45], Li et al. [40], and Li et al. [66]. These studies highlight the importance of considering age differences in the relationship between mental health issues and depression. Regardless of age, individuals may experience depression due to environmental factors, life experiences, and expectations, among other causes. However, the specific factors associated with each age group vary across studies. These differences in factors are reflected in the unique experiences and expectations that each age group encounters in their daily lives. Life changes and stressors from daily life are reflected in the varying prevalence of depression across the lifespan. Regarding the relationship between travel satisfaction and mental health by focusing on depression across different age groups, the study yielded two noteworthy findings: Firstly, it was observed that higher levels of travel satisfaction were associated with lower scores of depressions, indicating a negative influence on mental health. However, of particular interest were the statistically significant findings related to satisfaction with public transportation services and leisure travel activities, which exhibited a positive influence on depression scores. Specifically, increased satisfaction in these areas correlated with higher depression scores. These results diverge from previous studies suggesting that access to recreation and leisure activities contributes to good mental health. For example, Gao et al. [67] found that participation in leisure activities was significantly and negatively associated with depression among middle-aged and older individuals. However, considering the perspective of activity theory, commonly utilized to elucidate the relationship between activity participation and mental health, it is proposed that engagement in activities can mitigate the risk of depression [68,69]. A second interesting finding concerns the disparity in the number of sub-factors of travel satisfaction that significantly influenced each age group. It was observed that in the early adulthood and middle adulthood age groups, as many as 6–7 out of 10 factors were statistically significant. However, upon examination of age group disparities, it was revealed that within the later maturity (older adult) cohort, only one factor significantly impacted depression, namely, ease of access to the city center. This discrepancy contrasts with the findings identified in the early adulthood and middle adulthood age groups. In concordance with Nolen-Hoeksema and Ahrens [45], this suggests that age differences are related to depression. The differences are sub-factors, representing specific life events that people experience, or concerns that vary across the adult life span. The middle adulthood cohort has the highest number of sub-factors relating to travel satisfaction. This age group is commonly associated with a higher frequency of travel and road usage compared to other age demographics. The findings of this study align with those of the study by Zhu et al. [58], by focusing on investigation into the well-being of older individuals with regards to travel and health. Their study evaluated satisfaction across various domains. It revealed that well-being, and consequently, the quality of travel experiences, are dependent on access to essential activities such as education and healthcare services.

In terms of the relationship between perception of the streetscape and mental health with a focus on depression across different age groups, the study yielded several intrigu-

ing findings. Firstly, it was observed that certain factors related to the perception of the streetscape were significantly associated with negative influences on mental health, such as the presence of greenery. This highlights the importance of creating environments that promote good mental health. Secondly, notable differences were observed in the influence of perception of the streetscape on depression across various age groups. The later maturity group was the only age group in which a factor related to the perception of the streetscape had a positive effect on mental health, contrasting with the negative influences observed in other age groups. This factor, namely "openness", played a pivotal role in fostering a sense of safety during travel, stemming from perceptions of open roads and clear visibility. Moreover, the openness factor may indirectly reflect issues related to the density of activities associated with the liveliness of the local environment. Finally, in the age group of later maturity, comprising individuals aged 60 years and older. The samples exhibited higher average levels of satisfaction with travel and perception of the streetscape compared to other age cohorts which confirmed a finding consistent with the study by Kim et al. [57]. It demonstrates that older individuals generally report higher levels of travel satisfaction. Notably, ease of access to the city center and openness of the streetscape emerged as statistically significant factors influencing depression within the later maturity age group. As individuals age, there is an increased preference for convenience and ease of travel to access various urban activities, including navigation along open and clearly visible roads, which serves to alleviate the stress associated with travel. Considering the correlation between travel preferences, perceptions of the urban environment, and mental health, urban planners must prioritize the design and planning of cities that seamlessly integrate both activity spaces and transportation systems. This results in allocating resources to establish easily accessible and high-quality public transportation systems. Finally, it is imperative to prioritize addressing the multifaceted needs of older adults, with particular attention to mental health and transportation provisions. As the commuter demographic increasingly shifts towards older age groups, there arises an urgent demand to tailor infrastructure and services to meet their requirements. Neglecting these imperative considerations not only undermines the well-being of older individuals but also compromises the overall sustainability and inclusivity of transportation systems. Hence, the integration of comprehensive strategies aimed at strengthening the mental health support framework within transportation planning emerges as a crucial requirement for ensuring the enduring sustainability of societies, particularly those undergoing significant demographic transitions, such as Thailand's aging population. By thoroughly considering the mental health implications of travel for older adults, construction initiatives can significantly contribute to the development of more sustainable and equitable societal landscapes, enhancing both infrastructure and urban development.

6. Conclusions

Mental health issues constitute a significant concern for city planning and development. These problems can arise from various factors encountered in daily life, with travel being one such factor that can exert both positive and negative effects on mental well-being. The findings of this study reveal that travel satisfaction and perception of the streetscape significantly influence mental health outcomes, specifically depression, and highlight variations in stressors across different age groups. However, this study is subject to limitations arising from its reliance on subjective assessments of well-being, which focus on individual feelings regarding travel experiences and perceptions of the road environment. Depression, as one of the mental health problems, is not solely attributable to a single factor which may be influenced by numerous factors, including those related to the road environment and travel effects. This study contributes to bridging the gap and advancing our understanding of the contextual factors within the travel environment and their potential impact on depression. It highlights interesting findings both congruent with and divergent from previous research. Given the variability in study contexts, it is important to note that the results of this study may not encompass all etiological factors of mental health. Nonetheless, the

identification of specific factors related to travel satisfaction and the road environment suggests potential links to mental health issues associated with depression. Hence, future research should incorporate objective measures to enhance the robustness of the study findings. Additionally, emphasis should be placed on ensuring the reliability and validity of comprehensive assessments. Past studies have indicated that while assessments may possess excellent reliability and validity, uncertainties persist, which can vary according to the scale of deployment and the setting.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved from the Human Research Ethics Committee of Thammasat University Social Sciences (certificate of approval number 146/2021, 9 June 2022).

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