INTERNATIONALISLAMICUNIVERSITY ISLAMABAD

Analyzing Factors Affecting the Traveller's Well-Being and Commuting Behaviour

THESIS SUBMITTEDTO

DEPARTMENT OF CIVIL ENGINEERING INTERNATIONALISLAMICUNIVERSITY,ISLAMABAD

FORTHEAWARDOFDEGREEOF

MASTEROFSCIENCE

IN

CIVILENGINEERING

SubmittedBy

MOHAMMAD NOMAN AZIZ12-FET/MSCE/F22

JAN2025

Dedication

I dedicate this thesis with profound gratitude to my beloved parents, whose unwavering support, selfless sacrifices, and constant prayers have been the bedrock of my journey. They have always prioritized my future, making countless sacrifices for my well-being and instilling in me strong moral values. I also extend this dedication to my esteemed teachers, whose invaluable guidance and unwavering encouragement have been a constant source of inspiration and knowledge throughout my academic pursuit.

CERTIFICATEOFAPPROVAL

Analyzing Factors Affecting the Traveller's Well-Being and

CommutingBehaviour

SubmittedBy

Mohammad Noman Aziz

12-FET/BSCE/F22

ThesisExaminationCommittee

S.No.	Examiner	Name	Organization
(a)	ExternalExaminer		
(b)	InternalExaminer		IIU,Islamabad
(c)	Supervisor	Dr.Muhammad ArsalanKhan	IIU,Islamabad

_____

Engr.Dr.Muhammad Arsalan Khan

Thesis Supervisor

_____ _____

Mohammad Noman Aziz   Engr.Dr.RashidFarooq
Student   Head
Dept.ofCivilEngineering   DeptofCivil Engineering

Author's Declaration

I, **Mohammad Noman Aziz**hereby state that my MS thesis titled "Analyzing Factors Affecting the Traveller's Well-Being and Commuting Behaviour" is my work and has not been submitted previously by me for taking any degree from International Islamic University, Islamabad or anywhere else in the country/abroad.

At any time if my statement is found to be incorrect even after my graduation, the University has the right to withdraw my MS Degree.

_____

Mohammad Noman Aziz

12-FET/MSCE/F22

Plagiarism Undertaking

I solemnly declare that the research work presented in this thesis titled "Analyzing Factors Affecting the Traveller's Well-Being and Commuting Behaviour" is solely my research work with no significant contribution from any other person. Small contribution/help wherever taken has been duly acknowledged and that complete thesis has been written by me.

I understand the zero-tolerance policy of the HEC and International Islamic University, Islamabad towards plagiarism. Therefore, I as an author of the above-titled thesis declare that no portion of my thesis has been plagiarized and any material used as reference is properly referred/cited.

I undertake that if I am found guilty of any formal plagiarism in the above-titled thesis even after awarding of MS Degree, the University reserves the right to withdraw/revoke my MS degree and that HEC and the University have the right to publish my name on the HEC/University website on which names of students are placed who submitted plagiarized work.

_____

Mohammad Noman Aziz

12-FET/MSCE/F22

Acknowledgments

I begin by expressing my profound gratitude toALLAH ALMIGHTY, whose divine grace and guidance provided me with the strength, wisdom, and perseverance necessary to complete this research endeavor. I am deeply indebted to my beloved parents for their unwavering support, constant prayers, and endless encouragement, which have consistently formed the foundation of my achievements. Their constant prayers for my success have been a tremendous source of motivation.

I extend my sincere appreciation to **Dr. Arsalan Khan**, my supervisor, for his expert guidance, insightful remarks, and invaluable technical support throughout this research. His unwavering enthusiasm and keen interest in my progress were instrumental in keeping me engaged and motivated, transforming this challenging process into a fulfilling experience. It has been a privilege to have worked under his mentorship. May Allah Almighty bestow upon him countless blessings.

Lastly, I would like to thank all my best wishes for their unending love and support.

Table of Contents

List of Figures

List of Tables

Abstract

This study examines the multifaceted relationship between transportation behavioral choices and traveler well-being, emphasizing the integration of subjective well-being into transportation planning. Traditional transportation models often focus on objective factors such as cost and travel time, overlooking the emotional and behavioral dimensions that influence mode choice. Using data from the American Time Use Survey (ATUS), a comprehensive set of 17 travel-related variables was analyzed. These variables were clustered into five categories: well-being emotions, travel behavior, household factors, personal factors, and occupational factors, to contextualize their influence on traveler well-being. The study employed decision tree algorithms, binary logistic regression, and generalized ordered logistic regression to identify key determinants of travel happiness and well-being. Decision tree analysis identified travel partners, age, rest, household income, health, and employment status as significant factors. Binary logistic regression highlighted the roles of travel partners, age, income level, and rest, while generalized ordered logistic regression emphasized the importance of rest, household income, and age-related factors. Across all analyses, rest and age consistently emerged as pivotal determinants of traveler well-being. By integrating subjective well-being into transportation planning, the findings highlight the potential to design sustainable and inclusive transportation systems that enhance life satisfaction. This study provides actionable insights for policymakers to align infrastructure development with societal trends, cultural norms, and technological advancements.

Keywords: Traveler's Well-Being; Commuting Behavior; Mobility Behavior; Subjective Well-Being; Travel Companionship; Emotional Well-Being

Chapter 01: Introduction

Transportation networks form the backbone of modern society and fulfill an essential role in providing the means and opportunities for mobility and connectivity among various geographies, economies, and social groupings. They are critical for the stimulation of economic growth, participation in social interaction,development of people, and successful utilization of such basic services as employment, education, healthcare, and recreation [1].

Transportation networks link up urban centers, towns, and rural areas, enabling travel across physical distances to enhance opportunities for development and strengthen community ties [2].These have a tremendous impact on how people spend their time, how they work together, and indeed the quality of their lives. The importance of transportation networks in enhancing subjective well-being is illustrated in research by Zhu et al. [3] that shows that life satisfaction is enhanced by commute satisfaction, which depends on travel mode and experience. Traditionally, transportation planning was generally assessed by cost, efficiency, or speed [4].However, modern research suggests that subjective travel experiences play an important role in how people perceive and select mobility options.

Subjective well-being is increasingly important for transportation planning, which relates to the way people perceive and think about their life satisfaction. Travel choices are not only influenced by factors like comfort, convenience, safety and environmental sustainability [5], [6],but also travel choices are related to people's overall satisfaction with the experiences from their commuting. This relationship is recognized and allows transportation planners to adopt a more human-centered approach, designing infrastructure that will meet the needs and desires of a variety of

people [7].Well-being is a complex thing. Cognitive evaluations of life satisfaction, as well as other emotional states such as happiness, stress, and frustration, all make it part of this. Overall well-being and life satisfaction is improved with positive emotions (relaxation and contentment) and worsened with negative emotions (stress and fatigue) [8],[9].

The concept of travel well-being encompasses the emotional and psychological experiences that individuals encounter during their journeys. This aspect of well-being is vital yet frequently overlooked, highlighting its significance in understanding the overall impact of travel on individuals[10]. The dimension is found to be significantly influenced by factors such as travel duration, commuting mode and perceived travel comfort. Short, comfortable commutes using active modes, such as walking or cycling, are associated with improved physical and mental health.Extended trips characterized by traffic congestion and delays often lead to feelings of frustration and dissatisfaction among travelers[9],[11].Manaugh and El-Geneidy[12] analyze travel patterns, routines, and decision-making, highlighting the added value of walkers who are driven by environmental and health benefits. The findings reveal that these individuals report higher satisfaction levels, highlighting the importance of considering diverse motivations for active travel modes in transportation planning and their commuting experiences. Recognizing this relationship enables transportation planners to adopt a more human-centered approach, crafting infrastructure that accommodates diverse needs and aspirations [7]. Well-being is inherently multifaceted, encompassing mental, emotional, and physical health. It includes both cognitive evaluations of life satisfaction and emotional states like happiness, stress, and frustration. Positive emotions, such as relaxation and

contentment, enhance overall well-being and life satisfaction, while negative emotions, like stress and fatigue, have the opposite effect [8], [13].

A critical yet often underestimated aspect of well-being is travel well-being, the emotional and psychological experiences individuals have during travel [10].

Research shows that various factors, such as travel duration, mode of commuting, and perceived comfort, play a significant role in influencing this aspect. For example, short and enjoyable commutes using active modes like walking or cycling can enhance both physical and mental well-being. In contrast, long and stressful journeys often marked by traffic congestion and delays tend to lead to feelings of frustration and dissatisfaction[11], [13]. Manaugh and El-Geneidy[12]analyzing travel patterns, routines, and decision-making processes offers valuable insights into mobility. Additionally, it is noteworthy that individuals who walk for environmental and health-related reasons tend to report higher satisfaction levels. This underscores the importance of acknowledging the diverse motivations for active transportation modes in the planning of transportation systems.

Investigating travel patterns, courses, and choices provides insight into mobility behavior, which is influenced by travel decisions and constraints related to time and cost, among other factors. Additionally, broader social trends, including technological advancements, cultural influences, and policy measures aimed at promoting sustainable consumption, play a significant role in this context. Wiradnyana et al. [14] analyzed transportation behavioral intentions among domestic tourists in Southeast Asia, highlighting income and travel companions as key indicators in travel choices. The ATUS also provides important insights into travel behavior with comprehensive

survey information detailing time use and, thus, time spent on travel [7]. Subjective well-being approaches can further be used in systematic analysis, including measuring changes in psychological and emotional status by promptly identifying the domain where transport systems need improvement [15]. Information generated from this data presents features of interest like the correlation betweencommuting time and well-being. Extended commuting times are often associated with heightened levels of stress and fatigue, while shorter, more pleasant journeys are linked to increased overall satisfaction and a better quality of life [9].

Commuting behavior has a considerable impact on people's quality of life. This is because factors like the mode and frequency of transport, the time spent on traveling, as well as the quality of experience have long been linked to the mental, emotional, and physical well-being of individuals [2], [16]. Traffic congestion and journey time delays or discomforts lead to such undesirable effects as fatigue and increased stress levels and have a detrimental effect on productivity at work and social life.

Choi et al.[17] asserted that extended travel times significantly diminish both quantitative experience satisfaction and cognitive self-approval. Furthermore, it has been highlighted that reducing travel durations contributes positively to subjective utility. On the other hand, active commuting practices like walking or cycling give clear benefits, for instance, better cardiovascular health, lowered dangers of chronic diseases, and reduced stress. Furthermore, exposure to outside environments during active commute not only promotes relaxation, but also improves mood, and improves cognitive function and leads to increased overall well-being[9].It is essential for transportation planning and policy-making to recognize the connection between mobility behavior and well-being. Factors such as commuting mode, trip frequency,

and route selection all influence daily travel and are shaped by both economic considerations and individuals' perceptions of themselves as tourists, as well as their overall satisfaction. Planners, policymakers, and stakeholders involved in urban transport systems must understand these human factors to create systems that effectively meet the diverse needs of individuals and communities.

Sustainable transportation systems offer additional societal advantages that extend beyond the metrics of enhanced personal well-being.Promoting the use of environmentally friendly modes of transport like walking, cycling, and use of public transport eases traffic congestion, pollutes the natural environment, and reduces the effects of environmental pollution. Additionally, the implementation of Information and Communication Technologies (ICTs) could majorly decrease the amounts of mobility and travel thus leading to more sustainable urban habitats [18].

Cheng et al., [19]suggested that increased PT accessibility has an explicit effect of decreasing mental health issues and has further positive impacts on life satisfaction and well-being. They promote more sustainable, improved urban settings within the context of serving global sustainability goals. Moreover, focusing on the requirements of special categories of population and, therefore, ensuring equal transport opportunities for the generations and categories that can most of all need the assistance of otherlow-income people, the elderly, and the disabled, will help to maintain social cohesion. This research examines the relationship between commuters' behavior, mobility, and traveler satisfaction, drawing on time-use data obtained from the 2013 American Time Use Survey (ATUS). As proposed in [20], the computational paradigms designed are reliable methodologies to evaluate transport modalities and their impact on quality of life. It defines the relationships between other essential aspects of traveling, including the duration of travel, transportation

10

behaviors, decisions and social factors affecting travelers' well-being. By using complicated analyzing tools such as decision tree analysis and logistic regression, the study identifies critical trends and patterns[1]. The conclusions raise an awareness of the importance of bringing matters of well-being into the mainstream of transport missions and infrastructures[8].Clear examples include reducing transport time, increasing comfort in public transport systems, and encouraging the use of active and environmentally friendly means of transport to enhance the physical and emotional well-being of the public, while at the same time fostering social inclusion. The study, therefore, recommends a shift from a conventional cost and efficiency approach in the planning of transportation systems to a traveler-centered approach.

1.1. Research Problem

Existing transportation models primarily rely on objective factors such as travel time, cost etc., overlooking the complex relationship between individual well-being and mode choice. Consequently, a significant gap exists in comprehending how subjective well-being dimensions contribute to transportation choices. This research seeks to address this critical gap by investigating the impacts of traveller's well-being on mode choice decisions and, conversely, how these decisions influence the overall well-being and satisfaction of travellers.

1.2. Objectives of the Research

The objectives of the study are as follows:

1. To categorize and analyze travel patterns based on trip purposes and mode preferences.

2. To systematically identify and characterize the psychological and emotional aspects of traveller's well-being that are relevant to commuting behaviour.

3. Utilizing statistical analysis and machine learning to examine the dynamic relationship between traveller's well-being and mode choices.

1.3. Significance of the Research

This study seeks to address a notable research gap by contributing to the existing body of knowledge in transportation. It aims to provide a much-needed conceptual framework that examines the influence of subjective well-being on commuting behavior.Conventional models usually overlook this concern, which blindly focuses on travel time and cost variables. This study enhances the examination of utility associated with travel behavior by incorporating psychological and emotional aspects of subjective well-being (SWB).

The information obtained in the framework of this research can develop better transportation planning and make suitable policies. This research builds a strong mobility framework by expanding the knowledge learned from studying time and place restrictions on daily travel and mental health.This study aims to prioritize human orientation, significantly enhancing movement capacity, quality of life, psychological health, and objectively measured health outcomes. The advancement of sustainable and active transportation methods, such as walking, cycling, and public transit use, aligns with the global sustainability agenda. Furthermore, these initiatives enhance the resilience of urban environments in adapting to future challenges. In addition to covering traditional demographic concerns, such as gender, age and income, the study also addresses mobility challenges and solutions for specific

groups, such as the elderly, financially constrained people and the disabled, thus helping to level the playing field and provide more equal social opportunities.

Using the methods of decision tree analysis and logistic regression, this study presents practical recommendations for designing efficient, effective and welfare-focused transportation policies. This represents a significant shift from conventional transportation planning models, which primarily focus on service delivery and pricing considerations. This approach leads to a better, more connected and sustainable society in terms of well-being. In addition, the research fits under the United Nations Sustainable Development Goals (SDGs) because it encourages model choices that improve well-being. Specifically, it supports Goal 11: Sustainable Cities and Communities by advancing inclusive and sustainable urban mobility and Goal 13: Climate Action by encouraging low-emission and environmentally friendly transportation options.

Chapter 02: Literature Review

2.1. Background

Transportation research hasfocussed on traveler well-being to understand how mobility affects overall quality of life. In the past, transportation planning analyzed basic data points, including travel duration and financial costs. Research shows our mood and mental health directly influence travel behaviour, and our experiences on the road influence how we feel afterward. The research explores how transportation planning has shifted its focus from practical metrics to understanding how journeys affect individual well-being and which factorscontribute to this effect.

2.2. Subjective Well-being

Subjective well-being encompasses feelings of happiness and stress, as well as our overall life satisfaction. Transportation research utilizes subjective well-being data to assess how transportation systems impact travelers' lives [11].

Studies by Zhu et al. [9]demonstrate that the way people travel directly affects their mood because cycling and walking make them feel happier. The combination of exercise,exposure to nature, clean air and achievement helps people maintain their mental health during these actions. Travel by vehicle demands passengers to be still throughout the journey which results in disappointment and tiredness, supporting better transportation planning[8]. De Vos et al.[21] discovered that people feel most satisfied when their traveling goals match the fun activities they experience along the way.

According to Chen et al. [22], travelers' emotional state during trips directly influences different aspects of their daily happiness, including social bonds and

health. People who enjoy their commute feel better able to manage their work and personal lives while participating in social activities. Transportation policies must emphasize building well-being-oriented features in transportation systems.

Modern transportation design prioritizes traveler satisfaction ahead of basic travel duration and cost. Achieving good feelings for users alongside smooth system running is prioritized. According to François et al. [23] basic transportation planning measures hold value but neglect to measure how travelers actually feel when dealing with traffic congestion or finding delight in scenic views. The existing measurement system indicatethe need to develop travel metrics that consider each traveler's unique requirements. Morris and Guerra [1]found that traveler satisfaction with their transportation experience tells us more about system quality than just time measures. Updates to station appearance and real-time info enhance traveler experience regardless of travel time stability[24]. Adding measures of passenger satisfaction to our evaluations of transportation systems and their improvements is necessary. De Vos et al. [21] demonstrate that transportation systems need to perform functions while providing emotional benefits to users. Adopting emotional measurements for sustainable transport meets equity targets but requires efficient methods to combine subjective experiences with monetary valuations.

2.3. Factors Influencing Traveler Well-Being

Different aspects influence traveler well-being, including physical and mental relaxation, wellness and relaxation in body and mind, experiences with people, and soothing activities. Understanding how these aspects combine to influence people's emotions during travel, which guides transportation designers to create systems that meet user requirements.

2.3.1. Psychological and Emotional Dimensions

A traveler's mental state and emotional health determine their overall well-being during trip experiences. Emotional states while travelling affect both your perception and response to your daily commute. Scientists in Budapest discovered that transit systems designed for cleaner and less crowded travel create happier and healthier commuters making sustainable transportation necessary[25].Studies show that happy and relaxed feelings boost our overall health but feelings of stress and anxiety hurt it. Public transit riders reported lower satisfaction and increased stress according to Chen et al.'s[22] findings when journeys are long and the system becomes overcrowded. Riding a bike leads riders to enjoy better emotional feelings compared to other transport options. Zubair et al.[26] found that when people feel their journeys hold meaning they usually feel more pleased with them. Better travel policies that cut journey times and upgrade train services help people feel better about themselves.

According to De Vos et al.[21], when people perceive their travel as useful or enjoyable, they experience better emotional outcomes. Our mind state affects how we move around and demands transport networks that satisfy our emotional needs. Moving people faster on reliable public transit systems increases their general satisfaction in life.

2.3.2. Physical Health and Restfulness

Physical health without rest breaks can impair how travelers feel during and after their trips. Travelers with good rest feel better emotionally and handle travel challenges more efficiently than inactive drivers [9], [1]. The evidence from [23]demonstrates that physical pain from extended travels can harm how travelers experience their trips. Supporting activities like walking and developing effective

public transit systems that reduce physical strain are necessary for better traveler health.

2.4. Social Dynamics and Companionship During Travel

SocialPeople feel better during travel and have a better time when traveling with friends and family. Zhu et al. [9]found that traveling with family and friends makes people happier because these trips build strong bonds and valuable experiences together. Solo travelers struggle to maintain consistent happinessbecause they don't have anyone to rely on. According to François et al.[23] , travelers experience better travel satisfaction and improved experiences when they maintain their safety feelings and make social connections with community members. Studies by De Vos et al. [21] show that meeting people along the way makes travel more useful and fun. Chen et al.[22]found people gain less emotional value when they travel to work with colleagues compared to family members or friends. Transportation providers must design services that benefit families and maintain public areas securethat appeal to everyone using these systems.

2.5. Commuting Behavior and Emotional Well-Being

Scientists who research transportation behavior now evaluate how travel to work impacts our mental health.Traveling back and forth to work or other locations brings physical exhaustion and emotional discomfort to our lives. Businesses must study how people use their cars and buses to plan transit systems that improve their daily life quality. This part investigates these impacting factors, especially focusing on how active transport affects health and how income and work status affect commuting satisfaction.

2.6. Role of Travel Mode, Trip Duration, and Trip Purpose

Studies show that walking and cycling create more happiness than driving and transit because these travel options reduce stress associated with traffic congestion factors[9]. Research by Morris and Guerra[1]found that taking longer trips by bus makes people unhappier and more stressed than when taking trains. People experience greater joy during shorter trips they take for fun compared to extended ones.

Work-related journeys often induce stress, while personal vacations bring greater pleasure[21].When people travel specifically for personal goals they experience greater trip satisfaction than when they don't have personal connections to the trip[23].

2.7. Impact of Income and Employment Status on Commuting Satisfaction

Household incomes directly affect how people experience their daily travel to work. People with higher incomes enjoy shorter and less stressful commutes because they can choose from better transportation services [21]. People with lower incomes must cope with crowded transit services while traveling longer distances because they lack enough money.

People develop more satisfaction with their trips based on how they earn their income. People who work full-time regularly must follow strict work hours and make longer trips to work, which increases their stress and decreases their satisfaction with life. People having part-time jobs or flexible schedules experience greater well-being[22]. Morris and Guerra [1]suggested that employees who can choose when and where they work feel less stressed from commuting. Earning power and work status create multiple problems at the same time. High-income people who work part-time

and have flexible schedules report better travel satisfaction, but low-wage employees with fixed schedules must commute longer and have fewer options.

Social life patterns, community values, and family life affect how people travel. Cultural norms and social trends affect how people move from place to place, which directly impacts overall community health. Research on transportation helps us create better travel systems when we understand how society uses technology and learns to adapt to changing community practices. The types of daily activities people engage determine socioeconomic group travel behaviors. Eriksson et al. [2]examined how groups and personal needs drive travel behavior, especially when workers and students stick to consistent routines that maintain permanent traffic needs.

2.8. Cultural Norms and Technological Advancements Shaping Travel Behavior

Travel behaviors depend strongly on cultural values because family-focused communities prefer to travel for social and recreational purposes. People make transportation choices based on their ideas about time. Real-time transportation updates boost passenger satisfaction by providing accurate trip timing information[22]and electric-autonomous vehicle traits redefiningurban development patterns. Rising remote work popularity has made fewer people need traditional commuting options to reach their offices.

Household characteristics such as income and living arrangements strongly affecttravel decisions. Children impact travel needs differently with school and activities that push families toward using private vehicles when community transportation options are limited. Lower-income families have restricted movement because they mainly use limited public transit options. Wealthier households benefit

from many travel choices,but these households should embrace electric vehicles and rideshare programs to lower their impact on the environment [23].

When living alone people travel mainly for fun experiences but when family members share a home, they need to move between work and grocery locations [2]. Transportation planning needs to account for differences within each home environment. Transportation systems need planning that meets the different transportation requirements of different household types.

2.9. Methodologies in Assessing Travel Well-Being

The investigation of travel well-being needs research tools that combine complete data sources with updated analytical methods and a clear assessment of their positive and negative points. This section explains the suitability of decision tree and logistic regression methods for analyzing travel well-being patterns.

2.9.1. Use of Datasets like the American Time Use Survey (ATUS)

The American Time Use Survey offers valuable insights into individuals' travel behaviors as well as their overall well-being. This comprehensive survey captures daily activities, detailed travel patterns, while also measures respondents' happiness levels, stress, and fatigue. Research by De Vos et al.[27]shows that ATUS dataset gives scientists an excellent chance to explore how people travel while also studying their social life and well-being connections. The ATUS dataset gives researchers valuable insights about how people emotionally respond to different ways of travel. Eriksson et al.[2]reveals that ATUS data helps scientists understand how different travel choices affect a person's emotions. ATUS tracks both what travelers experience on trips and their emotional response to movements as part of its research on travel and quality of life.

2.10. Decision Tree and Logistic Regression Analyses in Travel Studies

Decision tree analysis allows transportation researchers to identify key travel factors, such as trip duration and travel companionthat are essential to understand and map out. Logistic regression helps discover positive emotions by showing which predictors of rest and transportation choices matter most. Both approaches reveal essential details about travel behavior and experiences that drive effective improvements for travelers.

2.11. Impact of Socioeconomic Variables on Mobility Choices

How people travel and respond emotionally during their trips depends on their current financial condition. People enjoy traveling better when money and work status determine both the travel choices they make and the amount of stress they face. Those with larger incomes have better travels because their money lets them use transport systems that work better and make them feel more relaxed[23].People in lower-income groups suffer from transportation problems on public transit, such as crowded rides and late service times, which make their travel more stressful [2].

Job position greatly impacts the drive schedule and travel time. When working full-time employees follow strict work hours and travel great distances which reduces their total health and quality of life. Their work flexibility and autonomy make part-time workers happier with their travel options [27].

Having more education makes people better travel choices because it lets them travel when and how they want. People who have attended more years of school

prefer active transportation choices that help them emotionally and physically while reducing environmental damage [27]. People with less education have both small amounts of money for travel and limited knowledge of their travel options.

Racial minorities experience insufficient transport options plus longer rides which make them feel irritated [23]. The choices women make during travel create added stress from multitasking and safety worries that restrict their available modes. Women who belong to minority groups experience more difficulties due to their combined race and gender situation.

Results show that why we must create transportation rules that protect all users and make public transit available to everyone. Public transportation security needs improvement alongside affordable transportation options to balance opportunities across communities [27].

2.12. Research Gap

Research shows progress in how people travel and feel, yet there is significant gap. The study of travel factors has focused mainly on practical details yet researchers do not assess how happiness and other mental states affect the entire travel process [23].According to De Vos et al.[27], to understand how ecological transportation methods influence emotions research needs to explore further.

Travel studies tend to focus on one discipline and overlook important insights that psychology and sociology provide about personal well-being. Combining quantitative research methods with qualitative exploration as De Vos et al.[27] and Eriksson et al.[2] recommend enables better analysis of how society impacts both transport and human well-being resulting in better transportation solutions.

2.13. Summary

The latest research develops how transportation impacts personal happiness instead of just examining travel speed and expenses. Travel mode choice combined with the length of the trip, social contact, and income powerfully shape how happy travelers feel when they travel. However, significant research gaps remain. Research about travel stress and satisfaction needs expansion to include security features and link-building alongside how sustainable choices affect a person's well-being. Research produced limited insights about travel well-being because few studies combine multiple research methods. Research gaps hinder transportation systems that meet everyone's well-being needs. We need to combine different viewpoints and look at subjects beyond mainstream travel. Transport research now puts greater importance on how travel makes passengers feel as well as statistical measures such as travel time and expense. How travelers interact with transportation systems depends strongly on their transportation habits as well as social contact and money income combined with travel time and distance. Our understanding continues to develop, but several important research areas still need further study. Research mostly focuses on how travel stress and happiness affect people when it overlooks safety concerns and the emotional benefits of eco-friendly transportation. Research benefits would improve if different types of studies work together.

Chapter 3: Methodology of Research

3.1. Background

The research used data from the 2013 American Time Use Survey (ATUS) to examine how people's travel activities affect their overall life satisfaction. A comprehensive and multi-phase methodology was followed to ensure the reliable and goal-oriented outcomes. Data was collected before cleaning and choosing variables for analysis, thenstatistical tools were applied to interpret the data findings.

3.2. Data Collection

The 2013 ATUS database contained several different files that provided complementary perspectives for analysis. These different data sets helped researchers understand how participants used their time and how well they felt. Seven distinct files including: Activity File, Respondent File, Roster File, Who File, CPS File, Well-being Activity File, and Well-being Respondent File emerged to provide a comprehensive analysis of factors impacting well-being.
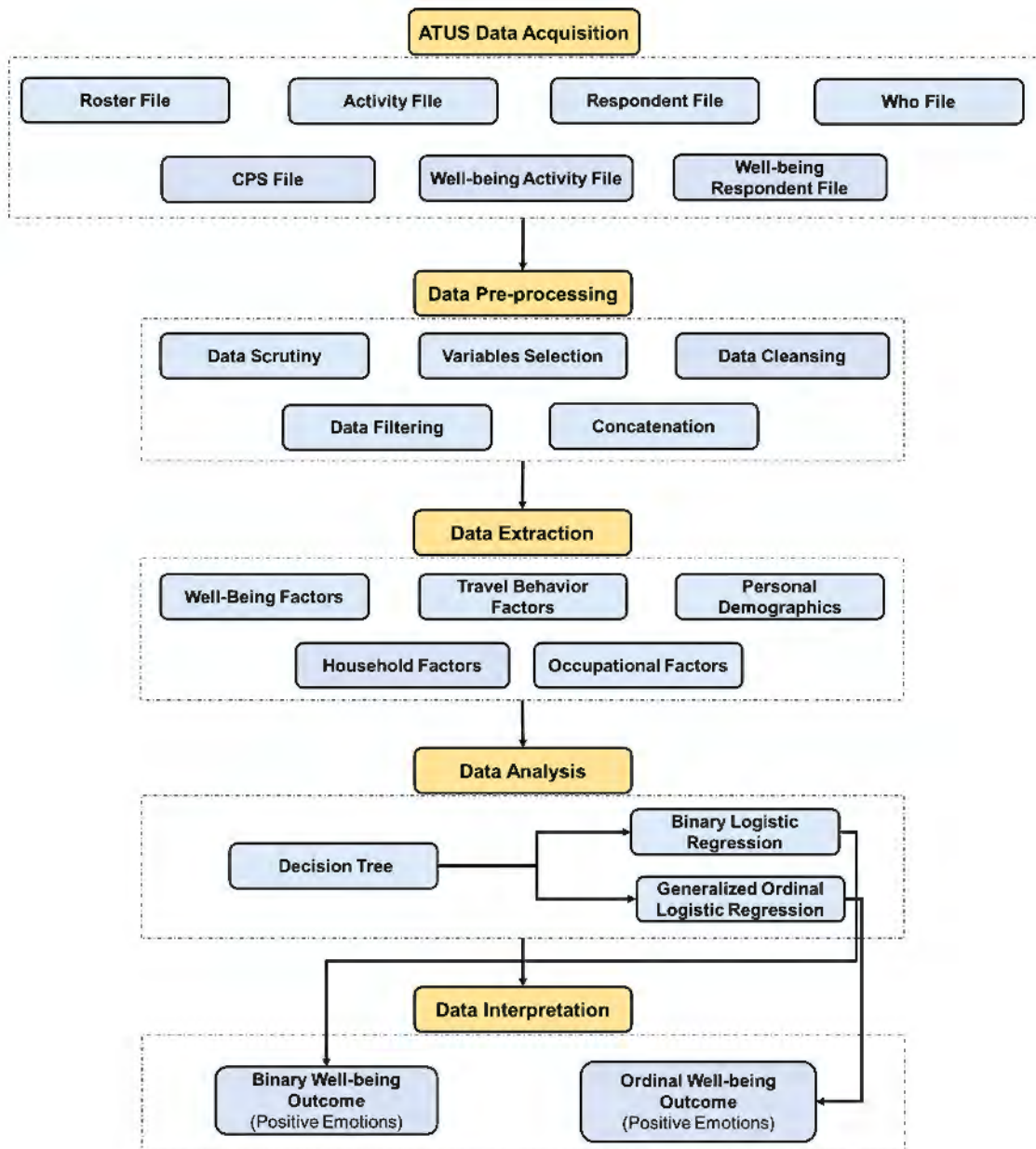
Figure 1: Methodology of the study

Table 1: Brief description of each ATUS file utilized in this study

ATUS File	Description
ATUS Activity File	It records respondents' daily activities, including travel, with durations and contextual information.
ATUS Respondent File	It contains demographic and socioeconomic data (e.g., age, gender, and income) essential for analyzing travel behaviour.
ATUS Roster File	It includes details about household members (e.g., family size, and relationships), offering insights into household dynamics that may influence travel choices.
ATUS Who File	It identifies individuals accompanying the respondent during activities, offering insights into social interactions and their impact on well-being.
ATUS CPS File	This file providesemployment-related information, particularly useful for analyzing commuting patterns.
Wellbeing Activity File	It captures respondents' emotional responses (e.g., happiness, stress, tiredness, sadness, and pain) on a scale of 0 to 6 during specific activities, including travel.
Wellbeing Respondent File	It summarizes the respondent's overall emotional state, providing a broader perspective on their well-being in relation to travel.

3.3. Data Pre-Processing and Variable Selection

The dataset preparation followed a rigorous pathway to validate its effectiveness and practical value. This process included several key steps. An initial examination of the dataset helped us find problems and correct wrong or missing data to keep it trustworthy. To analyze travel behaviour influence on well-being, only the relevant variableswere selected and unnecessary information was removed. All variables were cleaned carefully to ensure that they matched and worked the same way throughout the entire dataset.

3.4. Categorization of Influential Variables

Seventeen travel influence variables were categorized into five main sections to examine their impact on traveler well-being. Travel evaluation began with Well-Being Emotions where researchers tracked how travelers feel between stress, happiness, sadness, tiredness, and physical pain. Travel Behavior examines specific aspects of movement, including trip time lengths, transportation modes between walking, cycling, driving, and public transit, and trip purposes between work journeys, leisure activities, and caregiving responsibilities. The role of household size alongside member bonds and caregiving tasks was studied to measure how these variables affect both travel activities and emotional well-being. The final category called Personal Factors, records age, gender, education, and income data that impact both travel preferences and personal well-being. In the last category, Occupational Factors were explored, which include analyzing how job status, work hours, and business travel demands affect commuting well-being.

An optimized data collection process was implemented to enable a thorough analysis of how travel patterns influence individuals' well-being.

Table 2: Detailed description of each variable, explaining its relevance in the study.

Categories	Variables	Description
Well-Being Emotions	Happy	From 0 to 6, how happy do you consider yourself during the travelling activity?
	Meaningful	From 0 to 6, how meaningful do you consider yourself during the travelling activity?
	Pain	From 0 to 6, how much pain did you experience during your travelling activity?
	Sad	From 0 to 6, how sad do you consider yourself during a

		travelling activity?
	Stress	From 0 to 6, how stressed did you consider yourself during your travelling activity?
	Tired	From 0 to 6, how much tired do you consider yourself during the travelling activity?
Travel Behavior	Trip Purpose	Trips can be rigid or flexible.
	TripDuration	The duration of activities is divided into six categories: Activities fall into time ranges of 1-15 minutes up to 120 minutes or more.
	Mode Choice	Travel choices between cars, trucks, motorcycles, walking, buses, subways.
	Trip Partner	Who was with you during the activity (Alone, Spouse/Unmarried partner, Child/Grandchild, Parents, Siblings/Relatives, friends, colleagues)
Household Factors	HH children	Presence of household children (0-No, 1-Yes)
	HH residents	Number of people living in respondent's household (From 1 to 5)
	HH income	The dataset shows income data from households ranging from $5,000 to $150,000.
	HH type	The dataset reveals different types of households.
Occupational Factors	Occupation type	Categorical variable, 22 values to describe occupation category
	Worker Class	Categorical variable, 8 values to describe the individual class of worker
	Employment Status	Categorical variable, 2 values to describe the employment status of the respondent.
Personal Factors	Age	Categorical variable, with multiple age values to classify respondents into 7 groups (i.e., <18, 18-25, 26-34, 35-45,46-59-60-70 and >70).
	Gender	Categorical variable, typically with 2 values (1 for Male, 2 for Female) to identify respondent gender.
	Education	Categorical variable, with several values to indicate the respondent's highest education level.

Race	Categorical variable, with distinct values to represent racial/ethnic categories (e.g., White, Black, Asian, Hispanic).	
Rest Status	Categorical variable with levels (e.g., Well rested, Somewhat rested, A little rested) to measure the respondent's rest status.	
High Blood Pressure (HBP) Status	Binary categorical variable with two values (Yes or No) indicating whether a respondent has high blood pressure.	

3.5. Data Analysis

3.5.1. Statistical Analysis and Methodology

A detailed analysis plan was followed and used both SPSS and R programs to study how travel behaviour affects well-being. conduct our analysis of how travel behavior affects well-being.SPSS was choosen because it manages complex data efficiently and provides a complete set of statistical analysis methods.The SPSS and R statistical platforms together produced results that helped meet our study goals.

Exploratory Data Analysis (EDA): Exploratory Data Analysis (EDA) was performed to systematically examine the data through graphical representations and numerical analysis. This process aimed to identify valuable patterns and ascertain the most relevant variables. The comprehensive assessment provided clarity regarding the dataset, which effectively informed our subsequent research directions.

Decision Tree: The decision tree method was employed todiscover factors that affect users' overall travel satisfaction. This data analysis method shows strong performance when it detects patterns between variables while offering a visual representation of data patterns. The system ranks the significance of input variables by itself. Our study found that transportation behavior, trip lengths, and social events affect a person's overall well-being through cross-analyzing data.

Binary Logistic Regression: Binary logistic regression was applied to explorethe relationship between predictor variables and the probability of experiencing happy emotional states. Using this method, it was examined that if changes in travel habits and socioeconomic factors affect whether people reach binary emotional states.

Ordinal Logistic Regression: Ordinal logistic regression was employed to evaluate how emotional well-being varies across different intensity categories. The method works best for situations that measure ordered data points when exact differences between values are not clear (such as different happiness levels).

Both methods were used together to analyze travel well-being and predict future outcomes through multiple levels of understanding. The decision tree method showed whichtravel elements influence well-being most strongly through its clear ranking system. Logistic regression explored how well-being outcomes connect to travel activities by revealing the strength and likelihood of emotional responses. The analysis plan used strict data preparation methods alongside selected variables and SPSS tools to ensure exact findings. The study evaluates how travel behavior affects well-being by studying the emotional and social aspects of how we travel.

Chapter 04: Analysisand Results

4.1. Descriptive Analysis

The ATUS database tracks exactly how each individual uses their day and records their feelings. This study examined how travel-related elements affect emotional well-being using 17 main travel variables. This research examined how transportation decisions, travel time, excursion reasons, and social factors impact people's feelingsby providing a complete look at travel behaviors. The study offers a comprehensive analysis of travel behaviors, highlighting the relationship between travel choices, movement patterns and individual well-being

4.1.1. Emotional Well-Being and Travel Experiences

Initial analysis of the dataset has highlighted promising trends in emotional well-being. Approximately 54% of respondents indicated high levels of happiness, scoring either 5 or 6 on a scale ranging from 0 to 6, where a score of 6 denotes the highest intensity of happiness. Furthermore, the majority of participants reported low to moderate levels of stress and sadness, suggesting that daily travel routines do not significantly contribute to emotional distress. These findings suggest that travel may have a positive or neutral impact on overall emotional well-being for a substantial number of individuals.

Several factors account for these favorable outcomes. Utilizing walking and cycling as methods of commuting enhances overall well-being by promoting physical activity and facilitating a connection with nature. Furthermore, engaging in trips with friends and loved ones strengthens social ties and mitigates feelings of isolation and leisurely outings contribute to feelings of happiness and relaxation. This study

underscores the importance of promoting diverse transportation options that support and improve well-being.

Happiness Levels During Travel

- High happiness levels (scores of 5 or 6)
- Low to moderate happiness levels (Score 0-4)
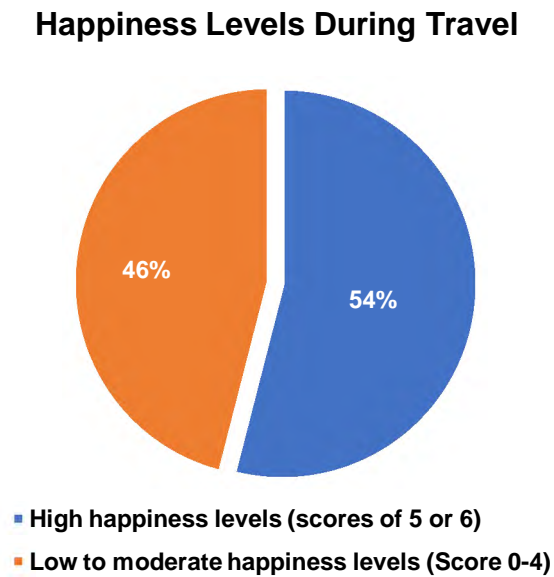
Figure 2: Happiness Levels During Travel through the descriptive analysis

4.1.2. Trip Purpose and Its Impact on Well-Being

The study categorized trip purposes into two main groups: rigid activities and flexible activities, which indicate how fixed or adaptable the schedules are. The rigid activities group primarily includes work-related trips, along with other time-constrained activities such as commuting. The need for strict scheduling and limited flexibility associated with work travel can create stress for individuals who rely on lengthy journeys through congested traffic or crowded public transportation.

Flexible activities include discretionary trips such as shopping, dining, and recreation, with shopping and dining being the most popular options. These voluntary outings not only provide valuable opportunities for leisure, relaxation, and social interaction but also contribute to positive emotional experiences. In contrast to rigid trips, flexible travel fosters happiness and effectively reduces stress, emphasizing its

vital role in promoting emotional well-being. By prioritizing these enjoyable activities, individuals can enhance their overall quality of life. Rigid business trips create stress but flexible personal trips boost happiness according to past research as shown in Chen et al.'s [1]study.
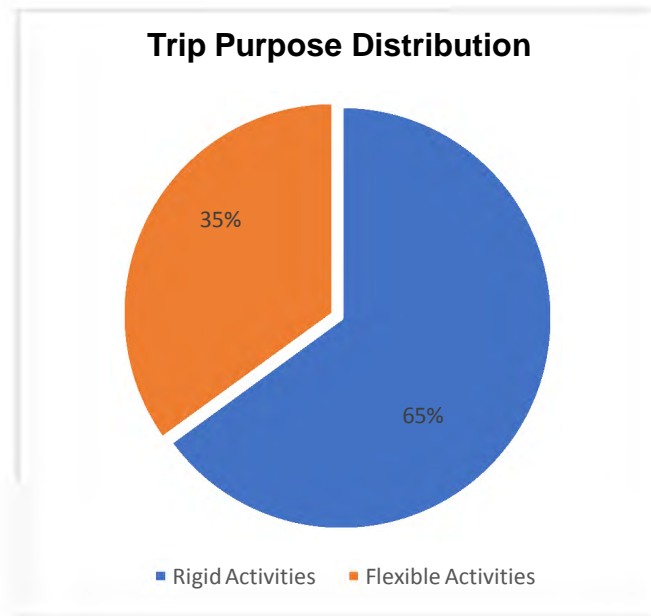
Figure 3: Trip purpose distribution through the descriptive analysis

This classification highlights the dual impact of travel on well-being: while rigid activities need essential work trips, these activities create stress even though flexible work schedules help employees rest. People feel better mentally and emotionally through trips they choose themselves. Results demonstrate that people need flexible travel opportunities to maintain their emotional health in daily activities

4.1.3. Trip Duration and Travel Patterns

The analysis examined the duration of travel trips to assess their impact on travel experiences and emotional well-being. The findings indicate that trip duration significantly affects both the journey experience and the emotional health of individuals. Notably, 84% of the trips analyzed were completed within a time frame

of one to thirty minutes. This suggests that most daily travels are relatively brief, allowing individuals to reach their destinations efficiently and comfortably. People experience less stress and fatigue when their trips stay brief as Ettema et al.[9] discovered. individuals tend to spend their time doing tasks at destinations that are near their residences or workplaces.

Short trips make us feel better and more relaxed yet work commutes extend over longer periods because they cover farther distances with increased traffic issues. Extended work journeys are associated with increased stress and fatigue, as well as a decline in overall life satisfaction. This research indicates that it is imperative to take immediate action to shorten travel durations by enhancing transportation efficiency and providing individuals with the flexibility to work from anywhere.

Trip Duration Distribution
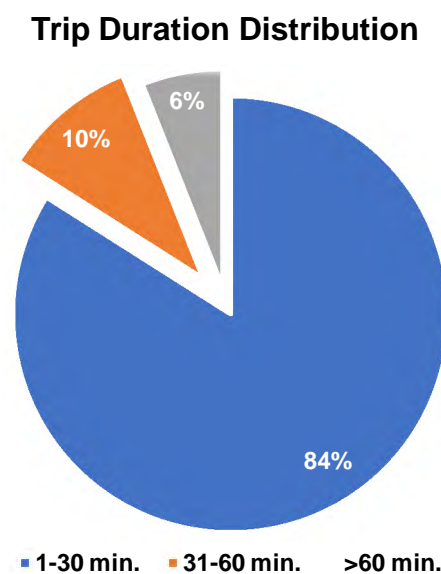

| 1-30 min. | 31-60 min. | >60 min. |

Figure 4: Trip durationdistribution through the descriptive analysis

4.1.4. Social and Economic Dynamics in Travel

The analysis revealed important social trends about how travel affects both personal connections and emotional well-being in homes. Half of all the trips were

alone. Work-related and everyday activities mostly happen alone according to the statistics. The freedom to control your schedule comes with reducing chances to develop emotionally from engaging with others.

The majority of respondents indicated that they lived with no children under age 18. The majority of households with children only have one or two kids. Having children adds travel disruptions to daily life as parents handle school schedules and childcare responsibilities which lead to higher stress and transportation needs.

Solo vs. Social Travel
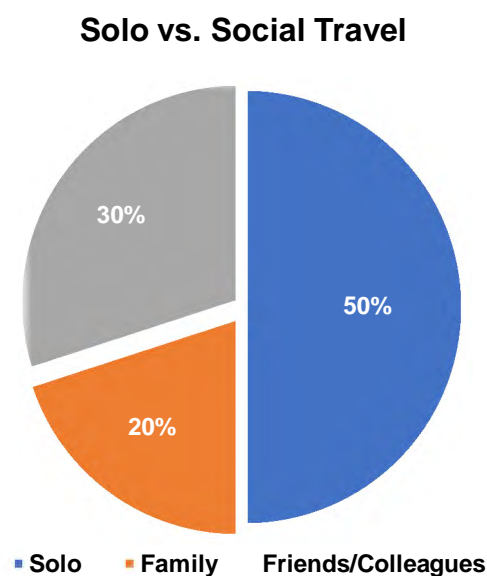
Figure 5: Solo vs. Social Travel distribution through the descriptive analysis

Income and Travel Patterns: Understanding income levels and work details has helped us to better understand how travel habits affect people's quality of life.

Income Levels: About 60% of people have incomes above $50,000 a year. People with high incomes get better travel choices and faster routes to work, which makes travel better overall. People with higher incomes face increased pressure from job demands while working longer days which reduces their freedom to travel for pleasure.

Income and Travel Patterns

Respondents earning >$50,000 (60%+): Higher access to comfortable transport and shorter commutes.

Respondents earning <$50,000 (40%-): Longer commutes and lower transport satisfaction.

40%

60%

■ Respondents earning >$50,000
■ Respondents earning <$50,000
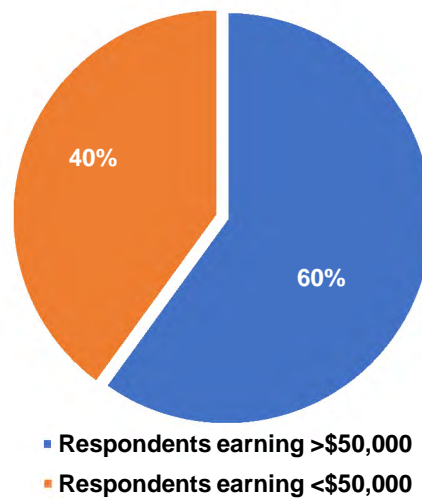
Figure 6: Relation between income & travel pattern distribution

Employment Characteristics: Most participants in this study are full-time workers with common occupations including management, office and administrative support, sales, and teaching. People performing these jobs need reliable transportation systems because they work fixed hours and travel every day.

Employment: Roughly 20% of the respondents work for the government with most of them being in the private sector. Private sector jobs typically require strict work hours making commuting stress worse. Our results show that flexible work and transport systems are essential to help employees balance their work lives and commuting experiences.

Personal finances, including employment and family life, influence travel decisions and their emotional outcomes.

Employment and Travel Patterns

- Full-time employees ▪ Private sector employees
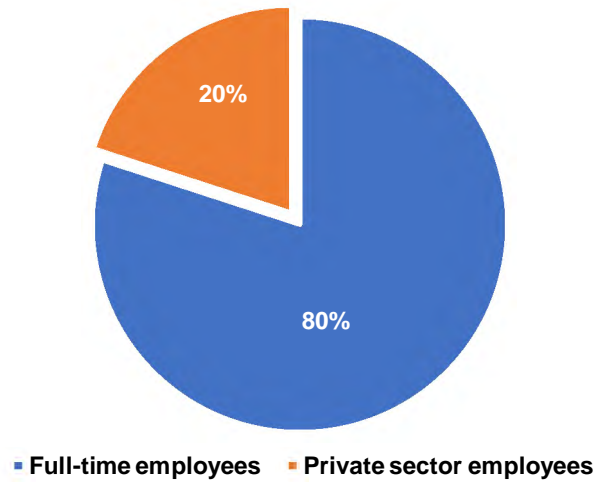
Figure 7: Relation between employment & travel pattern distribution

4.1.5. Implications for Policy and Planning

The study illustrates how work status, combined with household finances and daily activities, affects travel choices and emotional well-being. Scheduled work trips necessitate travel at specific times, which can negatively impact mental health. Emotional well-being is enhanced when we engage in discretionary outings for shopping and dining based on our individual preferences. Policymakers should focus on improving both workplace transportation and recreational mobility by developing safe and accessible travel solutions.

This research shows important travel factors that contribute to health and happiness while providing valuable guidance for transportation experts. Public transit solutions designed for solo passengers, families, and employees help diminish daily pressure and create a more comfortable lifestyle for everyone on the road.These findings emphasize the necessity of developing transportation systems that are both sustainable and inclusive, ensuring they better serve the diverse populations of today's world.

4.2. Decision Tree

This study analyzed many factors to determine their effects on life satisfaction while specifically studying how travel creates happiness. The investigation evaluated how four travel components affect people: trip purpose, travel mode, trip duration and travel partner. The resultsshowed which types of travel experiences result in better emotional outcomes. Traveling for leisure increased happiness ratings more than professional commutes while companion-led vacations produced better positive emotions than traveling alone.

4.3. Broader Context: Personal and Household Characteristics

This study explored travel by merging details about travelers and their trips. It assessed how age, gender, race, high blood pressure, education, and occupation influenced the experience. People who stay healthy and sleep enough have better travel experiences because they pay more attention to their environment.

Travel experiences are shaped by factors such as work situation, childcare responsibilities, household size, and income. Families with children often encounter stress during caregiving trips, while higher-income households enjoy more comfortable travel, leading to greater satisfaction. This aligns with Ma et al.'s [8] research, which highlights the importance of income and rest status in influencing travel well-being.

4.4. Decision Tree Analysis with CHAID

The CHI-SQUARE Automatic Interaction Detection (CHAID) method was used to analyze decision trees, examining complex data structures with multiple conditions. The study focused on travel experiences to identify key factors influencing happiness.

Analysis was performed at three levels to uncover happiness determinants, exploring various factor combinations for optimal outcomes. The model achieved a 71.4% success rate, highlighting its effectiveness in assessing happiness in travel contexts.

4.4.1. Key Findings

Through extensive analysis, the study revealed diverse components that affect how travel makes people feel by studying individual characteristics and social connections in various environments. The presence of travel companions proved an important predictor in this study (p-value = 0.000). Family members enhancethe travel happiness experience by offering emotional care and joining in memorable trip activities. Spending time with friends or colleagues while traveling made people happy, especially when they traveled for relaxation or teamwork activities. Solo travel proved lonely and reduced emotional well-being, leading to reduced happiness. People between 35 and 45 years old and those from 46 to 59 years old experienced decreased happiness mainly because their work and family duties made work travel more important than time off. However, leisure trips during these life stages provided crucial stress relief, underscoring the importance of travel purpose in shaping emotional well-being.

Participants experienced greater travel happiness when they arrived at their destinations well-rested (p-value = 0.000). People from wealthier households reported greater travel happiness as they could easily afford quality transportation and leisure options but upper income caused stress for financially challenged travellers.

Travel satisfaction declined for individuals who had high blood pressure since they require transportation that is easy to reach and maintains a calm environment. The type of employment a person had strongly affected their travel happiness.

Workers enjoyed their jobs more when they could balance work hours with their personal lives through part-time schedules. Research showed that traveling alone usually makes people feel isolated, but going with loved ones enhances happiness levels.

The enjoyment of trips depends strongly on the travel partner, age, rest, income, health conditions, and work situation, so we must create special travel solutions for all types of people.
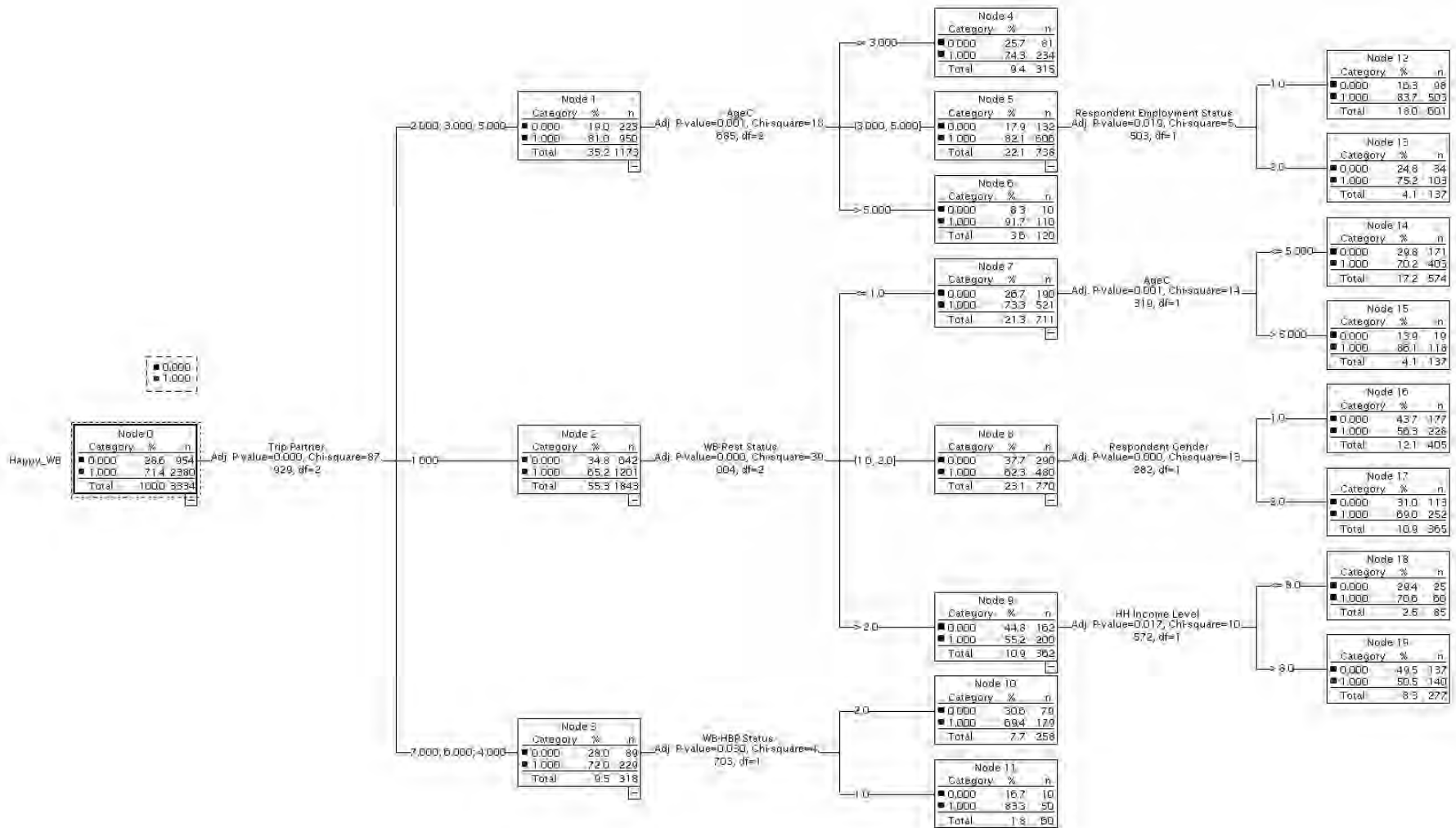
Figure 8:Results of Decision Tree Analysis

4.5. Binary Logistic Regression Analysis

4.5.1. Refined Analysis

The significant variables identified in the decision tree analysis were further examined through binary logistic regression to deepen the understanding of their influence on positive well-being. This analysis demonstrated that traveling together, age, income, and sufficient rest all strongly affected emotional well-being.

The analysis revealed that traveling with loved ones enhances emotional outcomes and highlights how connecting with new people enriches the travel experience. Additionally, life stage responsibilities have a direct impact on happiness levels across various age groups. Individuals with higher incomes reported greater well-being, attributed to their ability to access more comfortable travel options. Furthermore, travelers who feel well-rested prior to their trip tend to experience significantly more joy, as they are better prepared for their adventures.

The logistic regression model demonstrated moderate performance, with an accuracy of 71.5%, as detailed in Table 03. This high level of accuracy underscores the model's effectiveness in capturing the intricate relationships between these variables and emotional well-being.

4.5.2. Key Predictors of Positive Well-Being

Travel partner emerged as a significant factor influencing well-being, with certain companions, such as a spouse or child, significantly enhancing happiness levels during travel ($p = 0.000$). Traveling with family members fosters feelings of connection, emotional support, and shared enjoyment, creating meaningful experiences that positively impact

emotional well-being. In contrast, solo travel, while offering independence and control, lacks the social interactions that typically boost positive emotional states, underscoring the importance of social dynamics in shaping travel experiencesis consistent with Zubair et al. [26]. This study highlights the significant role of social interactions during travel, with travel companions such as family or friends substantially enhancing emotional well-being.

Age also demonstrated a complex relationship with well-being.All age groups had negative coefficients, indicating lower well-being levels compared to individuals under 18, with the negative impact diminishing with age (p < 0.000). This trend suggests that older adults derive greater satisfaction from travel, likely due to reduced time constraints, improved financial stability, and a greater focus on leisure activities. Conversely, younger individuals often contend with stressors related to work, financial pressures, and family responsibilities, which can negatively influence their emotional states during travel.

Household income showed a positive correlation with well-being. The overall effect of household income is significant (p = 0.004), indicating income influences well-being. Only the $30,000-$49,999 income group shows a significant positive effect (B = 0.538, p = 0.000, Exp(B) = 1.713), meaning those earning in this range are 1.7 times more likely to experience positive well-being compared to those earning less than $5,000.

Rest status also emerged as a crucial factor in determining well-being, with sufficient rest significantly increasing the likelihood of positive emotional states during travel. The analysis revealed that with a p-value of 0.000, well-rested individuals were more than twice as likely to report positive well-being. Adequate rest enhances physical and mental preparedness, enabling travelers to better handle stressors, appreciate their surroundings, and engage more fully in their travel experiences.

Interestingly, certain variables, such as high blood pressure and gender, did not show a significant impact on positive well-being. Although High blood pressure can affect physical health and movement during travel,its direct effect was not significant. Our research revealed that age, socioeconomic status, and personal circumstances proved more influential to travel emotions than gender identities across the group.

4.5.3. Model Performance and Reliability

Binary logistic regression model performance was measured using several evaluation methods. The Hosmer and Lemeshow Test shows model fit performance at 11.452 chi-square with 8 degrees of freedom and 0.177 significance level. This model is deemed a goodfit because significance level above 0.05 was achieved. These findings show that the statistical model effectively predicts well-being outcomes while maintaining its strength in detecting important relationships in the dataset. The analysis shows that expanding the model with extra variables could help explain current data relationships more thoroughly.

The analysis shows that income and daily habits strongly influence travelers' happiness levels. Family members also significantly contributed to happiness. Older adults experience high satisfaction from their travel activities which shows we need to create travel options designed to match their specific needs. Rested workers enjoy their travels better due to better work-life balance. Household income showed strong relations to travel satisfaction by revealing how financial stability affects the overall quality of travel experiences.

Binary logistic regression reveals significant connections between travel companions, age, personal income, and rest and how they impact the well-being of travellers. The results of the Binary Logistic Regression Analysis are visually represented in Figure (9).
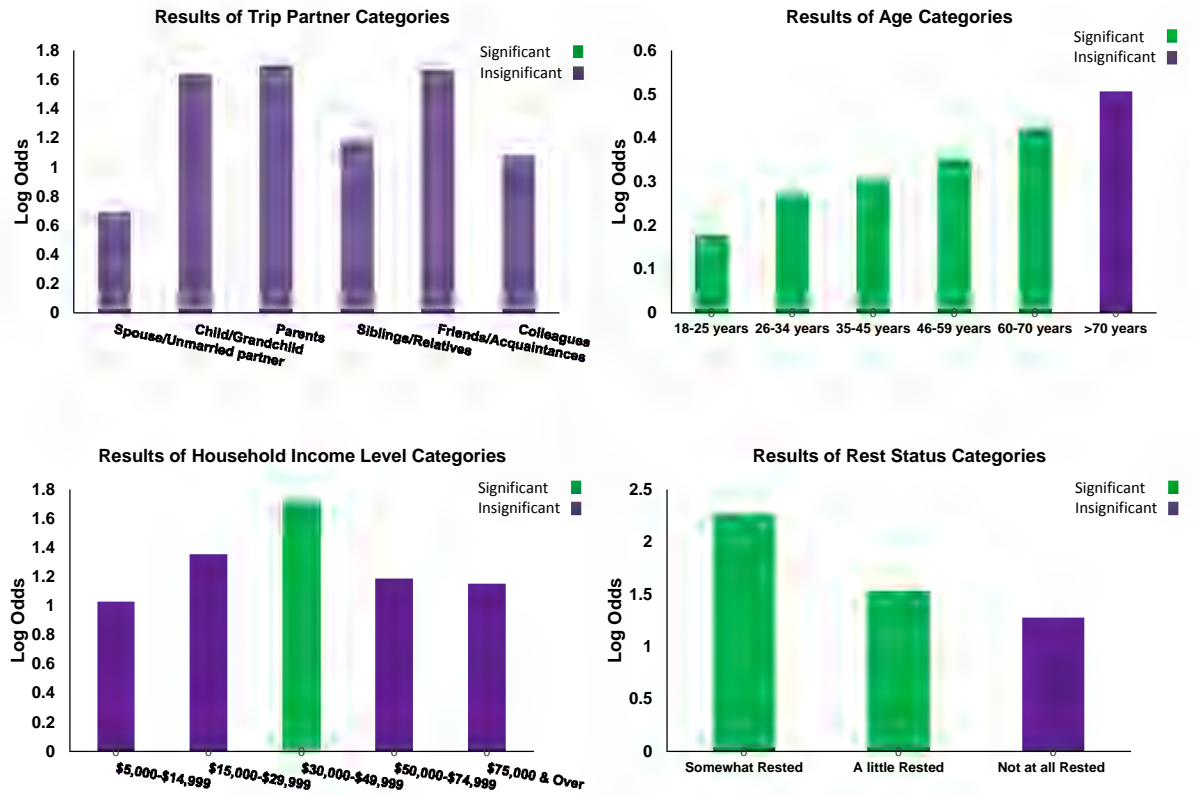
Figure 9:Results of Binary Logistic Regression Analysis

Table 3: Binary Logistic Regression Results

Variable Name	Variable Category	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Trip Partner		-	-	94.663	6	.000	-	-	-
1	Spouse/Unmarried partner	-.368	.337	1.196	1	.274	.692	.357	1.339
2	Child/Grandchild	.495	.361	1.883	1	.170	1.641	.809	3.327
3	Parents	.527	.349	2.284	1	.131	1.694	.855	3.356
4	Siblings/Relatives	.164	.450	.134	1	.715	1.179	.488	2.846
5	Friends/Acquaintances	.512	.401	1.631	1	.202	1.669	.760	3.664
6	Colleagues	.076	.370	.042	1	.837	1.079	.522	2.230
'Alone' is taken as a Reference Category									
Age		-	-	27.887	6	.000	-	-	-

45

1	18-25 years	-1.725	.505	11.658	1	.001	.178	.066	.480
2	26-34 years	-1.304	.432	9.104	1	.003	.271	.116	.633
3	35-45 years	-1.192	.420	8.036	1	.005	.304	.133	.692
4	46-59 years	-1.044	.418	6.251	1	.012	.352	.155	.798
5	60-70 years	-.862	.415	4.301	1	.038	.422	.187	.954
6	>70years	-.680	.426	2.541	1	.111	.507	.220	1.169
Age<18 years is taken as a Reference Category									
Household Income Level		-	-	17.115	5	.004	-	-	-
1	$5,000-$14,999	.028	.341	.007	1	.935	1.028	.527	2.007
2	$15,000-$29,999	.302	.180	2.834	1	.092	1.353	.952	1.923
3	$30,000-$49,999	.538	.135	15.947	1	.000	1.713	1.315	2.230
4	$50,000-$74,999	.171	.110	2.439	1	.118	1.187	.957	1.471
5	$75,000 & Over	.142	.107	1.761	1	.184	1.153	.935	1.421
< $5,000 Income Level is taken as a Reference Category									
Employment Status - Part Time		.004	.109	.001	1	.970	1.004	.811	1.243
Full-time Employment Status is taken as a Reference Category									
Gender – Female		-.125	.082	2.342	1	.126	.882	.752	1.036
Male gender is taken as Reference Category									
Rest Status		-	-	38.774	3	.000	-	-	-
1	Somewhat Rested	.816	.177	21.271	1	.000	2.260	1.598	3.197
2	A little Rested	.424	.173	5.996	1	.014	1.527	1.088	2.144
3	Not at all Rested	.242	.189	1.634	1	.201	1.274	.879	1.846
'Well rested' is taken as a Reference Category									
HBP Status - No		.097	.099	.964	1	.326	1.102	.908	1.339
HBP is considered as a Reference Category									
Constant		1.346	.560	5.777	1	.016	3.841	-	-

4.6. Generalized Ordered Logistic Regression Results

4.6.1. Refined Analysis of the Generalized Ordered Logit Model (GOLOGIT)

GOLOGIT can be used to analyze how multiple variables impact positive well-being using a sophisticated observational approach. The analysis measures how rest, age, income level, and travel companion create a complex web of social factors leading to different emotional responses. This powerful analytical system enables us to understand complex relationships.

4.6.2. Key Findings from the GOLOGIT Analysis

4.6.2.1. Rest and Emotional Well-Being

Rest emerged as a pivotal factor influencing Positive Well-Being, with well-rested individuals significantly more likely to experience positive emotional states during travel. Individuals who are not at all rested are 2.87 to 4.22 times less likely to report higher well-being compared to those who are well-rested.

The critical role of rest in shaping emotional well-being is supported by Ma et al. [8].and Zubair et al. [26], who demonstrated that well-rested individuals report significantly higher happiness levels, with rest being a key predictor of positive travel experiences.

4.6.2.2. Age and Emotional Outcomes

The analysis indicated that age influences well-being, with older adults (70-100 years) reporting lower levels of well-being than younger generations. Health and mobility restrictions can limit their travel enjoyment.

Response patterns also varied by age. Those aged 60-69 often experience lower well-being due to work and family responsibilities that hinder relaxation during travel. Overall, individuals of all ages react differently to travel based on their personal circumstances.

4.6.2.3. Household Income and Well-Being

Family income and well-being interact in various ways. Individuals earning between $15,000 and $29,999 show slight improvements in well-being compared to those earning less than $5,000, though enhanced well-being patterns are also observed among individuals in lower income brackets. Financial stability provides the ability to choose better travel options; however, the emotional benefits of income depend more on how money is utilized and the chosen lifestyle rather than the income level itself. Understanding the actual use of money is crucial for assessing positive feelings, as its impact does not follow a straightforward, linear pattern.

4.6.2.4. Travel Companionship and Gender Differences

Traveling with others directly influences travelers' well-being during trips. Contrary to expectations, traveling with friends or family members often reduces well-being responses compared to traveling independently. The chance of experiencing positive emotions decreases when traveling with a spouse or close relatives. This may be attributed to the added stress and responsibilities associated with accommodating others, which can diminish the enjoyment of travel.

Women show lower levels of well-being than men at every level these thresholds represent. Men and women respond to travel differently because of predefined social roles

and their duties. This analysis demonstrates the need to examine gender impacts on travel choices to build better transportation systems that serve all users equally.

4.6.2.5. *Model Performance and Robustness*

The GOLOGIT model was used to measure how different factors influence overall well-being. This analysis proved the proportionality assumption using the Test of Parallel Lines test (p-value = 0.184). The test results showed that our model accurately predicts how different life choices affect personal well-being regardless of its level. Results from the Generalized Ordered Logit Model support earlier methodological approaches described by Ettema et al.[1] in studying travel well-being dynamics.

A comparison between the General Model and Null Hypothesis Model confirmed that GOLOGIT is the appropriate model for this analysis. The General Model outperformed the Null Hypothesis Model by producing 8082.472 -2 Log Likelihood instead of 8298.193. This difference yielded a chi-square statistic of 215.721 with 198 degrees of freedom, demonstrating the General Model's superior ability to explain variations in well-being outcomes effectively.

4.6.2.6. *Implications for Policy and Planning*

Research-based on the GOLOGIT model provides useful direction for establishing future policies and plans. Work schedules, balance programs, and downtime rest can help people feel better. Transportation systems help users feel better through dedicated spaces designed for people to meet while sharing family-friendly and social travel choices.

Income disparities affect how lower-income households enjoy their travel experiences, so we need to create affordable travel options for everyone to benefit from positive travel

experiences. Solutions must address the needs of all groups within the population because each group has unique requirements. The aim is to build travel solutions that offer easy and comfortable options that suit older adults' desired travel experiences. Younger workers and part-time employees benefit from job design changes that reduce their work pressure while increasing their work-time options can enhance their well-being. Such focused and welcoming solutions help improve transportation systems to boost living standards for all people groups. The Generalized Ordered Logit Model served as a strong tool to identify what affects people's well-being positively. The method outperformed basic ordinal regression by discovering complex, non-linear linkages between factors and mood states that affect overall happiness.The results of the Generalized Ordered Logit Model (GOLOGIT) are visually represented in Figure (10).
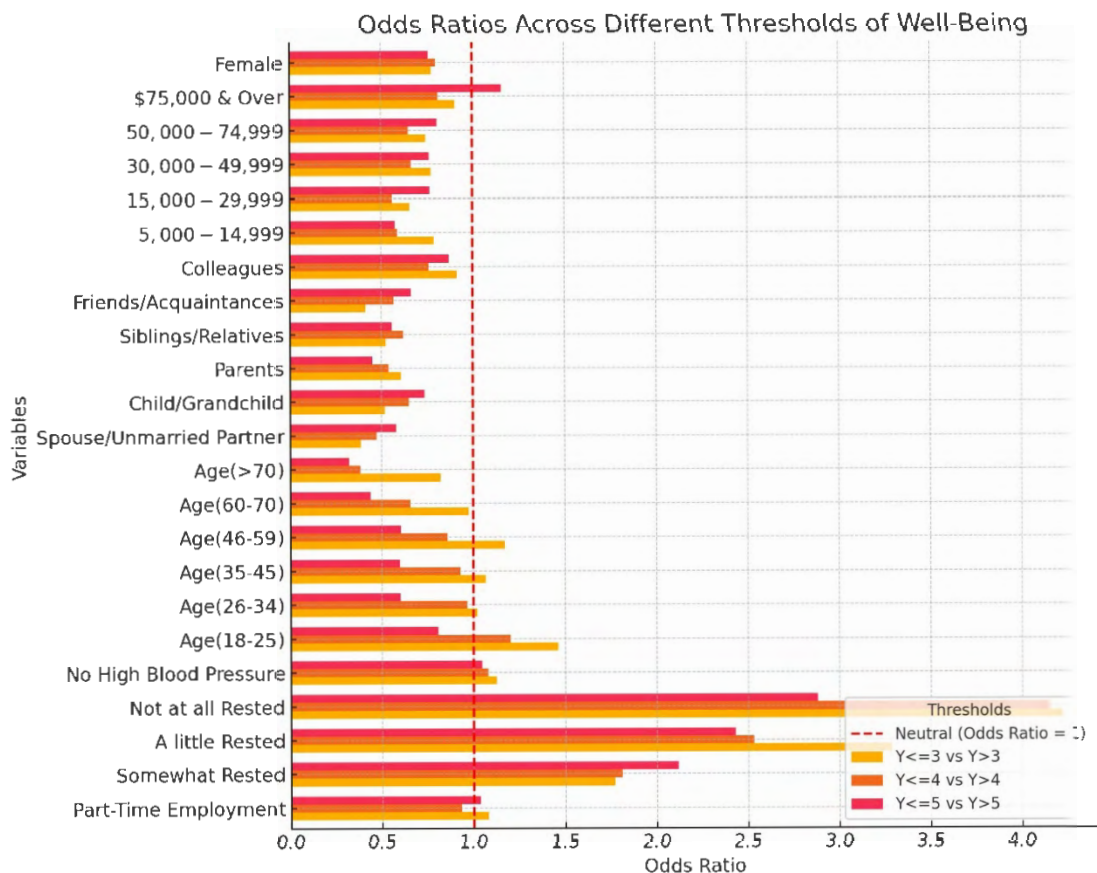

Figure (10)

Figure 10: Generalized Ordered Logistic Regression Results

Table 4: Generalized Ordered Logit Model Results

Variable	Y<= 3 vs Y>3	Y<= 4 vs Y>4	Y<= 5 vs Y>5
	Odds Ratio	**Odds Ratio**	**Odds Ratio**
Employment status ('Full-Time Employment' is considered as a reference category)			
Part-Time Employment status	1.07797	0.93134	1.03382
Well-being Rest Status ('Not at all Rested' is considered as Reference Category)			
Well rested	1.77087***	1.81226***	2.11811***
Somewhat Rested	3.2851***	2.52977***	2.4305***
A little Rested	4.2174***	4.14884***	2.8793***
Well-being High Blood Pressure Status ('No High Blood Pressure is considered as Reference Category)			
High Blood Pressure	1.1251	1.07773	1.04518
Respondents Age (Age <18 is considered as Reference Category)			
Age(18-25)	1.46111	1.20051	0.80466
Age(26-34)	1.02072	0.96632	0.60066
Age(35-45)	1.06468	0.92799	0.59606
Age(46-59)	1.16873	0.85672	0.60251
Age(60-70)	0.9737	0.65542	0.43694**
Age(>70)	0.82007	0.38236**	0.32136***
Trip Partner ('Alone' is considered as a Reference Category)			
Spouse/ Unmarried travel partner	0.38693***	0.47036***	0.5792***
Child/ Grandchild travel partner	0.51707***	0.64882***	0.7346***
Parents travel partner	0.60776	0.53739**	0.45002***
Siblings/Relatives' travel partner	0.52338***	0.61733***	0.55767***
Friends/Acquaintances' travel partner	0.41452***	0.56583***	0.6611**
Colleagues travel partner	0.91252	0.75922	0.87075
Households Income Level (Income < 5000$ is considered as Reference Category)			
Family Income ($5,000-$14,999)	0.78835	0.58916	0.57598

Family Income ($15,000-$29,999)	0.65495	0.56039*	0.7664
Family Income($30,000-$49,999)	0.77115	0.66424	0.7634
Family Income($50,000-$74,999)	0.74361	0.65025	0.80446
Family Income($75,000 & Over)	0.90398	0.81032	1.15714
Respondents Gender ('Male' is considered as Reference Category)			
Female	0.77338***	0.79879***	0.76038***

Chapter 05: Conclusions& Recommendations

Transport networks significantly influence the quality of life for all individuals by facilitating access to essential services and enabling participation in workforce.The duration of our travel, the methods of transportation, and the partners we choose to accompany us significantly influence the emotional impact of our experiences during the journey.Transportation planners typically focus on analyzing performance objectives and operational costs, primarily assessing trip speed and financial expenses. However, this research suggests that we should also incorporate factors such as comfort, safety, convenience, and emotional satisfaction into our evaluation of transportation planning decisions. These elements significantly influence personal mobility patterns and choices regarding transportation, making them essential components of modern transportation development.

This study highlights the importance of subjective well-being data in transportation planning to accurately predict traveler choices and their impact on life satisfaction. By employing a combination of decision tree algorithms, binary logistic regression, and generalized ordered logistic regression, we analyzed 17 travel-related variables to identify factors that influence travel happiness and the selection of travel companions, both of which play a significant role in emotional well-being.Traditional transportation planning has predominantly prioritized objective metrics such as cost, time, and efficiency. This study emphasizes the need to incorporate subjective well-being factors, including comfort, safety, convenience, and emotional satisfaction. These factors determine how people travel and

select transportation modes which makes them essential elements of current transportation planning.

This study shows that people's views about travel comfort depend strongly on travel companions, age, household income, health, and employment situation. Research results confirm that rest and age play aimportant role in enhancing life satisfaction. The study confirmed previous findings, it also contributed to our understanding of the subject by employing more innovative analysis techniques. Including measures of personal contentment into transportation planning presents a remarkable opportunity to enhance the quality of life for individuals and communities. Our transportation solutions must support rest breaks and social needs for older adults to create systems that everyone can use. By prioritizing policies and strategies that address rest, social dynamics, and the needs of an aging population, we can create sustainable and inclusive transportation systems. Insights derived from ATUS data provide essential guidance for creating transportation networks that align with societal trends, cultural norms, and technological advancements. This strategy can effectively inform infrastructure and policy decisions, fostering more efficient, sustainable, and inclusive communities. Ultimately, these efforts can enhance mobility, connectivity, and overall quality of life.

The study highlights that Transportation planners must combine both technical system analysis with public travel perception research to develop plans effective enough for present-day society. Policy makers should use ATUS data to design better transportation strategies that help people stay healthy while moving toward a sustainable future. Through transportation network planning we design systems that meet everyone's requirements which leads to better future.

5.1 Recommendations and Future Work

Researchers must collect reliable information about transport effects on people combined with social background evaluations of local practices. When science and personal travel insights combine they form better systems that improve how people move through public spaces. By including personal satisfaction ratings into traffic assessments researchers can better understand the diverse factors that influence how people use transportation. Creating transportation systems that serve everyone better depends on combining objective data with personal reports.

The following are the recommendations and future works:

•Integrate subjective well-being indicators, such as happiness and stress levels, into transportation evaluation frameworks. Utilize data-driven methodologies to inform policy and infrastructure development.

•Reinforce work-life balance initiatives and provide opportunities for adequate rest. Design transportation systems that alleviate stress and fatigue, particularly for frequent commuters, to enhance overall well-being.

These recommendations aim to transition transportation planning from a focus on efficiency and cost to a human-centered approach that prioritizes well-being, sustainability, and inclusivity.

References

[1]   E. A. Morris and E. Guerra, "Are we there yet? Trip duration and mood during travel," *Transp. Res. Part F Traffic Psychol. Behav.*, vol. 33, pp. 38–47, 2015, doi:

10.1016/j.trf.2015.06.003.

[2]   L. Eriksson, M. Friman, and T. Gärling, "Perceived attributes of bus and car mediating satisfaction with the work commute," *Transp. Res. Part A Policy Pract.*, vol. 47, pp. 87–96, 2013, doi: 10.1016/j.tra.2012.10.028.

[3]   J. Zhu and Y. Fan, "Commute happiness in Xi'an, China: Effects of commute mode, duration, and frequency," *Travel Behav. Soc.*, vol. 11, no. August 2017, pp. 43–51, 2018, doi: 10.1016/j.tbs.2018.01.001.

[4]   T. Litman, "Measuring transportation: Traffic, mobility and accessibility," *ITE J. (Institute Transp. Eng.*, vol. 73, no. 10, pp. 28–32, 2003.

[5]   M. Archer, R. Paleti, K. C. Konduri, R. M. Pendyala, and C. R. Bhat, "Modeling the Connection between Activity-Travel Patterns and Subjective Well-Being," 2012.

[6]   P. Vaitsis, S. Basbas, and A. Nikiforiadis, "How eudaimonic aspect of subjectivewell-being affect transport mode choice? The case of Thessaloniki, Greece," *Soc. Sci.*, vol. 8, no. 1, Jan. 2019, doi: 10.3390/socsci8010009.

[7]   H. Zhou, X. Chi, R. Norman, Y. Zhang, and C. Song, "Tourists' urban travel modes: Choices for enhanced transport and environmental sustainability," *Transp. Res. Part D Transp. Environ.*, vol. 129, no. September 2023, p. 104144, 2024, doi: 10.1016/j.trd.2024.104144.

[8]   Y. Ma *et al.*, "What Affects Emotional Well-Being during Travel? Identifying the Factors by Maximal Information Coefficient," *Int. J. Environ. Res. Public Health*, vol. 19, no. 7, Apr. 2022, doi: 10.3390/ijerph19074326.

[9]   J. Zhu and Y. Fan, "Daily travel behavior and emotional well-being: Effects of trip mode, duration, purpose, and companionship," *Transp. Res. Part A Policy Pract.*, vol. 118, no. September, pp. 360–373, 2018, doi: 10.1016/j.tra.2018.09.019.

[10]   L. E. Olsson, T. Gärling, D. Ettema, M. Friman, and S. Fujii, "Happiness and Satisfaction with Work Commute," *Soc. Indic. Res.*, vol. 111, no. 1, pp. 255–263, 2013, doi: 10.1007/s11205-012-0003-2.

[11]   S. Handy and C. Thigpen, "Commute quality and its implications for commute satisfaction: Exploring the role of mode, location, and other factors," *Travel Behav. Soc.*, vol. 16, no. September 2017, pp. 241–248, 2019, doi: 10.1016/j.tbs.2018.03.001.

[12]   K. Manaugh and A. M. El-Geneidy, "Does distance matter? Exploring the links among values, motivations, home location, and satisfaction in walking trips," *Transp. Res. Part A Policy Pract.*, vol. 50, pp. 198–208, 2013, doi: 10.1016/j.tra.2013.01.044.

[13]   Y. F. Jing Zhu, "Daily Travel Behavior and Emotional Well-Being: A comprehensive assessment of travel- related emotions and the associated trip and personal factors," no. 57, p. 3, 2009.

[14]   I. G. N. P. Wiradnyana, P. A. Suthanaya, D. M. P. Wedagama, A. A. G. A. Yana, and D. Dissanayake, "Analysing the choice and pattern of needs of transportation mode for domestic tourists in Bali," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 673, no. 1, 2021, doi: 10.1088/1755-1315/673/1/012019.

[15]   D. B. E. Dharmowijoyo, Y. O. Susilo, and A. Karlström, "Day-to-day variability in travellers' activity-travel patterns in the Jakarta metropolitan area," *Transportation (Amst).*, vol. 43, no. 4, pp. 601–621, 2016, doi: 10.1007/s11116-015-9591-4.

[16]   A. Ermagun, J. Erinne, and Y. Fan, "Travel duration tolerance: Examining the sensitivity of emotional well-being to trip duration," *Transp. Res. Part D Transp. Environ.*, vol. 102, no. December 2021, p. 103137, 2022, doi: 10.1016/j.trd.2021.103137.

[17]   J. Choi, J. Coughlin, and L. D'Ambrosio, "Travel time and subjective well-being," *Transp. Res. Rec.*, no. 2357, pp. 100–108, 2013, doi: 10.3141/2357-12.

[18]   X. Cao and P. L. Mokhtarian, "How do individuals adapt their personal travel? A conceptual exploration of the consideration of travel-related strategies," *Transp. Policy*, vol. 12, no. 3, pp. 199–206, May 2005, doi: 10.1016/j.tranpol.2005.03.002.

[19]   G. Cheng and J. Wang, "How Underlying Attitudes Affect the Well-Being of Travelling Pilgrims—A Case Study from Lhasa, China," *Sustain.*, vol. 15, no. 14, Jul. 2023, doi: 10.3390/su151411268.

[20] R. Ashalatha, V. S. Manju, and A. B. Zacharia, "Mode choice behavior of commuters in Thiruvananthapuram city," *J. Transp. Eng.*, vol. 139, no. 5, pp. 494–502, 2013, doi: 10.1061/(ASCE)TE.1943-5436.0000533.

[21] J. De Vos, P. L. Mokhtarian, T. Schwanen, V. Van Acker, and F. Witlox, "Travel mode choice and travel satisfaction: bridging the gap between decision utility and experienced utility," *Transportation (Amst).*, vol. 43, no. 5, pp. 771–796, 2016, doi: 10.1007/s11116-015-9619-9.

[22] S. Chen, Y. Fan, Y. Cao, and A. Khattak, "Assessing the relative importance of factors influencing travel happiness," *Travel Behav. Soc.*, vol. 16, no. December 2018, pp. 185–191, 2019, doi: 10.1016/j.tbs.2019.01.002.

[23] S. Francois, P. Astegiano, and F. Viti, "Analyzing the correlation between commuting satisfaction and travelling utility," *Transp. Res. Procedia*, vol. 25, pp. 2639–2648, 2017, doi: 10.1016/j.trpro.2017.05.318.

[24] A. Ermagun, J. Erinne, and Y. Fan, "Travel duration tolerance: Examining the sensitivity of emotional well-being to trip duration," *Transp. Res. Part D Transp. Environ.*, vol. 102, Jan. 2022, doi: 10.1016/j.trd.2021.103137.

[25] W. Qassim Al-Salih and D. Esztergar-Kiss, "An Analysis of the Impact of Activity Characteristics and Individual Characteristics on the Transport Mode Choice: A case Study of Budapest city, Hungary," *ACM Int. Conf. Proceeding Ser.*, pp. 561–568, 2021, doi: 10.1145/3512576.3512671.

[26] M. Zubair, S. Chen, Y. Ma, and X. Hu, "Use of Structural Equation Modeling to Identify Human Factors Relationship with Travel Well-Being," *Iran. J. Sci. Technol. - Trans. Civ. Eng.*, 2024, doi: 10.1007/s40996-024-01371-3.

[27] J. De Vos and F. Witlox, "Do people live in urban neighbourhoods because they do not like to travel? Analysing an alternative residential self-selection hypothesis," *Travel Behav. Soc.*, vol. 4, pp. 29–39, 2016, doi: 10.1016/j.tbs.2015.12.002.