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Public Acceptance of Medical Screening Recommendations, Safety Risks, and Implied Liabilities Requirements for Space Flight Participation

Cory J. Trunkhill
Embry-Riddle Aeronautical University, trunk2de@my.erau.edu

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Cory Justin Trunkhill

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By

Cory Justin Trunkhill

This dissertation was prepared under the direction of the candidate's Dissertation Committee Chair, Dr. Robert E. Joslin, and has been approved by the members of the dissertation committee. It was submitted to the College of Aviation and was accepted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy in Aviation.

Robert E. Joslin Digitally signed by Robert E. Joslin Date: 2022.09.28 13:55:18 -04'00'

Robert E. Joslin, Ph.D. Committee Chair
Committee Chair

Dennis A. Vincenzi, Ph.D. Digitally signed by Dennis A. Vincenzi, Ph.D. DN: cn=Dennis A. Vincenzi, Ph.D., o=Embry-Riddle Aeronautical University, ou, email=vincenzd@erau.edu, c=US Date: 2022.10.03 11:54:25 -04'00'

Dennis Vincenzi, Ph.D.
Committee Member

Steven Hampton Digitally signed by Steven Hampton Date: 2022.10.17 15:52:23 -04'00'

Steven Hampton, Ed.D.
Associate Dean, School of Graduate Studies, College of Aviation

Joseph Keebler Digitally signed by Joseph Keebler Date: 2022.10.04 09:42:58 -04'00'

Joseph Keebler, Ph.D.
Committee Member

Alan Stolzer Digitally signed by Alan Stolzer Date: 2022.10.18 20:28:55 -04'00'

Alan J. Stolzer, Ph.D.
Dean, College of Aviation

Committee Member

Lon Moeller Digitally signed by Lon Moeller Date: 2022.10.19 09:30:37 -04'00'

Lon Moeller, J.D.
Senior Vice President for Academic Affairs and Provost

CARLA A HACKWORTH Digitally signed by CARLA A HACKWORTH Date: 2022.09.28 16:43:38 -05'00'

Carla Hackworth, Ph.D.
Committee Member (External)

September 28, 2022

Signature Page Date

Abstract

Researcher: Cory Justin Trunkhill

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The space tourism industry is preparing to send space flight participants on orbital and suborbital flights. Space flight participants are not professional astronauts and are not subject to the rules and guidelines covering space flight crewmembers. This research addresses public acceptance of current Federal Aviation Administration guidance and regulations as designated for civil participation in human space flight.

The research utilized an ordinal linear regression analysis of survey data to explore the public acceptance of the current medical screening recommended guidance and the regulations for safety risk and implied liability for space flight participation. Independent variables constituted participant demographic representations while dependent variables represented current Federal Aviation Administration guidance and regulations for space flight participation. The analysis determined descriptive statistics, polytomous universal, and general linear modeling of the ordinal linear regression of the data. Odds ratios were derived based on the demographic categories to interpret likelihood of acceptance for the criteria.

Various ordinal regression modeling techniques were employed to ascertain significant likely acceptance of the guidance and regulation dependent variables as derived from the demographic independent variables. Five of the twelve demographic variables significantly influenced public acceptance of one or more areas of the Federal Aviation Administration guidance and regulations; age, household size, marital status, employment status, and employment class. Specifically, increases in age and household size, as well as those never married, those employed full-time, and the self-employed exhibited significance in increased likelihood of acceptance of one or more areas of the guidance and regulations for space flight participation. The findings are intended to inform government regulators and commercial space industries on what guidance and regulations the different demographics of the public are willing to accept.

Keywords: acceptance, demographic, space flight participant, space tourism

Dedication

I dedicate this work to my wife and children, who have sacrificed and borne many burdens that I might pursue my dreams. My wife has held our family together through the worst of times, always gave me the best advice and guidance, and took on added household management duties without complaint. My children have had to give up spending quality time with me that I may study and write. They have all had to bear with me as I confronted my own personal demons to pursue academic achievement and personal improvement. I owe my wife more than anyone for all she has done and been put through since my retirement from the USAF and embarked on this academic pursuit. I promise to stop attempting impossibly difficult tasks and take her on an extended vacation.

I dedicate this also to my father and mother, and my father- and mother-in-law, who have provided a multitude of support to myself and our family. My father and mother taught me to never give up on my goals and to do the best I could, no matter the situation. In addition, my father and mother-in-law had always provided us with material support and comfort when a much-needed break was in order.

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I want to thank Dr. Heidi Cuevas for her guidance and friendship. From class coordination to listening to my problems, she never failed to make time for me. I also want to thank Dr. Robert Joslin for motivating and challenging me to conduct the best research possible. His expertise, dedication, and professionalism were second to none, and I could not have asked for a better chairman.

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Chapter I: Introduction

Commercial space flight participation is of current public interest, spurred on by recent advancements and milestones within the space community. In acknowledging the term *space flight participant*, Weibel (2020) makes a succinct argument in that "tourism is passive, while space flight participants see themselves as explorers—active, productive, willing to experience danger for the greater good, and helping to create an intensely believed-in future that will benefit humankind" (p. 10). Throughout the decades, studies concerning commercial space flight participation and space tourism have researched public demand, consumer volumetrics, and financial possibilities (Musselman & Hampton, 2020). There exist, however, opportunities to research public acceptance of current space flight participant guidance and regulations. Quantifying public acceptance of the current administrative conditions for space flight will be of importance to defining the future potential of the space tourism industry and target markets.

Currently, prospective space flight participants are regulatorily required to partake in the training of emergency procedures and be informed of the safety risks and implied liability. However, they are not subject to any mandatory medical screening requirements, for which the Federal Aviation Administration (2017) only provides recommendations. It is unknown how the public will accept the current medical screening recommendations, safety risks, and implied liabilities for space flight participation. Just as the "public acceptance of air transport represented perhaps the most important key to its ultimate success" (Johnson, 2011, p. 86), perhaps the same will hold true for the introduction of commercial space flight.

When examining public acceptance of U.S. commercial space flight participation, it is important to consider the federal regulations for this emerging industry. Title 14- Aeronautics and Space, Code of Federal Regulations (14 CFR), Chapter III is entirely devoted to the emerging commercial space launch industry, ranging in topics from spaceport licensing to space flight participation. The publication details nearly all aspects of what the industry must do to ensure public safety and environmental surety, among other topics. 14 CFR § 401.5 provides official administrative definitions between crew members and participants regarding the conduct of space flight for tourism (FAA, 2006).

In accordance with the Federal Aviation Administration (FAA) guidance published in *Guidance for Medical Screening of Commercial Aerospace Passengers*, space flight participants are recommended to file a personal medical screening questionnaire, receive a physical exam, and undergo medical laboratory testing (Antuñano et al., 2006). Although 14 CFR regulatory requirements exist for safety risks and implied liability, there are no regulatory requirements for medical screening of space flight participants under 14 CFR, rather recommended guidance provided by the FAA's Office of Aerospace Medicine.

According to a recent U.S. Congressional research report (King, 2020), current guidance was written to allow space tourism companies a *learning period* expiring in 2023, during which business models, safety standards, and vehicles could be developed, researched, and investigated by industry before regulatory mandates are implemented. This learning period was established to allow the FAA to implement and monitor benchmarks for industry maturation with which to associate stricter safety and regulatory doctrine. Currently, no amendments to the existing 14 CFR regulations for safety risks and implied liability, nor the creation of 14 CFR regulations for medical screening, have been proposed through any Notice of Proposed Rulemaking (NPRM). Space tourism operators are further required under 14 CFR § 460.45, § 460.49, and § 460.51 to make participants aware of the risks, sign and file a waiver of liability, and partake training of emergency procedures (FAA, 2016).

Current FAA guidance is non-binding with general medical screening recommendations based on the operating area, suborbital or orbital, and the gravitational load induced upon human participants by the force of space flight, as shown in Table 1 (Antuñano et al., 2006).

Table 1

Suborbital and Orbital Medical and Medical Screening Recommendations

Suborbital Aerospace Flight	Orbital Aerospace Flight
G-load of up to +3gz during any phase of flight	G-load exceeding +3gz during any phase of flight
Simple medical history questionnaire prior to flight	Comprehensive medical history questionnaire prior to any duration flight
Questionnaire reviewed by a physician experienced/trained in concepts of aerospace medicine	Abbreviated physical exam completed 1-2 weeks prior to flight
No physical exam or medical laboratory testing required	Physical exam and medical laboratory testing recommended

Note. Data for table adapted from "Guidance for Medical Screening of Commercial Aerospace Passengers,″ by Antuñano et al., 2006, Federal Aviation Administration, Oklahoma City, OK, Civil Aeromedical Inst., pp. 1-2.

FAA recommendations, as derived from Table 1, are as follows (Antuñano et al., 2006):

- Prospective suborbital aerospace flight passengers should complete a simple questionnaire about their medical history but are not required to undergo a physical examination or complete medical laboratory testing.
- Prospective orbital aerospace flight passengers should complete a more comprehensive medical history questionnaire, physical exam, and medical laboratory tests, as well as an abbreviated pre-flight medical interview and physical examination within one to two weeks of departure of an orbital commercial aerospace flight.

Studies by Broman-Toft et al. (2014), Wang (2017), and Wu et al. (2019), amongst others, have researched public acceptance of new technologies, some of which have involved modes of transportation. However, the research has centered on new technology for new applications of existing modes of transportation, such as driverless-cars and remotely piloted aircraft. Furthermore, public acceptance of new technologies has rarely, if at all, required the public to consider any medical screening requirements beyond simple things such as having vision and hearing correctable to some predefined level or reasonable dexterity in their hands and feet. Space flight participation research explicitly focused on public acceptance has been of limited scope. For example, Hempsell (2006), Reddy et al. (2012), and Springer (2012) focused on general willingness to participate in space tourism and monetary cost, rather than the guidance and regulations participants must satisfy to embark on a space flight.

Public acceptance of medical screening, safety risk, and implied liability to participate in space flight needs investigation in gauging the importance of public access to space flight and industry viability. A balance exists for operators between stimulating public demand and optimizing capital, both based on the need for participants willing to navigate safety risk, informed liability, and medical screening particulars to partake in space flight. In addressing their budgetary limitations, the National Aeronautics and Space Administration (NASA) noted the necessity of a "continuous U.S. human presence in low-Earth orbit (LEO) – both with government astronauts and private citizens – in order to support the utilization of space by U.S. citizens, companies, academia, and international partners and to maintain a permanent American foothold on the nearest part of the space frontier" (NASA, 2019, p. 1).

The U.S. Commercial Space Launch Competitiveness Act (2015) directed that voluntary standards be adopted in place of regulations to facilitate a favorable developmental stage for the emerging commercial space industry.

> The Secretary shall continue to work with the commercial space sector, including the Commercial Space Transportation Advisory Committee, or its successor organization, to facilitate the development of voluntary industry consensus standards based on recommended best practices to improve the safety of crew, government astronauts, and space flight participants as the commercial space sector continues to mature. (U.S. Commercial Space Launch Competitiveness Act, 2015)

A report from the Congressional Research Service (2020) went further in stating that the U.S. Commercial Space Launch Competitiveness Act of 2015 required the FAA to submit a report to Congress in 2018 and again in 2022 on the commercial space industry's advancements in developing voluntary safety standards for human space flight. These reports, prepared in coordination with an industry advisory group, are required to include observable metrics to aid in evaluating the readiness of the commercial space sector to transition to increased regulation of safety without undermining the growth of the industry.

The facilitation of medical guidance was thus apportioned to support the space tourism industry with certain caveats. Current federal law requires commercial space flight companies to inform crew and passengers of the inherent risks involved and that elements involving certain medical conditions associated with space flight remain unknown (King, 2020). The FAA's Center of Excellence for Commercial Space Transportation (2012) issued broad guidelines for medically screening crew and space flight participants in preparation for space tourism flights. These guidelines were an attempt by the FAA, NASA, and aerospace medical experts to provide a compendium of recommended screening practices that commercial operators could employ to advise and inform the development of their own medical programs. As of 2019, per U.S. Congressional directives, the Secretary of Transportation recommended that based on the readiness indicators, no commercial human space flight activities were ready to transition to a new safety framework that would involve regulatory action (King, 2020).

Currently, the American Society for Testing and Materials (ASTM) International is forming a committee of industry professionals with the sole purpose of developing a consensus set of passenger acceptance guidelines to advise commercial operators as they develop their medical programs (2021). While both the committee and guidance scope are presently under development, the publicizing of the aims of their publication seeks to generate interest within the commercial space tourism industry to agree upon space flight participant medical considerations which should be reviewed before flight.

Statement of the Problem

There is currently no research concerning public acceptance of existing regulatory and guidance particulars for space flight participation. For the purpose of this research, *acceptance* refers to a level of agreement or sentiment of support for a variable under study. The space tourism industry is dependent on public acceptance of this new mode of transportation. Past research has focused on participant willingness and financials (Beard & Starzyk, 2002; Chang, 2017; Springer, 2012). Public acceptance of transportation technological advancements has also been explored, though demographic effects on the acceptability of these advents have not been thoroughly investigated. The research concerning transportation technology advancement addressed user intent, perceived usefulness, and operator satisfaction (Alghuson et al., 2019; Broman-Toft et al., 2014; Hornbaek & Hertzum, 2017). In review of recommendations for further research, authors have noted the prevalence of published research that have examined subjective attitudinal and behavioral factors and how there is a need to expand the body of knowledge by studying objective demographic variables (Chang, 2018; Zhang, 2019; Spector 2020). Demographic variables allow for predictive analysis and comparative study (Sheth, 1977; Schwartz et al., 1993), moving the body of knowledge beyond correlative and psychometric analysis.

Demographic differences in public acceptance of space flight participation safety risks, implied liability, and medical screening concerns have not been researched, formally peer-reviewed, or academically documented. Spector (2020) suggested that commercial aviation, adventure tourism, and other exploratory endeavors offer useful parallels to space flight participation. An assertion was made that current space flight participation is akin to adventure tourism, described as adrenaline and risk-laden excursion for a small segment of the population. However, as touristic space travel becomes increasingly prominent, space flight could be expected to parallel commercial aviation, relying primarily on objective demographic variables rather than the subjective attitudinal and behavioral variables associated with risk-taking activities. One of Spector’s recommendations is that "further research is required to understand the relationship between demographics and space travel intentions" (Spector, 2020, p. 505).

Purpose Statement

Public acceptance of current medical screening guidance, and regulations for safety risk and implied liability related to space flight participation is essential for the success of commercial space flight. Therefore, this exploratory study utilizes a survey research design to determine if the current guidance and regulations are acceptable to the United States population. Demographic variables utilized ascertain generalizability of the findings with the U.S. population and likelihood of acceptance as a predictive response in the data analysis.

Significance of the Study

Previous research in space operations make speculative claims regarding participant acceptance toward medical screenings and physical exam requirements, implied liability, and safety risks with scant data and tangential analysis, as their motivations are concerned with other research topics and areas (Beard & Starzyk, 2002; Carminati et al., 2013; Pelton, 2007). In terms of practical contributions, the present research is a core piece of evidence for exploring further insights into the space tourism industry centered on the influence of demographic variables on public acceptance of current FAA medical screening guidance and 14 CFR regulations regarding safety risks and implied liability. The findings are intended to inform government regulators and commercial space industries on what requirements differing demographics of the public are willing to accept. Insurance services may benefit from the findings of this research to derive innovative products for the space tourism industry. As future industry standards, guidance, and regulations are developed, demographic acceptance identifiers as applied to marketing efforts could indicate where efforts should be focused. Theoretical contributions include enabling psychometric analysis of attitudinal behaviors, market viability and behaviors, and identification of key demographic acceptance identifiers based on the findings of this research, though these items were not explicitly derived in this research. The methodology could also be extended to public acceptance of medical screening, safety risks, and implied liability for the use of other high-risk technologies.

Research Questions

This exploratory study surveyed participants about their acceptance of current guidance and regulations on medical screening, safety risks, and implied liabilities and compared how these perceptions may differ based on the targeted demographic variables. However, the study did not examine relationships, either expressed or implied, between these demographic variables and the actual safety risks and implied liabilities associated with participation in commercial space flight. Instead, the focus is on the general public's acceptance of the current guidance and regulations rather than how these demographic variables relate directly to safety and implied liabilities or their willingness to travel as a space participant.

The survey examined the following exploratory research questions:

- What demographic factors significantly influence public acceptance of safety risks, liability, and medical screening for space flight participation?
- How do these demographic factors affect public acceptance of the safety risks, liability, and medical screening for space flight participation?

Delimitations

The FAA guidance for medical screening only addresses orbital and suborbital space flight and not interplanetary travel. Hence, orbital and suborbital space flights are the explicit destinations as participant physiological health is discussed to measure acceptance of medical screening guidance for travel. Technological maturation of systems for the Moon, Mars, or other areas beyond Earth’s orbit is not yet at a developmental stage for serious consideration of large-scale space tourism.

Survey respondents were required to be 18 years of age or older and have access to an internet-connected computing device. Further, respondents had to be U.S. residents who could read and understand English, as this was the format in which the research survey was written. The survey was administered via SurveyMonkey online web services, accessible to participants who utilized this internet platform for various personal and professional reasons. The data relates only to the U.S. space tourism market since U.S. regulations and guidance are not globally accepted. Finally, differences in social and cultural niches may also limit the research findings' applicability in other markets.

Demographic variables were utilized to predict public acceptance indicators, as opposed to behavioral intent variables and corresponding influences, which would move the findings beyond the intended scope of the study, as numerous behavioral intent factors would confound the results and make the research purpose unsupportable. However, the results from this research could be utilized in a resultant behavioral intent study to substantiate further acceptance research in the commercial space tourism industry. Psychographic scales assess beliefs, motivations, and priorities, and thus will not be utilized in this research as they do not capture the intent of the demographic variables utilized with space flight participation and acceptance as defined in this study.

Limitations and Assumptions

Only participants with access to a computing device and internet access were able to take part in the survey. The population of respondents was assumed to be at least moderately interested in space tourism, the major sciences, and current events regarding the space community as a whole. The use of an online survey tool assumes participants were honest in their input concerning demographic representation. As there was no tangible or intangible gain, profit, or motive connected with responding in any particular way, respondents were implicitly expected to provide their true responses to the questions. As this research utilized a cross-sectional convenience sample, differences in collected demographics could be attributed to U.S. Census Bureau attrition as their values are continually updated. Participant non-probability and self-selection biases may also be prevalent due to the use of an internet distributed survey instrument.

Summary

The need for research on potential space flight participant acceptance of medical screening, safety risk, and implied liability was explored through the current U.S. federal regulations and guidance. Previous research present speculative claims regarding consumer acceptance involved with space tourism and thus present the need for further research concerning the acceptability of current guidelines and regulations. The research will describe acceptance factors from a sample of U.S. residents with access to an internet-connected computing device. While orbital and suborbital space flight destinations will be implied in the research, the ability to afford space flight participation will not be required for the results to be considered generalizable to the general population. The survey research method allows for the greatest possible distribution and efficiency for data collection. The following chapter is a review of published literature on public acceptance of space tourism.

Definitions of Terms

Acceptability	Attitudes or reactions toward a new device before its introduction (Vlassenroot et al., 2010).
Acceptance	Attitudes or reactions toward a new device after its introduction (Vlassenroot et al., 2010).
Age	A demographic variable used by the U.S. Census Bureau to describe a person's chronological age based on year of birth.
Class of Employment	Demographic variable utilized to ascertain which segment of the workforce an individual is employed within, if any, as derived by the U.S. Census Bureau.

Crew Member	Any employee who performs activities directly relating to the launch, reentry, or other operation in support of a launch or reentry vehicle that carries human beings; typically consisting of the flight crew and any remote operator (FAA Human Space Flight Requirements for Crew and Space Flight Participants Rule, 2006).
Employment Status	Demographic variable pertaining to current status of full time employment, part time employment, or currently not working, as derived by the U.S. Census Bureau.
Favorability	A positive assessment leading to an increased willingness to accept a measure and even support it actively (Vlassenroot et al., 2010).
Flight Crew Member	A crew member who can control, in real-time, a launch or reentry vehicle's flight path (FAA Human Space Flight Requirements for Crew and Space Flight Participants Rule, 2006).
G-load	Gravitational load or force exerted as a result of physics involved in motion upon the human body (Antuñano et al., 2006).
Highest Level of Education Achieved	Demographic variable derived from the Educational Attainment population variable used by the U.S. Census Bureau.

Household Size	Demographic variable to ascertain the total number of people residing in the same domicile, as derived by the U.S. Census Bureau.
Implied Liability	An assumption of risk inherent and acknowledged by a participant in the activity involved (FAA Human Space Flight Requirements for Crew and Space Flight Participants Rule, 2006).
Income	Demographic variable to ascertain annual reported income, as sourced by the U.S. Census Bureau.
Indemnification	A legal qualifier to hold a party or persons harmless against liability, loss, or damage arising out of claims (FAA Human Space Flight Requirements for Crew and Space Flight Participants Notice of Proposed Rulemaking, 2005).
Liability	A legal obligation to pay a claim for bodily injury or property damage resulting from a licensed or permitted activity (FAA Human Space Flight Requirements for Crew and Space Flight Participants Notice of Proposed Rulemaking, 2005).
Marital Status	Demographic variable derived from the Marital Status/Marital History population used by the U.S. Census Bureau.
Number of Children	Demographic variable of the number of minor aged children residing in a domicile, as derived by the U.S. Census Bureau.
Orbital Space Destination	A ballistic flight profile entailing at least one orbit of the Earth, typically involving apogee and perigee inclinations

	(FAA Human Space Flight Requirements for Crew and Space Flight Participants Rule, 2006).
Public Acceptance	Normative assumption of an idea, activity, or construct by consensus of a majority or plurality of a population (Vlassenroot et al., 2010).
Public Perception	A popular opinion formed by prejudices, opinions, and normative thoughts on a concept that may or may not reflect logical absolute truth (Vlassenroot et al., 2010).
Race	A demographic variable used by the U.S. Census Bureau to describe a person's racial classification based on self-identification.
Region	Demographic variable used by the U.S. Census Bureau to identify an area of the United States in which a person resides.
Sex	A demographic variable used by the U. S. Census Bureau to describe a person's biological sex based on self-identification.
Social Construct	An idea that has been created and accepted by the people in a society (Merriam-Webster.com, n.d.).
Space Flight Participant	A human occupant of a space vehicle who has contracted an operator for flight and does not perform crew/flight functions or operations (FAA Human Space Flight Requirements for Crew and Space Flight Participants Rule, 2006).

Space Tourism	The practice of traveling beyond Earth's atmosphere for recreational purposes, usually for a short duration by untrained, non-professional astronauts (Hempsell, 2006).
Suborbital Space Destination	A ballistic flight profile entailing an inclination such that space flight is achieved, but an orbital trajectory is not (FAA Human Space Flight Requirements for Crew and Space Flight Participants Rule, 2006).
Work Sector	Demographic variable used by the U.S. Census Bureau to categorize occupation by industry qualifiers.

List of Acronyms

AST	Office of Space Transportation, DOT
AV	Automated Vehicle
CAASD	Center for Advanced Aviation System Development
CFR	Code of Federal Regulations
DCE	Discrete Choice Experiment
DCM	Discrete Choice Model
DOT	Department of Transportation
EADS	European Aeronautic Defense and Space Company
EKG	Electrocardiogram
FAA	Federal Aviation Administration
GENLIN	General Linear
HCI	Human Computer Interaction

HSRB	Human System Risk Board
IA	Information Acceleration
IRB	Institutional Review Board
ISS	International Space Station
ISSB	Independent Space Safety Board
MPL	Maximum Probable Loss
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NPRM	Notice of Proposed Rulemaking
OLR	Ordinal Logistic Regression
PLUM	Polytomous Universal Model
SMST	Safety Management System Theory
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UN	United Nations
U.S.C.	United States Code
UX	User Experience
VIF	Variance Inflation Factors

Chapter II: Review of the Relevant Literature

This chapter will present a review of the literature to examine the concepts surrounding public acceptance, safety risk, medical, and legal topics as well as research conducted in those areas. In addition, current public acceptance research was reviewed for technology advents in other fields (e.g., driverless vehicles) for medical requirements and case law involving liability and safety risk market viability. Government and industry stakeholders involved in commercial space applications were also reviewed to diversify the topic further. Demographic studies as applied to acceptance also shaped the research.

This chapter begins with a review of the literature that examines perceptions and concepts of acceptance. While each work reviewed was assessed in terms of space flight participation, inferences from technological and social constructs endeavor to expand the research. The chapter will then pivot to the safety risk aspects of commercial space flight participation. Next, medical aspects associated with space flight operations and possible impacts on a general population will be examined. Current legal aspects will be reviewed along with proposed changes for future engagement. Finally, a review of the theoretical framework will be examined to justify the survey research design utilizing demographic variables for public acceptance of new technology incorporated into new and novel modes of transportation.

Public Acceptance

Vlassenroot et al. (2010) defined acceptance as being linked closely to usage, dependent upon how user needs are integrated into the development of the system. This, in turn, is contingent on whether the system is good enough to satisfy all needs and requirements of the users' attitudes and behavioral responses after the introduction of the measure and acceptability of prospective judgment before such futures were introduced (Vlassenroot et al., 2010, p. 165). Thus, public acceptance can be defined as the plurality characterization of *what* is expected of a certain concept, corporeal device, or social construct during and after initial conscious contact and relative to others' viewpoints of similar interaction. A connection between acceptance and favorability depends on how potential users react if a certain measure or device is implemented. Interest in defining acceptance or acceptability lies in the precondition that the effectiveness and success of a measure will increase if there is public or social support for it. A plurality of positive assessments usually leads to an increased willingness to accept and support the measure (Vlassenroot et al., 2010, p. 165). Though Vlassenroot et al. note that acceptance and favorability are not necessarily mutually exclusive and that the phenomenological relationship between them requires further study, they are concepts connected to the adaptation of technology by society when deemed necessary or desirable (Vlassenroot et al., 2010). While centered on automotive equipment and artificial intelligence integration, Vlassenroot et al. succinctly describe how humankind integrates original technology into both corporeal and social constructs relative to acceptance for such. Vlassenroot et al. utilized an internet-based thirty-six-question survey using five-point Likert scale responses. While their goal was to gain responses from 2,000 Dutch-speaking respondents in Belgium and the Netherlands, only 148 participants completed the survey. Vlassenroot et al.'s (2010) premise of human behavior and attitudes parallels research for public acceptance of space flight participation medical screening, safety risk, and implied liability, as their work bears credence toward concepts based on preconceived notions, adaptation, and fulfilling criteria or needs. Theories and models are given to support acceptance as both a term and construct around which attitudes could be measured, including the Theory of Planned Behavior (TPB) and Technology Acceptance Model (TAM). TPB assumes that three components may predict behavioral intentions: attitudes and self-evaluation toward the behavior, subjective norms of other people's beliefs, and perceived behavioral control of public perception of their capability (Vlassenroot et al., 2010, p. 166). The authors also describe the purpose of TAM as "…designed to predict information technology acceptance and usage on the job. TAM assumes that perceived usefulness and perceived ease of use determine an individual's intention to use a system with the intention to use serving as a mediator of actual system use" (Vlassenroot et al., 2010, p. 166). These theories support and lend weight to examining space flight participation acceptance in appreciation of models against which to ascertain a population's measures, yet they do not research demographic variables as predictors to acceptance and are therefore incongruous with the research within this paper. While this work is not directly analogous to space flight participation, the precepts presented regarding acceptance and acceptability are useful for research informing public and social manifestations of acceptance.

A work from the Pew Research Center by Funk and Strauss (2018) described popular opinions about the nation's standing concerning space developments and continued space flight. Funk and Strauss (2018) reported 2,541 survey responses from the American Trends Panel, which were drawn from national landline and cellphone panelists of the Political Polarization and Typology Survey, the Pew Research Center Survey on Government, and random non-affiliated persons aged 18 and over from across the U.S. Many of the results were delineated by political leanings, generational connotations, gender, or implied simple majorities with no affiliation attached. The survey results which focused on space tourism are compelling in that the authors highlight public non-interest in space tourism, with the exception of the Millennial generation. According to Funk and Strauss (2018), interest in space tourism is greater among younger generations, men, and those with an active interest in space-related current events. "Some 63% of Millennials (born 1981 to 1996) say they are definitely or probably interested in space tourism, compared with 39% of Gen Xers (born 1965 to 1980) and 27% of those in the Baby Boomer or older generations" (Funk & Strauss, 2018, p. 11). This publication also highlights a revelation about a gender divide, denoting men were more likely than women to partake in space tourism by a 51% to 31% ratio. The work concludes by elucidating the methodology of the survey design utilized, margins of error in quantitative analysis of the data, and the weighting process for scoring, in an effort to relay reliable results.

Broman-Toft et al. (2014) detail public determination of technological interaction acceptance by laying out their interpretation based on TAM, Theory of Reasoned Action (TRA), and TPB. They relate acceptance of new technology as being based upon the degree of perceived usefulness and perceived ease-of-use to the individual, which then determines attitudes toward using the technology. If the use of new technology is evaluated favorably, it is then expected the individual will form an intention to use it. When this intention to use the new technology is expressed in response to a request to use it, the intention can then be referred to as acceptance of the technology (Broman-Toft et al., 2014, p. 393). While this work focuses on the acceptance of smart-grid technology, the use of supplemental renewable energy sources and automated regulation of consumer energy consumption (Broman-Toft et al., 2014), the determination of public acceptance is what makes it applicable for further utilization. The authors' application of societal impact as viewed by the usefulness of utilization is innovative and may be of use when framed in a normative activation model, which denotes that an individual performing a behavior that benefits others or the environment is motivated by a moral self-expectation (Broman-Toft et al., 2014, p. 394). The survey for their research utilized an online questionnaire that polled 950 Yougov Panel members from Denmark, Norway, and German-speaking Switzerland who directly consumed and paid for electricity. In terms of public space flight participation acceptance, this aspect may be interesting to explore as an individual's assessment of social acceptance is weighed against personal morals. The authors move on to discuss responsible TAM, which makes an "underlying assumption that an individual's decision to accept or reject a new technology is based on rational deliberation and self-interested motives" (Broman-Toft et al., 2014, p. 394). Their premise that dynamic forces determine an individual's and society's evaluations in the adoption of technology will play a conscious part in forming any survey for space flight participant acceptance.

Wang (2017) examined popular space tourism influencing factors utilizing an online survey of 700 random U.S. citizens across social media platforms and another 300 distributed to University of Florida students, all of whom were assumed to be 18 years of age or older. The author collected a total of 173 respondent questionnaires, utilizing a sampling measure for formula adequacy to determine satisfactory fit values. While the research looked specifically at a population's desire to partake in orbital space travel, the focus remained upon the factors which would influence that same population's motivations and desires for space travel; that is, *what* are the motivations for people interested in space travel and *how likely* are they to participate given the risks involved. The author uses push and pull factors, distinguishing between space tourism and high-risk adventure tourism (i.e., skydiving). Specifically, Crompton's push and pull theory is cited in the research, though a clear understanding is not readily comprehended in the reading. This leaves open interpretation as to what the theory contributes other than possible motivating factors by participants. Another area that is difficult to ascertain in terms of space tourism noted in the paper is the *level of involvement*, which seems superfluous to the concept of space tourism when motivational factors, desire, and intent are considered. Another point of contention is the inclusion of sub-orbital space travel in the paper's *key factors* for space travel decision-making influences, as the stated purpose of the paper was to examine orbital space tourism. The risk factors were pulled from reviews of other works, of which some are not considered scholarly contributions. The survey instrument and methodology overall ostensibly required greater rigor in construction and presentation. The author noted, "future researchers need to consider [and] adopt a more rigorous and reliable sampling method" (Wang, 2017, p. 55), which was indicative of the work as a whole.

Technology advancement often outpaces legislative administration and even social acceptance. The latter issue is addressed in Sener et al.'s (2019) research on social acceptance or rejection of technology and how it is affected by individual incorporation, as influenced by societal pressures. The authors take a head-on approach to the subject by providing information about previous work performed on technology acceptance before going on to address their public survey to ascertain public sentiment toward automated vehicle designs. The online survey was distributed to 3,097 respondents aged 18 years and older from cities across Texas to include Austin, Houston, Dallas, and Waco. To support the research, TAM was applied as "acceptance has been defined as the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support" (Sener et al., 2019, p. 68). As in similar studies, TPB is discussed in terms of acceptance and the survey model design they utilized to form a unified model of acceptance and use of technology. This paper identified positive assessments of technology acceptance and negative assessments in acceptance of technological innovation within their sample. They found that the *intent* of technology use plays a unique role in adaptation and acceptance in personal and social terms. The quantitative charting of intent-to-use was particularly informative, as were the demographic disclosures.

Hornbaek and Hertzum (2017) attempt to integrate TAM by leveraging user experience (UX) modeling. UX modeling was developed to probe the perceived limitations of usability models for consumer products, chiefly involving human-to-computer interactions. Some of the UX modeling constructs emphasize perceived usefulness, ease of use, and perceived enjoyment (Hornbaek & Hertzum, 2017). The authors firstly note,

> the overlap between work on technology acceptance models and work on user experience models is limited: Most work on technical acceptance modeling does not cite user experience models and most work on user experience contains just one or two paragraphs on technology acceptance models. (Hornbaek & Hertzum, 2017, p. 33:2)

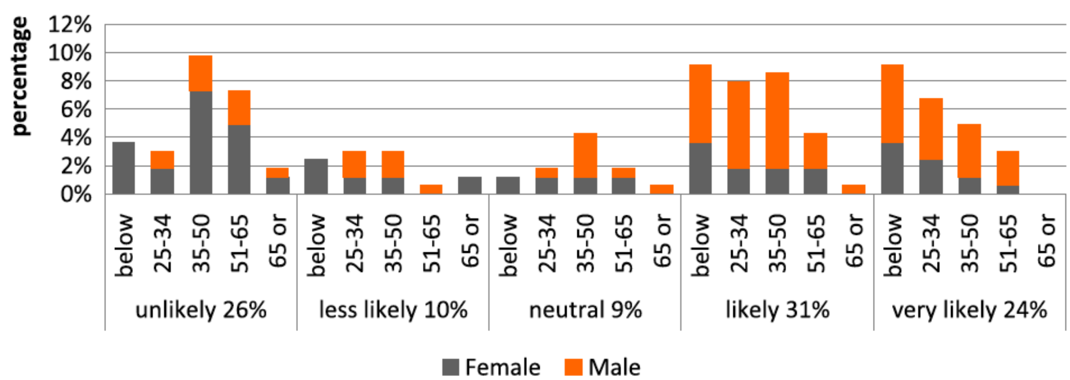
Discussion of the modeling effort in surveying a population is at the forefront before the researchers embark on integrating UX modeling and the lack of empirical consensus on how to best measure user experience. This paper was unique because the researcher's sampling frame for the survey utilized 40 published papers identified by criteria browsing that included specific keyword terminology relevant to their research. Upon conclusion, the authors note the unique problem of integrating both UX and TAM modeling platforms and the need for further research. On the whole, the paper is qualitative but uses data mining to extrapolate data from a series of papers that feature both UX and TAM modeling methods. This work may help construct a research model to gauge space flight participation acceptance, emphasizing UX in a survey design.

Yudhistira and Sushandoyo (2018) focused on TAM, as acceptance of mobile online transportation service in Indonesia is explored as a novel provision provided to a population with no previous similar or parametric technology. The authors denote the adaptation of the TAM construct to a service that had not existed at the inception of the model, combining many technological devices and services into a seamless construct that has benefited the public. The paper first defines the technology acceptance model as two main variables termed *perceived usefulness* and *perceived ease-of-use*. Perceived usefulness can be described as the degree to which a person believes using a particular system would enhance their performance. Perceived ease-of-use can be related as the degree to which a person believes that using a particular system would ease exerted effort (Yudhistira & Sushandoyo, 2018, p. 126). The authors' sampling frame is not explicit as they utilized mobile online transportation system application consumer review responses from Indonesia. However, as in other studies, usage intention and system behavior play key roles in the research as individuals are surveyed. Additionally, the authors note that TAM is not stagnant but able to evolve and be manipulated to the level of technology maturation at hand. The paper continues on to study mobile online transportation services, product-service systems, and product-oriented services, which may need to be evaluated further to determine any congruence to space flight participation acceptance factors.

Reddy et al.'s (2012) research relates participant acceptance of space tourism recommendations. Their work focused on participants in the United Kingdom, with chief attention paid to the likeliness of space tourism based on age and sex, as provided in Figure 1 and Table 2.

Figure 1

Willingness to Undertake Space Travel Versus Respondent Sex and Age



Note. From "Space tourism: Research recommendations for the future of the industry and perspectives of potential participants" by M. Reddy, M. Nica, and K. Wilkes, 2012, *Tourism Management*, *33*, p. 1097.

Table 2

Unwillingness to Undertake Space Travel Versus Sex

Gender	If you are not that interested in a space trip, what is the reason?					
	Too risky	Health problems	Enough destinations to see on earth	Environmental concern	Other	Total
Female	30.00%	2.90%	17.10%	5.70%	10.00%	65.70%
Male	4.30%	4.30%	15.70%	2.90%	7.10%	34.30%
Total	*34.30%*	*7.10%*	*32.90%*	*8.60%*	*17.10%*	*100.00%*

Note. From “Space Tourism: Research recommendations for the future of the industry and perspectives of potential participants” by M. Reddy, M. Nica, and K. Wilkes, 2012, *Tourism Management, 33,* p. 1098.

The paper presents a foundation in practical issues and anecdotes to explore and extrapolate in comparison to participant attitudes such as space tourism awareness, actualized demand quantification, and participant motivational inquiry. Features that steer the work into better areas left to other research include the need for private investment and annual operation financials. While relevant to an overall institutional picture of space tourism operations, the divergences from the central premise of participant perspectives muddy the presented material. The authors make a few speculations that have already been rendered moot; one such example being, “sub-orbital space tourism business could generate 10,000 passengers by the year 2021 with revenues of more than $650 million” (Reddy et al., 2012, p. 1095).

However, the researchers make salient points regarding the value of training for hazards based on the various configurations available for space flight and denote attitudes concerning physical training and health. The analogies drawn by the authors between likely initial space tourists, existing adventure tourism, and extreme sports markets seem to make logical connections to acceptance indicators such as wants, needs, and desires as individual motivators to participate in space tourism. Key distinctions were drawn based on respondents' thoughts on training versus space tourism providers within the researchers' survey (Reddy et al., 2012). While the subject pool was confined to 164 random respondents in the United Kingdom, it would be interesting to evaluate their findings compared to a study of a U.S. population. The paper aptly details research methods, data collection, and analysis regarding the methodology surrounding the survey instrument and qualitative interview strata. The findings center moreover on participant reasoning for partaking in space tourism. While the key factors support the authors' purpose in conducting this research, it skirts acceptance of risk factors, implied liability, and medical screening by concentrating on availability and willingness factors.

Beard and Starzyk (2002) make an earnest effort to determine space tourism viability commercially and economically. While not resolutely focused on acceptance of guidance about space flight participation, the study "presented a realistic portrayal of spaceflight to its respondents and selected a respondent population that could potentially afford to pay the current and future prices for the service" (Beard & Starzyk, 2002, p. 1). Featuring early narratives of space tourism via the Russian Soyuz missions to the International Space Station (ISS), the authors detail the financials involved in these early exploits and attempt to utilize parametric analysis to project future market demand as measured against the then-field of space tourism providers. However, the authors do acknowledge that further research and contributing data would be needed to accurately depict the market as technology and the industry at large developed.

Survey results were tabulated and graphed to demonstrate forecasted annual revenues. The survey was conducted via 450 telephone responses of U.S. households with annual incomes of at least $250,000. The survey data indicated the type and duration of experience desired by the sampling pool, though more and differing analyses in terms of demographic predilections could have been utilized. Delimitations included annual income and net worth, though this may be restrictive in determining wider space flight participation acceptance. Further, the survey instrument had participants self-identify their own opinions on fitness, training, and expense, which may reflect selective public attitudes concerning space flight participation and warrant further exploration utilizing a broader audience. The survey results were delineated between suborbital and orbital space tour destinations and participant attitudes entailing desired experiences. Detailed attention was given to interpreting the results while extolling potential impacts for the industry's future. While dated, the historical anecdotes represent the basis for space tourism as it has evolved today. The figures detailing consumer sentiment were thorough and complemented the many charts, graphs, and tables to interpret the research data and findings.

Public acceptance of space flight participation may mean different things to different people, and thus delineation of the experience on the part of the researcher needs to be expressed in context of the research involved. Crouch et al. (2009) attempt to estimate the demand for certain types of space tourism services by modeling and forecasting likely consumer response. The study goes forward to detail survey results of four *types* of space tourism: "high-altitude jet fighter flights, atmospheric zero-gravity flights, short-duration sub-orbital flights, and longer duration orbital trips into space"

(Crouch et al., 2009, p. 441). The data utilized in the sample were collected from an online consumer panel of more than 300,000 Australians.

The authors conducted their research utilizing discrete choice models (DCM) and discrete choice experiments (DCE) to produce an orthogonal main effects plan framework for interpreting their findings. DCEs feed into DCMs by allowing "one to decompose the independent contributions of the many factors that comprise a space tourism experience. A DCE is a designed 'choice experiment' in which the features (variables) of interest are systematically varied using statistical design theory" (Crouch et al., 2009, p. 443). While the survey and crosstabulation yielded useful intimations for the reasoning behind public participation in space tourism, the results do not appreciably indicate public acceptance of space flight participation doctrine. Before proceeding into their survey and results, the authors detail other researchers' findings that also utilized DCE, DCM, and information acceleration (IA) methods, giving analogous helpful information for further research. The issue remains that demographic factors in acceptance are not elucidated, and thus further research is needed to examine this gap in knowledge. The literature stays true to its intended purpose and delineates responses based on the economic status of the participants, though this again strays from a generalized examination of public acceptance across multiple demographic spectra. A great deal of effort and care was utilized in explaining their results with ample charts detailing the data and scoring.

Space tourism is detailed by Chang (2017) in an appraisal of current research and areas for further study. However, the review of other's published works is very brief given the broad scope of the subject. Chang's reference makes an excellent compendium due to relevant research regarding public attitudes toward space tourism with a pointed effort to review space tourism novelty and consumer attitudes regarding public perception. The quantitative survey conducted by the author utilized 354 responses from Taiwanese residents in the Hsinchu region, known for its scientific industry. The paper's hypothesis espouses to research "The effect of innovativeness on attitude towards space travel is mediated by novelty" (Chang, 2017, p. 1439). Innovation adoption theory is yet another principle to consider when ascertaining participant acceptance in the space tourism industry. This theory "incorporate the stages of consumer decision processes when applied to understanding new product/service adoptions" (Chang, 2017, p. 1437). As space tourism is still a socially novel concept, the motivations behind adoption as related to acceptance are relevant to further research. In utilizing a 20-item, five-point Likert scale survey to gauge hedonic and novelty assessments of consumer attitudes toward space tourism, it becomes a reasonable analog for use in other research areas.

The methodology and analytic techniques involved may likewise be helpful in the parametric construction of similar research. Chang's findings and discussion, again while analogous to the concept of acceptance, parsed consumer's perceived novelty and innovativeness, utilizing acceptance as a normative quality to relay the outcomes. While mirroring aspects of other works, the information is poignant given how recently it was published. Chang (2017) provides due diligence in offering other investigations from prominent researchers involved in space and aeronautics to advance other study areas.

A qualitative review of space tourism is given by Cohen, who examines "limitations of human cosmic expansion, subversion of adventure in space tourism, banalization of the sublimity of the experience of space tourism, and the deflowering of the pristinity of other celestial bodies by space" tourism (2017, p. 22). The paper looks at the history and evolution of space exploration before moving quickly into the field of private space operations and the revenues involved. Cohen imparts his thoughts on humanity's ability to populate the broader cosmos, given the technical level of engineering required. The work returns to the adventuring aspect of space travel with a qualitative analysis via interviews and a review of publications about the types of participants that may be interested. Cohen draws parallels between adventure tourism and space tourism with the exception that "the very technical and organizational complexity of space travel robs the space tourist of agency, namely the very spontaneity and individuality of action which is the mark of the adventure tourist" (2017, p. 25). The author notes how current space tourists are expected to be passive participants with trained professionals responsible for the mission and overall safety. While extremely wealthy space tourists are not favorably denoted in this work, their contribution to the advancement of the space tourism industry was remarked upon as a necessary step to dissociate space flight participation, "from space exploration conducted by governments, and moved into the hands of specialized private start-up companies…" (Cohen, 2017, p. 27). The paper moves on to describe the possible motivations for potential space tourism participants. While constructive, this work is qualitative, relying on quotes, interviews, and publications to critically examine space tourism and space flight participation.

Chang (2015) takes a wide-ranging qualitative view of space flight participation using a chronological progression of historical space tourism developments. Using third-party figures and mentions of survey results from other research, Chang provides no quantitative study of space tourism of his own. Concerning public acceptance for space tourism, Chang notes the millions of visitors to the Smithsonian Air and Space Museum in Washington D.C. and other independent market studies from the 1980s to make a case for widespread interest. The presented materials are seemingly conjecture at best, but Chang does go on to look at more recent projections from the European Aeronautic Defense and Space Company (EADS) and Futron Corporation, which indicate more realistic measures and projections for the current space market and industry. However, the paper leaves the necessity of further first-hand research open as it is a report constituting a patchwork of others whose emphasis was more about industry viability than public acceptance. Moreover, even where public acceptance was concerned, the paper focused on the type and duration of space flight voyage prospective tourists may prefer.

Safety Risks

Safety risks will be bounded to space flight participation for this research, as additional medical and safety screening requirements are apportioned to space flight crewmembers. United States Code (U.S.C.) Title 14 CFR § 460.45, Operator Informing Space Flight Participant of Risk, states the operator must inform the participant of the risks involved. The risks that must be satisfactorily conveyed include the operator's safety record, risks associated with each phase of flight, and that there may be unanticipated hazards incurred during flight and operations. Participants must also be made aware that space flight could result in serious injury or death and that the U.S. government bears no responsibility for their safety or protection (DOT, 2016). The regulation goes on to denote the consents, waivers, and ancillary items which must be complied with by the participant and operator. This reference is notable for officiating *acceptable risk* in a legal and regulatory sense, though this is bounded by actuation of debris, toxins, and far-field blast overpressure (DOT, 2016). The officiating of risk acceptance is necessary to regulatory evaluation, though further research needs to be centered on space flight participant risk acceptance and the characterizations entailed in legal evaluation thereof. The assumption of risk, in particular, should be explored in a manner to discern disparities between legal definitions and consumer rationalizations.

The Independent Space Safety Board (ISSB) put forth a technical manual with the express purpose of protecting "flight personnel (i.e., crew and flight participants), ground personnel, the vehicle and relevant launcher or carrier, and any other interfacing system from CHS-related hazards" (2010, p. 11). Commercial human-rated systems (CHS) within the confines of this work refer to commercially developed human space flight systems and their operation. While the publication covers all forms of systems and operations involved with a human space flight craft, the scope of the document is to reduce risk and hazard exposure where possible. The Mission Safety Risk section, in particular, espouses to expose the minimum number of people to the minimum amount of hazard for the minimum amount of time, and that continuous redundant real-time system monitoring should take priority such that a flight should be terminated if loss of critical systems monitoring occurs. The section of the work goes on to state that space flight crew and participants are not to be exposed to 10^{-3} (1 in 1000 chance) catastrophic events for orbital flight or 10^{-4} (1 in 10000 chance) for suborbital (ISSB, 2010, p. 13). The publication makes salient definitions to characterize a *catastrophic hazard* as one in which loss of life occurs and a *critical hazard* as an event in which injury is sustained. The paper goes on to describe equivalent safety standards, services, and control of safety-critical functions. The top-down approach to the safety recommendations and protocols is sound and straightforward, though quantifiable measures are needed to aid in the definitions. This technical document is helpful in the formation of a survey device with which to derive acceptance of the protocols within it. However, it is a qualitative subject matter expert document that follows a hierarchical approach to eliciting guidance.

The FAA issued guidance for commercial space flight occupant safety in 2014, intended to separate recommendations for commercial human space flight from other space flight areas and concerns. In essence, the document serves to issue advice and support for suborbital and orbital crew and participants involved in space launch and recovery of short duration, less than two weeks. The proposals span considerations ranging from vehicle dangers, flight, and recovery. Notable in this document is the purposeful levels of care involved with vehicle occupants and the vehicle itself, safety-critical operations, and emergencies with survival and safety of occupants as first and foremost in each instance. This line of thought goes further with recommended practices for design, manufacture, and operations, such as with the concept of acceptability, only with a focus on occupant safety in mind. Performance and process-centered safety objectives are unrefined so as to allow for adaptation and advancements in the commercial space industry, given the pace of technological advancements and special circumstances involving human space flight. Due to a lack of data or instability in records, some items are not addressed for space flight safety, including medical limitations, radiation, and occupant and public safety integration. These factors are not accorded as the recommendations provided are based on FAA perspectives, and the achievement of zero-risk in such areas would be unnecessarily burdensome to operations.

Ample coverage of a wide variety of space flight occupant safety concerns are readily addressed in broad terms with governing rationale affording common-sense approaches to each. The document covers topics by vehicle design, manufacturing, and operations, with subordinate areas giving thorough yet flexible recommendations and rationales. The document provides a reliable primer for commercial space flight participation, emphasizing crew and participant safety, easily referenced and adaptive to changes within the industry.

Quinn (2012) takes a qualitative examination of the private space flight industry utilizing historical events to relate subsequent legal renderings and implementation of safety practices. The work begins with a current review of safety, standards, and approaches in an attempt to synthesize a safety matrix utilizing goal structuring notation to make a case for the methodology involved. The nexus of the literature revolves around space tourism chronologically following the history of commercial space flight customers joining Soyuz missions to the ISS and the awarding of the Ansari X-Prize as the catalysts to the beginnings of the space tourism industry. The space tourism market is briefly considered utilizing Futron and Zogby reports to indicate that the general public is interested in obtaining space flight. The paper studies accident investigation and associated safety protocols to make a case for new safety management tools proposed therein. Hazard management is identified at length as a "process [which] should start at the beginning of a program and continue throughout the life of the program up to 'Disposal'" (Quinn, 2012, p. 34). The author makes use of lifecycle development in the presentation of hazard, safety, and fault analysis. The paper utilizes no survey instrument to assess the public acceptance of safety, risk, or the tools it prescribes. However, it relies on subject matter expert publications and qualitative analysis to derive its goal. This work leaves open the necessity of assessing public acceptance of safety risks concerning space flight participation as it does not adequately address their interaction.

Springer (2012) revealed findings of an opinion survey relative to regulations and risk acceptance for commercial space flight. Springer noted the research purposes were to: demonstrate how much risk the public is willing to assume, what public sentiments were on survivability and government oversight, and public impressions regarding the state of current regulations for commercial space flight (2012). The publication denotes current regulations regarding informed consent and public safety contrasted with participant and crew health and safety concerns. Springer (2012) launches forward into the survey design utilizing a base number of invited applicants not tied to any sample size formula for generalizability of the results. While responses to the survey netted nearly one-third of the intended participants, the instrument aimed to examine participant attitudes by demographic variables. The demographic responses were cataloged by sex, age, familial status, aerospace industry exposure, and interest in space travel. Certain findings by the author were incongruous and derivative to the stated purpose, such as participants' industry exposure and space flight expenditure price-point considerations. The most valuable aspects of the Springer (2012) study had to do with perspectives relative to government oversight and risk acceptance, though they made up a small portion overall and could have been expounded upon. The bulk of the research utilized bar charts to depict various demographic delineations. Areas concerning risk acceptance employed five-point Likert response scoring or statement-agreement percentage ranks to elucidate the findings. The final results were difficult to connect to the data rendered, as clear links between risk acceptance and demographics were not established with causal or predictive relationships. The conclusions were confounding regarding participant risk acceptance for space travel compared to automobile or airline travel. The data have borne out participant belief in more regulations regarding safety and survivability.

A comprehensive investigation into historical and current international safety regulations related to commercial space transportation, culminating in a statistical analysis of effectiveness, is given by Wakimoto (2019). Much of the discussion centers on the early days of aviation and advancements through the World Wars to the birth of the space race of the 1960s. A comprehensive review of U.S and international treaties, regulations, and conventions are described to give background to the current situation as various space tourism companies prepare to begin operations. A number of disparities are reviewed regarding differences between air law and space law, suborbital and orbital trajectories, and ideas governing sovereign boundary definitions. Wakimoto (2019) identified the gaps in law and legal definitions regarding aircraft, aerospace vehicles, and space objects as there seems to be conflicting interpretations depending upon the governing bodies and phase of flight involved. Comparative arguments, theories, and philosophical approaches detail the bulk of the publication in a qualitative analysis before moving on to the statistical assessments of laws and regulations. Descriptive statistical analysis is utilized in a broad way to compare and contrast regulatory implementation over time against aircraft accidents and incidents. While not completely analogous to human space transportation, the results give the impression that safety has improved over time by the implementation of regulations on industry (Wakimoto, 2019). The conflation of space-faring vehicle and aircraft accidents gives future researchers the opportunity to specify and delineate between these distinct industries to give more refined results.

The concept of novelty versus risk, as factored into travel and adventure for decision motivations to either embark or not, is presented in a work by Chang and Lu (2018). Risk acceptance is the primary area under research as the authors attempt to explain how and why people decide to take trips to unfamiliar places for unfamiliar experiences. Chang and Lu define risk in terms of novelty-seeking as “the uncertainty one will face when one cannot foresee the consequence of the purchase decision” (2018, p. 499). The concept of visit intention adds a new dynamic when considering risk acceptance regarding novelty-seeking via adventure travel. The authors utilized 302 survey responses collected from a Taiwanese travel agency customer database specializing in independent novelty-seeking consumers to conduct their research. This parallels into a study of space flight participation quite well by examining public intention to partake in space flight by factoring in risk acceptance. The authors developed and conducted a survey instrument design that employed structural equation modeling to delineate the findings. This work is helpful to consult when identifying concepts of novelty seeking, risk acceptance, and visit intention.

A work by Pelton (2007) takes a worldwide look at the space industry and space tourism constructs. Though it encompasses a breadth of developing space tourism projects and programs, it also devotes a portion to the safety and risks involved. While largely qualitative in nature, tables and figures produced by the Futron Corporation are utilized to make the author’s positions regarding possible revenues, demand, and annual traffic known. Much of the work is dedicated to the development of the space tourism industry and possible impediments, as the author points out areas of apprehension, including environmental concerns about impacts on the Earth's ozone layer, the weaponization of space, and orbital space debris in Low Earth Orbit (Pelton, 2007). The sheer volume of material makes it a challenging read, though it is comprehensive regarding environmental concerns, marketing, international cooperation and competitiveness, and legal aspects. The primary focus is on these and many more aspects related to future space tourism developments, safety issues, and risks. For this review, special attention was focused on the author's safety and risk issues. While comprehensive and exhaustive, the work did not create any survey or data analysis of its own but relied instead upon work compiled by Zogby International and the Futron Corporation, thus bolstering the need for independent research in the area of safety risk, especially given the date of publication.

A work by Macauley (2005) titled "Flying in the Face of Uncertainty: Human Risk in Space Activities," notes that risk management is a growing issue due to increased investiture in the development of space. Directly involved persons, such as space flight participants and third parties, such as those dwelling in space flight paths, must be considered when managing risk. What is more, considerations regarding extraterrestrial biological contamination should be factored into safety protocols as well. Macauley notes that as unknowns will exist within the space operations industry, a "large private-sector role in space also calls for greater consideration of the advantages and disadvantages of relying on conventional practices, such as tort liability and insurance, as alternatives to government intervention in designing public policy" (Macauley, 2005, p. 131-132). Macauley points out that the space industry project's objective should be to manage risk through incentives, regulation, and legislation. The paper demonstrates how past accidents involving NASA missions resulted in congressional investigations, which in turn led to engineering redesigns, though accidents continued to be incurred. The author covers incidents that, while rooted in engineering issues, were ultimately failures of leadership and decision-making. Despite continued incidents and accidents, the space industry continued to grow, as did the pool of astronaut candidates, even though the inherent risks of space flight and unknown risks became more evident. Macauley goes on to note that "balancing manned and robotic exploration – based in part on a comparison of human risk – is only part of a decision about future space activities" (2005, p. 137). This observation was made regarding new advancements in robotic exploration, including artificial intelligence and computer learning, which were extolled. The work details the recent history of the Ansari X Prize and SpaceShipOne's achievement, harkening the birth of space tourism. Macauley goes on to detail the follow-on legislative debate surrounding the idea of the public to fly at their own risk and other arguments that there need be regulations to loosely oversee space transportation and passenger safety, which led to the Commercial Space Launch Amendments Act of 2004 (2005, p. 139). This act allowed for the licensing of spacecraft under experimental guidelines and permitted passenger travel so long as participants were informed of the risks. The paper examines the Commercial Space Launch Act of 1984 and the provision for maximum probable loss (MPL), capping indemnification claims at $1.5 billion, which, if exceeded, were to be taken up by the U.S. Congress pay out. Macauley notes that this provision in the U.S. market for indemnification is not a significant factor in the price-competitiveness of U.S. launch vehicles partly because of a nearly flawless safety record. Over the history of the U.S. space flight industry, there have been no injuries or fatalities to third parties (Macauley, 2005, p. 142). This revelation resulted in further industry discussion to do away with the indemnification provisions and instead favor insurance pools for self-insurance, bond issuing, and establishment of trust funds. Macauley's work overall is qualitative, utilizing historical anecdotes and public records to disclose the current risk and indemnification within the body of knowledge. The paper does not research potential participant acceptance of any current or proposed risk and indemnification protocols; thus, more research into these issues is required.

Teske and Adjekum (2021) offer a novel approach in utilizing an exploratory sequential mixed method design to analyze human space flight safety. The research begins with a review of U.S. legislation related to commercial space endeavors, pointing out safety issues related to government space crew safety requirements and the disparities with commercial space tourism. The authors particularly denote potential challenges regarding FAA and NASA governance regarding commercial space tourism and human space flight participants (Teske & Adjekum, 2021). The publication therein posits that safety management system theory (SMST) would be a good approach to implement to ensure the safety of space flight participants as commercial providers are "not formally mandated to have SMS and personnel in Part 121 airlines mandated to have SMS under 14 CFR Part 5 requirements" (Teske & Adjekum, 2021, p. 267). To that end, SMST is cited in chronological order ending in a modern comprehensive framework to outline the key elements. The research was conducted using qualitative and quantitative methods of both archival literature reviews and survey instrumentation. The qualitative portion identified descriptive theories to distillate into the quantitative survey questions. The authors then utilized power analysis of their 24-question survey utilizing seven-point Likert responses to factor for evaluation. A convenience sample was drawn from airline and commercial space tourism companies, which may factor in generalizability of the results. The data were analyzed using confirmatory factor analysis, structural equation modeling, and average variance extracted. The findings elicited the prevalence of awareness of SMST within both airline industry and commercial space tourism providers. While the use of qualitative archival research married with quantitative analysis of survey Likert responses in this publication, the objectives of the research did not reflect acceptance of the current guidance and requirements for space flight participation.

The MITRE Corporation stressed more significant integration efforts for space operation into the national airspace system (NAS) due to the coming advent of space tourism. The Center for Advanced Aviation System Development (CAASD) makes a wide range of recommendations denoting how the line between airspace and outer space is becoming intermingled (2019). According to the authors, "soon, space tourism operations will build additional demand for access to space through the NAS" (MITRE, 2019, p. 54). Unfortunately, the publication is somewhat abridged with subject matter expert input recommendations for updates to the NAS. While mentions of integration and collaborative efforts are made, no data or analysis are given to back up the claims made. This piece represents a bit of useful information but lacks hard data and methodological analysis. Therefore, as safety risk is examined, a survey device utilizing inputs from this document may be prudent to space flight participant acceptance of risk in traversing the NAS into outer space.

As with other literature reviews that have examined the field of space flight participation indemnification and law, Bensoussan (2010) begins with a brief history of commercial space operations development and a transitory overview of space law. The author speaks to the differences in technology, experience, and risk when describing the differences between commercial air transportation and space tourism. The technology, operations, and flight profiles are just some of the differences, but these issues are tertiary to the paper's primary purpose of space flight risk and liability. The risk of hull loss is one of the topics briefly covered as:

> the primary risk which insurers would consider and analyze is related to physical damages that may affect Space Tourism vehicles themselves in the course of their operations … What the policy covers is the reinstatement of the aircraft to its 'pre-loss' condition if repairable damage is involved; or some other form of settlement in the event that more substantial damage is sustained … The indemnity is generally based on an agreed value or the replacement cost of the vehicle. (Bensoussan, 2010, p. 1635)

The author moves on to passenger, third party, and personal accident liabilities, denoting that liability waivers must be signed for space flight participation. The signatory acknowledges the inherent risks and that unknown risks exist. Third-party liability is satisfied by space flight operators obtaining compulsory insurance to cover an MPL of no less than $500 million in the event of a catastrophic loss (Bensoussan, 2010, p. 1636). These liability issues feed into the authors' risk assessment practices which utilize analogies from the airline industry. However, no statistical data or figures are presented to suggest solutions to the issues within. This glaring omission could be appraised in a formal quantitative study on risk, implied liability, and indemnity acceptance.

A comprehensive look into automation and technology levels to interpret the varieties of trust and risk the public associates with them is found in a work by Zhang et al. (2019). The research focus on automated vehicle (AV) technology denotes that “the biggest barrier to AV penetration does not originate from the technology aspect but is due to low public acceptance” (Zhang et al., 2019, p. 208). This potential could exist with the onset of the space tourism industry due to the novel mode of travel and destination environment involved. According to the publication, public acceptance of technology and the risk involved will need to be overcome via large-scale public demonstration and safety record promotion. The authors note the importance of demographics on acceptance levels and willingness of intent. The research utilized an in-person survey conducted in Shenzhen, China, automobile parking lots which involved 216 participants. The survey was conducted in three parts: the participants' demographics, driving history and experience, and awareness of automated vehicle development and their acceptance of it via scenario presentations in Likert scale responses. Confirmatory factor analysis was used to examine the psychometric values. The author states, “no significant demographic or driving record related effects on trust, attitude or usage intention were identified” (Zhang et al., 2019, p. 214). Acceptance models are discussed in a general sense, though evidence for their use is relegated to the methodology and findings sections of the paper. They note the lack of research regarding psychological determinants, variance in acceptance, pathways to influence, and failure to identify the significant role of perceived risk in technology acceptance. This paper does make strides to address these issues in quantifiable and actionable findings by using TAM with initial trust and perceived risk as inputs. In this research, they attempt to demonstrate “that trust is the key path in shaping acceptance which mediate, fully or partially, the effect of other psychological determinants” (Zhang et al., 2019, p. 208). The paper mentions many other models and theories that would warrant further examination in any research of space flight participation, such as the TPB, TAM, unified theory of acceptance, and use of technology, amongst others. The findings demonstrate how positive attitudes toward technology and intent-to-use impact behavior. The second area of research, perceived risk, receives equal attention and impact via the survey instrument design and findings. The research acknowledges that “perceived risk… still remains controversial in terms of the nature of the relationships among trust, risk and consumer acceptance” (Zhang et al., 2019, p. 211). This admission makes the inference that risk is not mutually exclusive to acceptance but plays a role nonetheless, which should be further explored.

Building off the Commercial Space Launch Act of 1984, the DOT addresses the hazards of launch and reentry to participants, the public at large, and the safety of property (2019). Their documentation aims to streamline the commercial space industry by allowing for “… a single license for all types of commercial space flight operations and replace prescriptive requirements with performance-based criteria” and “derive safety requirements through a ‘system safety’ process” (DOT, 2019, p. 15297). These processes are further defined in terms of the performance-based regulatory process to administer the safety of operations. The proposed rulemaking notes that safety requirements may be met through current FAA inspection systems, request for waivers, or compensatory safety measures to ensure compliance. Much of this proposed rulemaking document allows greater flexibility in administrating safety inspection and allowances for operators to demonstrate safety compliance either via adherence to current safety requirements or demonstrating safety protocols that may satisfy inspection protocols. Another area of streamlining involves changing regulatory requirements from prescriptive-based formats to performance-based so that "… an operator would be able to use an acceptable means of compliance to demonstrate compliance with the requirements" (DOT, 2019, p. 15303). This shift in safety administration allows the industry to capitalize on technological developments occurring as advancements and developmental evolutions, reducing the burden of waiver applications and review. The proposed rulemaking prescribes that operators establish a system safety program to coincide with the lifecycle of the vehicles utilized. Further elucidation of the safety protocol aspect is extensive and provides a framework for describing flight safety analysis, derived hazard controls, and prescribed hazard controls, amongst others. The document goes into great detail regarding safety acceptance, practices, and how they would be administered, depending on participant acceptance of safety risk. Due to the amount of information, these factors may need to be distilled into a palatable format for participant determination of acceptance. Participant acceptance, in particular, features prominently within the document in determining appropriate safety risk based on the operators' compliance, inspection, and safety programs.

In another DOT publication, the participant risk limit is revised quantitatively to ease operations for providers and allow greater access for the general public (DOT, 2016). The departmental rulemaking issued the following: "The FAA proposed to revise the acceptable risk limit for launch to 1×10^{-4}, encompassing all three hazards—debris, toxic release, and far field blast overpressure" (DOT, 2016, p. 47019). As participants are likely to be exposed to such hazards, the revision is significant by easing safety risk liability and allowing greater flexibility in risk mitigation strategies. It also affords streamlining the level of safety risk commensurate with other governmental administrations and reduces confusion in meeting the threshold as the previous limit was set at 1 x 10^{-6} chance of occurrence. Moreover, it gives indemnification a definable benchmark from which to allow operators, participants, and insurers a basis to frame risk strategies and mitigation objectives.

Safety and risk are identified as areas of public concern by the FAA (2017), warranting continued research to explore participant expectations, obligations, and possible rationales. While space flight crew and participant informed consent are seminal concentrations in administrative documentation, risk and safety factors are instrumental to the focus and are adjoined throughout their publications. The assumption of risk is based partly on the responsibility of operators to ensure the vehicle is capable of launching and reentering without jeopardizing public health and safety and private property safety. Operators are further encouraged to explain that the U.S. government will not ensure the safety of the flight crew, government astronauts, or space flight participants (FAA, 2017). The FAA's documentation describes the risks that participants must be aware of and the operator's safety record associated with the spacecraft. The reporting requirements held with the FAA must detail both the operator's conveyance of risk and safety and the participant's understanding of them before contracting for a space flight. The risk of launch and reentry, unknown hazards, vehicle non-certification, safety record, and any additional accidents and incidents are some of the significant items that must be disclosed and documented in a written and oral manner.

Medical

Research by Jennings et al. (2012) provides a consolidated set of recommendations for crew medical standards that may be useful to the FAA in its regulatory responsibility for such. Their documentation was also intended to provide a consensus set of passenger acceptance guidelines that can advise commercial space flight operators as they develop their medical programs. Though the FAA sponsored this project, it neither endorsed nor rejected the findings of their research; “The presentation of this information is in the interest of invoking technical community comment on the results and conclusions of the research” (Jennings et al., 2012, p. 1). An investigation into their defined categories of space flight participation is worth exploring on a fractional basis. Flight G-load profiles will help frame participant expectations concerning health and risk as a parametric reference to the stresses induced on the body, which will need to be ascertained to determine personal fitness for flight. Of interest is the section on suborbital space flight participant health guidelines. The authors’ questionnaire may prove helpful in crafting survey questions as physiology, health, and self-limiting risk factors may affect participant acceptance on the whole. The authors succinctly define the types of health issues participants should be screened for and present a mockup of a potential medical screening questionnaire. Although health hazards and effects are broadly defined, no substantiating data is provided.

An account of risk incurred during space flight and in the space environment relative to health impacts is given by Antuñano et al. (2020). The paper is written by subject matter experts in the space industry field, expressed qualitatively. The authors do well to describe the hazards involved in space flight, the space environment, and the health issues involved with participation. Special emphasis is given to pre-existing health conditions and possible impacts, as exacerbated by the special conditions of launch, space flight, and recovery in both orbital and suborbital modes. A brief history of non-professional astronaut participation is given relating the experiences of national assets and the early commercial space industry. Assumptions and concerns of likely space flight participant age and health are expressed though no substantive data or analogs are given to back up the suppositions. The authors' lack of standardized medical evaluation for commercial space flight participation, aerospace medical screening practices, and scarcity of historical medical records for untrained astronauts are central concerns as the commercial space flight industry readies for initial participant space flight operations. Synopses of others’ research in applying space flight training regimens and simulated space environmental effects are presented to generalize the need for more research into best practices for health screening and training for space flight participation, caveated by duration and risk exposure. Medical risk management conception is then presented as a basis for further mitigation actions related to policy, safety risk, assurance, and promotion. These concepts are expounded upon as an overarching methodology aimed at protecting the participant and operator in precluding health issues, screening practices, training programs, mitigating in-flight emergencies, and post-flight medical assessments, amongst other program ideals. The concept of medical risk management is then segued into informed consent as a policy backstop for which to justify the need for a formalized risk mitigation strategy. The paper presents the need for and constructive solutions to health and medical situational awareness and risk mitigation in the commercial space flight industry, as related by field experts. The authors note the lack of medical data for further analysis and do not present any quantitative data for their conclusions.

Kluge et al. (2013) takes a proactive approach to known health and physiological risks inherent in space flight. Their publication does not focus on either type of spacecraft, differences in orbital or suborbital travel, nor specific areas of physiology but attempts to address all hazards a space flight participant is likely to encounter across all types of space flight vehicles and associated flight profiles. The paper delves into medical screening as currently established, remarking on the lack of proactive protections to assure the space tourism industry and space flight participants (Kluge et al., 2013). The authors detail their proposed steps in potential space tourist medical screenings, related issues, and possible resolutions. They go further in elucidating a potential medical screening questionnaire, noting possibilities for self-eliminating answers. The authors then go over medical selection issues that a flight surgeon would review before supposing a variety of training program regimens for space flight. The glaring issue with the work is that it involved no applied research and appears to detail recommendations by subject matter experts only. Overall, the work lacks descriptive statistics and data, prescribing solutions without corresponding criteria. While providing generalized information on space flight medicine, hazards, risks, and possible mitigations, it leaves many areas open for further parsing due to the lack of quantitative data.

Schroeder et al. (2021) give a qualitative examination of the emerging commercial space tourism industry and current medical guidelines. The aim of the authors is to both identify gaps in previous literature regarding medical recommendations for non-crew members and legal ethics involved with current guidance. A general review of current commercial space craft profiles, existing medical data, and medical guidance are given, though no novel insights are gained, and issues revealed in other publications are reiterated. Schroeder et al. do go into great detail regarding the evolution of space flight participant medical recommendations, governing bodies responsible, and the historical anecdotes associated (2021). Utilizing subject matter expert opinion, the authors address perceived disparities within current medical guidance. Further areas for specified research surrounding common medical issues and likely impacted organs and physiological systems are expounded upon with sound reasoning given. While the authors initially promise to identify gaps in the legal ethics involved adjoined to medical screening and recommendations, there is relatively little expounded upon, and what is covered has already been identified in prior publications. While a very good review of the history and current issues regarding medical screening for space flight participation, there is no original quantitative analysis to backstop their assertions as they instead rely on other published data for perspective.

A concise study on the psychological effects that could be visited upon space flight participants is given by Florom-Smith et al. (2022). The publication is a qualitative archival review of other published reports, organized by space flight profile, duration, and possible effects. The authors begin with an overview of recent events in space tourism and potential industry revenue expected in the coming decade. The authors then move on to explain how potential physiological health impacts have been reported upon and the lack of study regarding potential psychological impacts on space flight participants. Beginning with citations of nominal general public psychological issues, the publication notes the lack of study within the human space flight field. Florom-Smith et al.’s qualitative effort utilized integrative literature to derive their findings from institutional databases and websites. The output produced published training assessments and psychological assessments centered on major space tourism operators. Findings distinguished in large part the lack of any formal psychological study or screening, with rarer instances of minimal psychological conditioning on the part of space tourism providers. The research concludes with proposed methods for collecting and studying space flight participant psychological effects and future research proposals to include training.

A comprehensive qualitative archival review of commercial human space flight medical screening differences between crew and participants is given by Blue et al. (2007). An in-depth synopsis between FAA and NASA qualifiers for crewmember flight standards is outlined over the course of the publication. Subject matter expert analysis is given on the known and likely physiological maladies associated with launch, space flight, and recovery. The authors begin with an overview of contemporary space tourism companies and institutions as they have evolved in advocacy for human space flight. Suborbital and orbital flight profiles are considered in relation to physiological and psychological issues that have promulgated with such activities. No quantitative analysis is given, however, as the publication relies instead on documented narratives to derive the authors’ conclusions on best practices for medical screening. Blue et al. end their publication with a critique of current medical screening guidance and regulations delineated by crew members and space flight participants (2017). The training considerations and risk mitigations prescribed are useful to consider in future research, though there are no suppositions given for how their positions should be tested.

McDonald et al.’s (2007) document, produced by Wyle Laboratories for the Volpe National Transportation Systems Center, utilizes a technical writing approach to historical anecdotes, typical health issues, and substantive reference materials laid out in a logical progression culminating in an appendices section useful for further research and citation. The historical flight physiology data could be beneficial in formulating experiments, archival studies, and possibly even survey instruments to deduce medical screening acceptance measures. Many of the historical physiology records contained professional astronauts situated in either prolonged space environments or flights during the ‘Space Race’ of the 1960s and 1970s (McDonald et al., 2007). The work features useful comparisons and analogies between historical space flight launches and recoveries, juxtaposed with everyday devices the general public is familiar with, such as rollercoasters and skydiving, to make points about possible health risk episodes and forces incurred. In addition, the work contains possibilities for further research from sections covering longitudinal studies of astronaut health and associated recommendations concerning participant health monitoring. Weaknesses in utilizing this research paper include the broad physiological topics covered, non-specific findings, and unsupported recommendations.

A concise reference for study is given by Antuñano et al. (2006), who ties government space flight doctrine to likely participant synopses. This document will be utilized for the research as current FAA guidance, as there are currently no federally mandated medical screening requirements. The purpose of the work is to aid operators to

"… identify those individuals who have medical conditions that may result in an inflight medical emergency or inflight death or may compromise in any other way the health and safety of any occupants…" (Antuñano et al., 2006, p. 1). The authors delve into codification by the FAA for space flight participant medical screening criteria based on the craft's flight profile and where they are going, be it orbital or suborbital. The work is succinct and actionable, given the regulatory addendums pointed out in the document. While quantitative physiological and health data are not given, qualitative signs, symptoms, and countermeasures are detailed.

A comprehensive effort by the International Academy of Astronautics was made to aid medical personnel in identifying and prioritizing medical screening factors for space flight participants (Antuñano & Gerzer, 2008). Their research looks at the physiological and pathological factors that may impact participants during space flight, with particular emphasis placed on orbital trajectories. A literature review of modern developments regarding the topics of space flight passengers, physiology, and medicine was culled relative to current destinations, such as short-duration orbital and on route to the ISS, to give a thorough background into the development and evolution of various space flight medical guidelines, standards, and recommendations. The authors note the disparity between historical studies of trained professional astronauts and the unknown introduction of paying passengers, including a study that factored all known reported ailments on U.S. space shuttle missions. Environmental factors and medical conditions which could correlate to various complications are interspersed throughout the body of the work. This relating of physiological and environmental counterpoint information is similar to other qualitative papers on the topic, and no novel or unexpected revelations are exposed. However, the detail in environmental factors and possible physiological impacts is more detailed in scope and relationship than is forecasted in most other works of similar discipline. A notable effort is made to detail various recommended medical screening guidance iterations based on medical history, physical examination, and medical testing. Ancillary attention is given to medical preclusions and dispositions for prospective space flight participants. The inclusion of this information is significant in its forethought by denoting possible accommodations and scenarios, based in part on ethical and legal considerations. Other areas that are remarked upon about space flight participation are the possibility for in-flight medical episodes and post-flight medical issues. Overall, the work is the product of subject matter experts with no data or quantitative analysis to support the assertions and proposals.

Staedter (2019) presents a summary of the types of destinations space flight participants will be able to journey soon. While taking a qualitative note in the citation of subject matter experts in aerospace medicine, the publication does not utilize any quantitative data analysis to analyze the acceptance of medical screening for space flight participation. The physiological effects on health during flight, both suborbital and orbital, are briefly described. The work describes short duration effects of a suborbital trip to risks involved in long-duration space environment exposure in a habitable environment. The piece concludes with the need for more data and research into short and long-term health effects, especially for women and diverse age groups.

Space medicine and space effects on the human body are entailed by Aravindhan et al. (2020) in a qualitative research publication, utilizing historical events from early NASA manned missions to make the case that the space environment is harsh on human physiology. The authors contend that real-time monitoring should be utilized to diagnose the early onset of symptoms and continuous monitoring to build data analytics for future use. Their work describes wearable health monitoring technology to more quickly diagnose and assess space flight participants, as swift abort and return may not be an option due to the flight profile involved. The authors prescribe situations and solutions without any analysis of other published works or quantitative data and come off as subject matter experts in their own right to discuss intracranial pressure measurements. The paper is confined to cardiac medicine, thus making a case for further research into acceptance of medical screening, whether participants would be comfortable wearing biofeedback devices, and sharing physiological information with other parties.

Grenon et al. (2012) takes a qualitative look at implications for increased space flight as the public becomes suborbital and orbital tourists. The work begins with a general overview of the private space flight industry and projections for consumption in the near future. The authors cite forecasting, which shows “demand for seats on suborbital reusable vehicles (for tourism, research, education, point to point transportation, etc.) will be 4,518 seats at baseline, growing to 13,134 seats over 10 years once the vehicles become operational” (Grenon et al., 2012, p. 1). They do not project a specific year for these projections to transpire but rather tie the figures to operations development. The piece relates how flights to the ISS, space hotels, and lunar excursions will follow, presenting new opportunities and challenges for medicine. The authors detail how ordinary physicians will be challenged by space flight participation, but by utilizing historical antecedents, many conditions that are likely to befall participants may be anticipated and countered. The issue remains that many of the historical precedents for current space medicine are derived from professionally trained and physically conditioned astronauts, and those general public ailments may differ as to what degree is unknown. While proposing a regulatory body to ascertain space flight participant health, the paper goes on to comment, “the FAA has taken the lead in drafting legislation regulating commercial human spaceflight through its Office of Commercial Space Transportation” (Grenon et al., 2012, p. 2). Nevertheless, according to the authors at the time of this publication, the FAA did not require regulation of medical implications beyond the signatory acknowledgment of informed consent. The lack of quantitative data makes the need for further research clear, as acceptance of medical screening is missing in this work.

An insightful take on risk and medical screening is found in a publication by Law et al. (2013). The authors begin with the assumption of commercial suborbital space flight being utilized by participants with pre-existing medical conditions, which may be exacerbated by the g-forces or microgravity effects involved. The article goes on to describe NASA’s human system risk management as a “multi-faceted approach, deriving from a variety of previous work since the 1990s to assess human spaceflight risks” (Law et al., 2013, p. 68). However, they note the qualitative nature of current documentation for space flight-related risks to health and performance by the Human System Risk Board (HSRB). This board maintains a Human System Risk Master List which,

> currently contains 48 risks encompassing medical conditions, nutrition, human performance, human-machine integration, and vehicle design (E. Romero, oral communication, 2012 January 20). Each risk is systematically analyzed and summarized in a 5 x 5 risk matrix of likelihood versus consequence (LxC) that

> allows the risk to be further stratified as high, medium, or low, with corresponding mitigation strategies. A successor to the plot of effect versus probability of medical risk first described by Bilica et al. (1), this LxC risk matrix is consistent with the current risk management plan for NASA at both the Headquarters level and the Program level (e.g., International Space Station). (Law et al., 2012, p. 69)

This information would be of value in future studies on acceptance of safety risk and medical screening as they are connected in this fashion. The paper summarizes the prevalence of various medical health symptoms experienced by trained astronauts, stressing the need for medical screening and environmental controls capable of mitigating as many health impacts as possible. The authors go further with predictive analysis of health symptoms:

> using Monte Carlo simulations consisting of multiple iterations of random sampling from predefined probability distributions of input values to account for the uncertainty in the input values, a method typically used in quantitative stochastic models to estimate output values. Crew composition, mission duration, and in-flight medical resources are entered as inputs to the integrated medical model (IMM) to predict the occurrence of medical events, crew functional impairment due to these events, medical evacuation, loss of life, and medical resource usage. (Law et al., 2012, p. 71)

While the results are not presented, the assessments are derived from descriptions of how the data were transformed and processed. The work concludes that more research is required into commercial space flight, and thus the need for medical screening and safety risk assessment will play roles in filling this knowledge gap.

Stepanek et al. (2019) describes the current state of the two health systems in place for professional astronauts and private space operations before going on to denote the requirement for space flight participants to be made aware of informed consent and that crew need to possess a second-class medical certificate to operate. The researchers comment on the lack of current medical data from commercial space flights and speculate that its collection will be necessary for the continued improvement of medical screening and physiological conditioning for future space flight participation. The paper describes the effects of space flight on human physiology, which could span from hours to days, and their professional judgment on the level of seriousness associated with the possible conditions.

Legal

The legal and regulatory aspects of space flight participation warrant inclusion in any industry research due to the propensity for technology to outpace oversight. Carminati et al. (2013) detail, in a critical manner, the current legal administration of the U.S. space tourism industry and proactive efforts by touristic space flight providers to mitigate participant medical issues during suborbital flights. Their paper is qualitative, having no data or statistics to back up the authors' positions. However, the paper accurately relates crew and participant informed consent and waiver requirements as mandated by the FAA in 14 CFR § 460.45. Four states have passed requirements as of the date of this work's publication;

> Virginia, Florida, New Mexico, and Texas have passed space flight immunity acts to protect commercial CHSF operators from liability resulting from death or injury caused by the inherent risks of space flight to SFPs. The four state laws condition the protection upon the CHSF operator providing SFPs with varying amounts of information. CHSF operators, and if applicable their aerospace medicine professionals, should rely on federal law and supplement the CSLA's language with "warning statements" from the appropriate state legislation. (Carminati et al., 2013, p. 264)

Though brief on the whole, the federal and state legislative rules given explain operator waiver of liability due to the inherent risk involved with space travel except in the event of gross negligence, which must be proven in a court of law. The authors note quite succinctly that,

> Whereas failure to comply with government standards can be a basis for liability in a lawsuit, the reverse is not true. Decades of case law evolving in the aviation accident context tells us that liability can attach even where no FAA regulation has been violated. (Carminati et al., 2013, p. 264)

This observation will likely play into future discussion and literature when determining legal standing for implied liability, assumption of risk, culpability, and determination of responsibility. Anecdotally, this paper also makes recommendations regarding professional physical examination of participants and how they would be administered. Federal jurisprudence and limitations are detailed in the DOT's "Streamlined Launch and Reentry Licensing Requirements" (FAA, 2019) which relates the goals of FAA commercial space transportation regulations to protect public health and safety, and the safety of property from the hazards of launch and reentry. The regulations address a broad range of national security and foreign policy interests for the U. S., financial responsibilities, environmental impacts, and informed consent for crew and space flight participants (DOT, 2019). The legal definitions and explanations are meant to define expectations and exemptions and clarify operations for participants, the public, and the industry. Mishap classifications, designations between participant and crew, and demonstration of reciprocal waiver of claims agreements compliance are significant components of 14 CFR pertinent to legally bounding commercial space flight participation. The subsections go further into detail, explaining the breadth of responsibilities and obligations on the part of all parties, including the public. Specific exemptions and waiver-able compliance standards based on circumstance particulars are made throughout the document to identify as many situations and perspective outcomes as may be defined. These play into participant acceptance based on the specific considerations that have been emplaced for orbital, suborbital, and various other inputs. The basic parameters of flight safety, public safety criteria, operations protocols, and indemnification obligations as enumerated may aid participants, and other interested parties, in terms of legal acceptance of safety risk, implied indemnification, and other legal issues involved with commercial space flight operations.

Antuñano et al. (2009) provided an in-depth treatise on space flight participant medical and legal considerations, liabilities, and probable jurisprudence. The history behind private space tourism is a compelling read that gives a substantial backstory to the current state of affairs within the space tourism industry. Forethought into how regulatory constraints, or lack thereof, would affect industry growth and participant enthusiasm have been relatively correct given the paper was published in 2009. Citations of medical doctrine give areas for additional research to pursue and validate the authors' claims. While space tourism operators could be of varying degrees more rigorous in their participant health and safety programs, they are largely left to their own judgment as to a participant's fitness for flight, and on the face of it, leave it to the participant to decide their own suitability. Because of this, many assumptions are made regarding how the space tourism industry views both the environmental conditions in which it operates and the perception of participant safety based on nominal and routine operation without incident. The data points, delimitations, flight characteristics, and profiles give a complete picture of what participants could experience health-wise. The medical health exam details given by the authors in the supposed physical exam points and medical recommendations were easily understood. The lack of quantitative statistical analysis and data concerning possible or likely participant medical screening concerns and fitness is the only drawback to using this paper in future studies.

Sgobba and Kezirian (2016) conducted a qualitative archival review of legal regulations relative to human space flight safety issues within the space tourism field. Beginning with U.S. legal definitions of the suborbital and orbital human space flight environments, the authors then move into a chronological historical narrative of U.S. legal doctrine governing human space flight. The publication does well to compare and contrast government human space flight requirements with commercial space tourism endeavors. Sgobba and Kezirian continue along the same lines as they also tie in international safety regulations as currently codified, though they denote the issues with a lack of enforcement and transnational adoption (2016). The publication then proffers a number of human space flight safety enforcement models utilizing historical analogies stemming from similar human transit endeavors. Maritime and high-risk activity laws are cited to advance novel safety paradigms for the space tourism industry, to include private-government partnership and self-regulation models (Sgobba & Kezirian, 2016). The authors conclude with recommendations for establishment of an international safety regulatory and governing body to be administered by an established multinational council. While the background references and recommendations are not necessarily novel, the historical equivalencies utilized in advocating for a safety standardization body offer a unique approach to the issue.

Orme (2017) examined telemedicine as applied to space tourism. A review of the development and usefulness of remote medical diagnosis and monitoring is given before imparting the possibilities of telemedicine, as applied to human space flight. The publication makes the assumption that physiological complications will arise on short duration space flights due to varying states of health. Orme (2017) proposed enforcement of standardized health screening and active medical monitoring during space flight by examination of U.S. legal standards for human space flight. Disparities between professional astronaut health and medical regulations are juxtaposed against the health screening recommendations for space flight participants. Overall, a great effort is expended in citing chronological developments in commercial space tourism paralleled with U.S. legal developments. The author proposes a number of regulatory and standardization measures. The paper ends with a summation of telemedicine technological applications and the legal basis for their implementation in general aviation and institutional government space launches, and how these could be leveraged against space tourism endeavors.

An extensive accounting of the current legal and indemnification framework, as given by federal and state statutes, is related by Carminati (2014) by taking a qualitative subject matter expert approach to explain implied indemnification and liability in the space flight industry. Carminati relates how specific U.S. states have passed statutes limiting liability to the potential customer base. The juxtaposition of statutes limiting liability with tort law and policy-making interests are explored via high-risk activity jurisprudence, as in skiing and equine sports industries. The paper covers all existing federal space activity acts with bearing on liability to elucidate current space operator obligations in the event of accidents and incidents, particularly involving loss of life and property damage. Carminati (2014) goes further to detail the current definition of informed consent relative to space flight participation and special considerations for industry crew members and operators. The author succinctly details indemnification from international, national, state, and operator responsibilities based on treaties, statutes, and law. Moving back into space flight operator indemnification duties, the expressed assumption of risk inherent in space flight is explored as participation is considered a high-risk activity. Provisions for gross negligence in the case of a catastrophe, injury, or death lie at the basis for any claim and must be successfully argued in court. Thus, the protections for operations and insurance requirements are meted out in such a fashion as to protect the industry against spurious claims, even by third-party and class-action suits (Carminati, 2014). The document spends a great deal of effort classifying the various U.S. state statutes definitions of risk, indemnification, and liability, denoting variations in composition, responsibilities, and policy. This paper is very effective for studying international, federal, and state law concerning just how well assumption of risk, implied indemnification, and liability can be applied in opposition to tort law arguments. The author states their findings as a subject matter expert, though data and quantitative analysis are absent.

A concise chronology of space law that notes the areas of jurisprudence that are currently lacking is detailed by Masson-Zwaan and Freeland (2010). First, they present a qualitative document that denotes areas of air and space law that should be addressed, such as the UN Outer Space Treaty of 1967, noting that while “private entities would one day engage in space activities, yet of the most essential topics for private operators, namely their exposure to second- or third-party liability is not addressed” (Masson-Zwaan & Freeland, 2010, p. 1598). The paper examines suborbital and orbital space flight differences where space tourism is involved before scoping the legal landscape of the U.S., Europe, and international law. One of the focal points of the paper is liability, and the authors note how international law is currently not equipped to deal with the safety and liability of space flight participants. Masson-Zwaan and Freeland (2010) posit that world governments “create a State-based system of absolute liability for damage caused on earth or to aircraft in flight, and a similar system of fault liability for damage caused to other space objects in outer space or property or personnel on board” (p. 1604). This work is similar in scope to others in its prescription for further oversight and centrality of jurisprudence. However, it does not generate its own data or methodology to arrive at its conclusions.

Acceptance of legal paradigms is critical to the success or failure of space flight participation due to the inherent risk of space flight, indemnifications involved, and safety risks apparent. This makes the work of Abeyratne (2013) a key piece of evidence for the need for quantitative research of acceptance. As a matter of course, the work is another qualitative piece that utilizes similar law citations to make the point that space law should be delineated from air law; “Given that a spacecraft traverses airspace before it goes into outer space, one would have to have a clear, internationally accepted definition of outer space” (Abeyratne, 2013, p. 260). Much of the paper is dedicated to pointing out the inconsistencies “… such areas as licensing of spaceports, human space flight, space traffic management, safety of personnel and astronauts and security” (Abeyratne, 2013, p. 259). The paper makes use of common definitions to clarify issues of international boundaries and administration as it uses historical anecdotes to make points where space flight was impacted by legal standing. One such example from the text is:

> SpaceShipOne, strictly speaking, does not operate as an aeroplane or even as an aircraft during the ballistic portion of the flight while it is not supported by the reactions of the air, even though some degree of aerodynamic control exists throughout the trajectory from launch altitude until the craft enters the upper reaches of the atmosphere where the air density is no longer sufficient for aerodynamic flight. (Abeyratne, 2013, p. 262)

The work seems to stray into the vehicle designs of individual private space flight companies before returning to security implications. The paper queries the jurisprudence of security offenses, especially in outer space where no state can claim jurisdiction due to the UN Outer Space Treaty of 1967. The paper then indicates maritime law as either a placeholder or stand-in for future legislative action to entail security issues and crime that would take place in outer space.

Insurance will play a role in developing the space tourism industry because of the large amount of capital involved and the inherent risks. Insurance gives stakeholders stability by leveraging risk to another party situated to absorb monetary losses due to accidents or incidents. Rosa (2013) addresses a wide array of insurance and indemnity policies for space flight participation via a qualitative approach to presenting the present space industry insurance landscape while balancing regulation by air or space law. The space tourism insurance market is complicated due to the number of various stakeholders (e.g., participants, crew, subcontractors), varieties of risk (e.g., injury, death, health risks, environmental damage), and damage to property on Earth and in space (to include third parties) (Rosa, 2013, p. 236). The paper breaks space tourism into orbital and suborbital to further refine insurance and indemnity particulars. The main difference between the two destinations lay with the UN Outer Space Treaty of 1967 and the Liability Convention of 1972. As orbital space flight participation will travel the span of the globe, the measures for ensuring growth as international conventions apply, and remittances between nation-states come to account in the event of an emergency or catastrophe over a sovereign border. Although suborbital space flight participation is likely to remain within the country of launch's airspace, differing legal requirements for indemnification and insurance exist. While passengers, crew, and third parties must be accounted for, the paper notes that suborbital launches within the U.S. may be subject to the Chicago Convention as the spacecraft is a "machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the Earth's surface" (Rosa, 2013, p. 239). While these points are engaging in accepting indemnification and liability, there is still another point to contemplate when informed consent for space flight is considered.

> The U.S. Commercial Space Launch Amendments Act of 2004 does not mandate licensed operators to cover space flight participants or passengers under the protection of insurance policies. Thus, if they want protection against personal liability, they must secure their own insurance and sign waivers of recourse based on informed consent. (Rosa, 2013, p. 240)

This protection is intended to shield operators from the legal liability of participants. Informed consent allows for participants to recognize they are partaking in space flight at their own risk. This does not apply to gross negligence on the operator's part, which must be proven after an investigation and presented in a court of law. The aspects of liability, indemnification, and insurance will play a part in a study of public acceptance but should be calculated quantitatively to show determinates for the demographics involved.

A paper by von der Dunk (2013) takes a practical approach to the legal aspects of space tourism by first defining and relating the modes of space travel, what defines space, and what defines private human space flight. The work examines space law, air law, and high-risk adventure tourism law to look for areas of overlap and areas that warrant concern. Starting with space law, the author notes existing international treaties, foreign laws, and U.S. laws requiring fundamental licensing practices for spacecraft and launch operations. The paper details how private space flight integrates into the existing laws for licensing and oversight, as many of them today were written for unmanned space flight operations, such as satellite deployment. The paper goes on to demonstrate the differing liability burdens for space launch companies by differing nations. Von der Dunk notes, “international space law does not provide for any regime regarding the liability of spaceflight operators to humans on board of their spacecraft” (2013, p. 203). Thus, the need for research on acceptance regarding the liability, indemnification, and legal attributes of space flight participation becomes more apparent as the technology moves toward initial operations. Continuing with air law, von der Dunk notes the propensity of analogous application to operational space situations as crew and customers *fly* through legally recognized, managed, and administered air space. This issue defines how responsibility becomes blurred as space flight participants transition from legally defined areas of air to space; even the operation of the spacecraft itself fails to meet the standard for aircraft because of the advent of ballistic trajectories, particularly should the space tourism operation originate in one country and land in another. However, von der Dunk states, “the application of both the contractual liability and third-party liability regimes of air law is made contingent upon transport on board of aircraft,” (2013, p. 204) as space flight is analogous to commercial air travel when a contract has been exercised for a non-crew space flight participant to be on board. The final issue regarding private human space flight and the application of high-risk adventure tourism law is proposed to be addressed by developing a special oversight administration for private human space flight focused on the concept of *informed consent* and closely related liability waivers and disclaimers. High-risk adventure tourism activity disclaimers are already in use in many national jurisdictions providing jurisprudence over such interests as bungee jumping, helicopter-skiing, survival outdoorsmanship, and others (von der Dunk, 2013, p. 206).

This concept is also reflected in the 2004 Commercial Space Launch Amendments Act by way of informed consent on the participant's part, which denies contractual liability. Von der Dunk (2013) notes the discrepancy between air law, which would allow for a suit in the event of an accident or incident to be brought by a customer. Accepting this difference between air and space laws requires further investigation, as the author makes no quantitative study.

An examination of liability and reusable launch vehicles is found in Flores' paper (2010). The author takes a measured approach to liability and regulatory oversight by chronologically examining recent events involving Virgin Galactic's spacecraft launches and development, as accidents and incidents involving human casualties have occurred in the past. The author details the Commercial Space Launch Act of 1984, which created the Office of Space Transportation (AST) under the DOT, which acts as a regulatory board for commercial space transportation to ensure operators adhere to compliance and administration oversite while also ensuring safety (Flores, 2010). The paper meanders through historical anecdotes relating to the role of the FAA and NASA in space transportation oversight before rebounding on international treaties to specify jurisprudence in cases of accidents or incidents involving manned spacecraft and the public. The paper then makes some distinct points regarding negligence and duty:

> … negligence is primarily a state law concept, negligence claims brought in federal courts are generally adjudicated under state law (…) requires the existence of a duty from a defendant to a plaintiff, breach of that duty, which is typically based upon a standard of reasonable care, and the breach being a proximate cause and cause in fact of the plaintiff's damages. (Flores, 2010, p. 9)

Duty then depends on a conscious choice by the operator to proceed given an unsafe design, critical design flaw, etc. However, this also depends on foreseeability, given that the operator would not consciously fly in circumstances that would result in damage, injury, or death. Thus, the state of Florida enacted the Spaceflight Informed Consent Act of 2008, mandating space flight participants sign a liability of waiver of claims (Flores, 2010). This allows operators to take on passengers so long as those passengers are made aware of the inherent risk involving space flight. The paper examines product defect and proximate causal connection law concerning space tourism before expounding the Francioni model to strict liability law. The author makes the argument that under this model, a plaintiff would have the burden of proving:

1. Whether the defendant is the only member of the marketing chain available to the injured plaintiff for redress.
2. Whether the imposition of strict liability would serve as an incentive to safety.
3. Whether the defendant is in a better position than the consumer to prevent the circulation of defective products.
4. Whether the defendant can distribute the cost of compensating for injuries resulting from defects by charging for it in the business. (Flores, 2010, p. 14)

The paper posits that while these represent safety measures for participants and operators, they would also serve as ways to incentivize safety overall. “The liability scheme derived from Francioni provides the FAA/AST answers to questions concerning liability and RLVs while protecting the agency from the dangers of agency capture” (Flores, 2010, p. 15). The work is qualitative yet adds areas of interest to developing a survey questionnaire concerning law, indemnification, and insurance regarding acceptance.

Dempsey and Manoli (2017) look at the legal aspects of air and space law, where they mingle, and gaps that exist. The authors note, "… there is no unified or integrated regime of Aerospace Law, and there is significant overlap and inconsistency between the regimes of air law and space law" (Dempsey & Manoli, 2017, p. 3). The work details the issues with winged craft that transverse the air into outer space and back. The paper then considers the functionalist approach, that is, what the vehicle is considered *as* versus the spatialist approach, that is, *where* the craft travels (Dempsey & Manoli, 2017). The authors note the sheer volume of air law and agreements in the number of conventions addressing various issues from 1919 to the present day. The differences in international agreements in space law are made plain as the authors denote that the UN has overseen nearly all agreements thus far. The qualitative nature of the paper is due to the use of doctrine and legal proceedings with no data for use to address the acceptance of the air and space law presented. Significant differences in air and space law are listed in that nation-states maintain sovereignty over their airspace and impose legal jurisdiction over aircraft operating within, while any nation does not govern outer space and that those nations are responsible for any object under their direction. The work cites the advent of suborbital flight as the impetus to integrate air and space law by way of how the craft travels airspace into outer space and back. "Defining suborbital flight will enable states to determine the agency most suited to regulation and oversight of such activity, the associated risks, and the international obligations and liabilities attached to the state" (Dempsey & Manoli, 2017, p. 11). The paper discusses functionalism regarding what an aircraft is and how to delineate it from a spacecraft to meet legal definitions.

The FAA publishes Notice of Proposed Rulemaking (NPRM) for public discussion and comment in the Federal Register, which can be found online. The proposed rulemaking is fluid and subject to changes in the material over time. Such is the case regarding the NPRM titled "Human Space Flight Requirements for Crew and Space Flight Participants" (2005, 2006), wherein proposed regulations for medical screening of space flight participants evolved from generalized recommendations to defined areas of concern. Guidance documented from 2003 detailed within the 2005 NPRM stated, "The FAA does not intend to propose that this recommendation become a requirement unless a clear public safety need is identified. It is, of course, in a space flight participant's own interest to obtain such medical advice…" (FAA, 2005, pp. 77270-77271). The following year's NPRM noted, "several commenters recommended the FAA adopt more stringent medical standards… examination should be conducted by a physician with aerospace medicine training and include screening tests consistent with prudent aeromedical practice and recommendations" (FAA, 2006, p. 75620). The juxtaposition between the concurrent years NPRMs demonstrate public interest in the risks involving participant physiology and medical screening standardization and thus initial insight into public acceptance of medical screening guidelines. Collectively, the two NPRMs provide the framework for the proposed research in addressing why the rulemakings were proposed, what they were meant to address, and how they would be executed.

Under 14 CFR § E440, Financial Responsibility, is "Appendix E--Agreement for Waiver of Claims and Assumption of Responsibility for a Space Flight Participant" (FAA, 2012). As this will be a major piece of evidence for the acceptance of legal liability and indemnification, it should be discussed in the scheme of whether it goes far enough. Meant as protection for space flight operators, it "waives and releases claims it may have against the United States, and against its respective Contractors and Subcontractors, for Bodily Injury, including Death, or Property Damage sustained by Space Flight Participant, resulting from Licensed/Permitted Activities, regardless of fault" (FAA, 2012). The referral to this part of the law will be instrumental in surveying and demographically assessing the public acceptance of its contents and ascertaining the breadth of impact. The waiver relates that the U.S. government bears no responsibility for the safety and wellbeing of the signatory.

Gaps in the Literature

Previously published literature have not adequately addressed space flight participation and public acceptability corresponding to medical screening, safety risk, and liability. Moreover, studies that have utilized acceptance as a paradigm in a survey instrument have been limited by focusing on technology acceptance of automotive innovations and infrastructure. Studies that have examined space flight participation have been focused on tourism aspects and the financials involved for industry viability. Typically, in the works reviewed previously, the acceptability of the constructs involved in space flight participation relayed by a survey instrument have been secondary to the purpose involved. The review of relevant literature has not produced a current study that utilized a survey instrument involving public acceptance of medical screening, safety risk, and implied liability employing demographic variables as predictors. In this way, the research will be filling this gap in the literature and expanding the body of knowledge.

Theoretical Framework

This section presents the theoretical framework for defining acceptance in relation to utilization of survey instrument design, Likert scale responses, demographics as predictive variables, and ordinal logistic regression analysis. The theoretical framework also presents the need to study motivations and factors for public space flight and points out areas not fully explored regarding acceptance of the criteria that this study will endeavor to fulfill. Past studies regarding public space flight participation are examined contextually for what they accomplished, their shortcomings, and how the research will expand and fulfill a unique area in the body of knowledge.

Space Flight Participation

Suborbital space flight participation is seen as a steppingstone and a catalyst to continuous human presence in space (Musselman & Hampton, 2020). The key factors to sustainable suborbital space tourism rest in demand, ticket cost, motivation and risk, health risks, and policy (Musselman & Hampton, 2020). In Musselman and Hampton's review of other works on the subject, many contrasting determinations were pointed out regarding the usefulness of space tourism, the types of participants, enthusiasm, and continued support for suborbital trips. The problem becomes how best to capture these types of queries in quantifiably actionable research. Musselman and Hampton delve into motivations for acceptance criteria when motivation and risk, and health risks are discussed, though overall acceptance of the risks inherent are seen as motivators for cathartic differentiation and adventurism by consumers (2020). Broad platitudes are given concerning these areas, and there is a limited extrapolation of the topics beyond pointing out discrepancies for the commercial space flight field to maneuver. Informed consent is singled out in light of the risks involved with space flight and the lack of policy protections given by current governance. Concluding the need for further understanding of the key influences for the space flight industry, the work presents a challenge for capturing such facets involved with commercial space flight participation per public acceptance of them. Accordingly, the theoretical framework for the research centers on the concept of *acceptance*, as further discussed next.

Acceptance

In assessing acceptance of a perception or concept, framing public sentiment about intent and behavioral response is important. Work done by Malik et al. (2020) utilized an electronic questionnaire to assess the public acceptance of COVID-19 vaccine regimens. The research provides a template to emulate regarding survey instrument design, sample size and selection, data analysis, and methodological conduct. Acceptance criteria are parsed in a relatable manner by many demographic factors, including age, geographic locale, and race, amongst others. The paper goes into great detail to relate the researcher's assessments of public acceptability for a COVID-19 vaccine based on intent, behavioral response, and influence factors. While not directly analogous to space flight participation, the findings represent the application of demographic variables, survey research design, and logistic regression analysis to assess public acceptance.

Several researchers have defined the concept of acceptance to perceived usefulness, societal intent for utilization, and perceived ease of use (Sener, Zmud, & Williams, 2019; Vlassenroot et al., 2010; Yudhistira & Sushandoyo, 2018). Other researchers have linked acceptance as a concept to public attitudes and intentional beliefs (Chang & Lu, 2018; Malik et al., 2020; Schwartz et al., 1993). The present research finds similarity in definition between both spheres of acceptance concepts, as intentions and perceptions will be utilized to determine the acceptance of space flight as construed by current U.S. administrative guidance and regulations.

Demographics as Predictor Variables

Sheth (1977) stated that demographic variables are highly desirable and often necessary in marketing and public policy decisions since they are easy to collect, communicate to others, and more reliable in measurement than many other competing factors, including personality, lifestyles, or psychographics. Furthermore, generalizing the results of a study to a country's population can only be achieved through demographics because the respective Bureau of the Census collects and updates only the demographic profiles of the affected country.

Schwartz et al. (1993) utilized demographic predictor variables to assess public attitudes concerning juvenile judicial and correctional procedures. Public assumptions regarding juvenile punitive constructs were the focus of the research though the survey instrument design and methodology represented a provenance for assessing acceptance factors. Likert responses, which entailed both categorical and continuous options, featured prominently in the research methodology and determinations. Analyzing the data using Ordinal Logistic Regression (OLR) made the acceptance conclusions easily discernable in the output results. Similar to other research that examined acceptance, demographic variables were vital to the data analysis.

Ordinal Logistic Regression

McCullagh (1980) demonstrated ordinal regressions ability to statistically model dependent variables allowing for more than two ordered response categories. OLR aims to determine relationships between singular dependent variables and multiple independent variables, a form of predictive analysis. Dependencies and causal relationships are assumed to be present between the variables utilized. As such, the relationships could be leveraged to extrapolate dependent variable changes when the independent variable is altered. This, in turn, allows researchers to forecast and estimate responses based on the patterns that emerge.

Research Questions and Support

The use of demographics as related to prediction has been utilized far and wide for a variety of purposes. However, public acceptance of medical screening, safety risk, and implied liabilities regarding space flight participation is a new effort in adding to the knowledge base. Thus, the solicitation of factors regarding sex, age, marital status, race, and education level relative to acceptance to participate in space flight is critical to the space industry, regulatory agencies, and other stakeholders to better strategize marketing, forecasting, and societal penetration of what constitutes space flight participation. It could also allow industry to actively pursue space flight participants by way of data indicators.

Acceptance of medical screening recommendations for space flight participation based on demographics are demonstratable in several prior research papers. The work of Law et al. (2013) demonstrates the use of predictive analysis centered on medical conditions related to space flight regardless of demographic input to arrive at possible outcomes and the likelihood of occurrence. While a risk matrix was utilized to identify likelihood comparative to consequence, the level of concerns for passengers and crew were quantitatively demonstrated against the risks involved using the Monte Carlo methodology. McDonald (2007) uses historical space flight medical records to format for survey instrumentation data collection and questionnaire inputs. A cohort study utilizing observational data was conducted to determine the findings. The questionnaire survey technique has also been detailed in Jennings et al. (2012) by using demographic indicators for predictive analysis. While no data were collected, the methodology and recommendations behind the questionnaire were informative for future study. Musselman and Hampton (2020) explicitly state the relevance of demographics in the assessment of acceptance for space flight and thus are a key feature to the utilization of survey instrumentation and techniques to perform predictive analysis as related to medical screening guidance. Jennings et al. (2012) and Mussleman and Hampton (2020) works describe the invaluable information gathered from demographic surveys to inform predictive analysis and current trends regarding the space flight community.

Demographic variables involving space flight participant particulars have also been explained in a variety of published papers. Springer (2012) utilized demographics, survey instrumentation, and predictive analysis to demonstrate acceptance of safety risk factors regarding the intention to partake in space flight. The survey was defined by demographic input to gather potential customer sentiment regarding space flight and the assumption of risks involved with special emphasis centered on governmental oversight. Likewise, Zhang et al. (2019) utilized survey techniques with demographic inputs to address risk assessments and intent to utilize automated vehicle technology. The information gathered outlined the likelihood of acceptance and intent to utilize the technology based on the predictive analysis of the demographic characteristics of the participants. Chang and Lu (2018) utilized demographic survey instrumentation to extrapolate risk acceptance, intention, and novelty-seeking associated into quantitative predictive analysis. Respective to demographic inputs of participants, risk acceptance of novelty-seeking and intention were analyzed using statistical modeling techniques to form a predictive analysis.

Rosa (2013) qualitatively documented the specifics of implied liability coupled with legal insurance forbearance particulars, which would be of value in determining demographics as tied to risk and adventure-seeking. Another study that describes the necessity of identifying consumer types by demographics is found in von der Dunk (2013). Qualitative analysis of novelty-seeking customer types juxtaposed against current adventure tourism indemnity qualifiers was discussed as space tourism contracts were described against commercial air travel and the similarities between them. Typification of demographics for indemnity acceptance was called upon for further study.

OLR forms a predictive analysis via a singular ordinally ranked dependent variable and multiple independent variables (Lund & Lund, 2018). The dependent variable will have x categories requiring x-1 equations to be created with the same *b* coefficient slopes for the independent predictor variables, but with differing intercepts (Garson, 2014). There are x-1 equations because there needs to be a reference category for odds ratio comparison. Significance is checked in a test for multicollinearity in which linear regression modeling must demonstrate levels greater than .001, signifying better performance than the null-intercept only model. The -2 log likelihood statistic is also compared against the fitted location model to a varying location parameters model. Binomial logistic regression determines if significant differences exist within the test of parallel lines to demonstrate if the model is a good fit (Garson, 2014). Reliability is checked as Cronbach's alpha determines internal consistency of the dependent variables (Hair et al., 2010). The pilot study results also assess the initial internal consistency of the survey scales and overall feasibility. Content validity is addressed by ensuring survey statements were drawn directly from 14 CFR and FAA Medical Guidance (Antuñano et al., 2006). Criterion validity, an estimate of the extent to which a measure agrees with a gold standard (Hochberg, 2015), is assessed by way of the test of parallel lines which compares the null hypothesis against the slope coefficients in the model, which are supposed to be reasonably close across response categories. Validity is also checked by the goodness-of-fit statistic which evaluates if sample data reflects parity with the actual population. External validity can be evaluated be comparing survey participant demographic characteristics against current U.S. Census Bureau QuickFacts database (n.d.) ratios.

It could be said that space flight participation is a steppingstone to human colonization of space to include Earth's Moon and other planets. Weibel makes the argument that space flight participation has a place in society because, "…in order to thrive, even to survive, the human species must develop settlements beyond earth through commercial space enterprises" (2020, p. 8).

Summary

The current collection of reference and literary materials related to space flight participation does not examine potential participant demographics concerning the acceptance of medical screening, safety risk, and implied liability. While some of the literature is qualitative, it does little to support predictive analysis of future trends. Much of the existing quantitative literature analysis uses established theories and models which limit generalizability due to limitations and delimitations of the research involved. Another matter is that public acceptance, by and large, is not the primary focus of the published literature. The lack of empirical and quantitative evidence to ascertain public acceptance of safety risks, medical screening, and liability further acknowledges the need for future research. Thus, the need for a demographic survey of public acceptance for safety risk, medical screening, and implied liability is important to fill this knowledge gap.

Chapter III: Methodology

This chapter will focus on describing the research methods and data analysis utilized. The purpose is to specify and support the steps applied to answer the research questions. The objective of the research is to explore significant public acceptance of medical screening, safety risk, and implied liability associated with various demographic variables. The measures and analysis of this research will be presented to determine likelihood of public acceptance of the medical guidance, liability, and safety risk regulations associated with space flight participation. This will also allow other researchers to replicate the research and investigate the findings, utilizing a similar survey research design to conduct an independent replication or reanalysis of the original research (Plesser, 2018).

Research Method Selection

Given the research questions for significant public acceptance of regulations and guidance regarding space flight participation medical screening, safety risk, and implied liability, a survey research design was deemed most optimal due to the need to gather a large number of broad representations in a short amount of time (Vogt et al., 2012). The independent variables (demographics) are drawn from U.S. Census Bureau data, while the dependent variables (acceptance of medical screening, safety risk, and implied liability) are drawn from 14 CFR part 460 and FAA medical screening guidance. Self-administration of the online survey allowed for greater flexibility for participant schedules and the possible need to gather further information. The data derived directly from survey respondents were analyzed to investigate the research questions. Responses gave direct replies from participants relative to demographic variables as predictor variables and acceptance factors relative to the dependent variables.

Population/Sample

This research utilized a cross-sectional approach as the survey retrieved data from a section of the wider population at a single point in time, over a three-week period (Vogt et al., 2012). The demographic characteristics were compared against the U.S. Census Bureau’s (n.d.) QuickFacts, an internet-based platform, which provides current government-conducted census attributes to ascertain if the sample's demographic characteristics were representative of the general population. As the survey collected demographic information as part of the research, the sample indicated generalizability to the U.S. population at large.

Population and Sampling Frame

The research sought to examine demographic variables relative to acceptance of space flight participation particulars enumerated within a sample of U.S. residents aged 18 years or older. The population should demonstrate parity as reflected in current U.S. Census Bureau demographic percentages. A randomized sampling frame of the proper size was supplied from SurveyMonkey survey web services Audience subscriber contacts. SurveyMonkey provides an Audience subscriber feature that allows survey participant targeting per specified demographic inputs. SurveyMonkey notifies these Audience subscribers that they match the criteria for the selected research and are invited to participate (SurveyMonkey, 2018).

The sampling frame was analyzed for consistency in the representativeness of the U.S. Census Bureau demographics based in the Quickfacts (n.d.) database by targeted inputs into the SurveyMonkey Audience (2018) options for dissemination. The sampling frame did not cap participant age, as current space flight administration does not preclude space flight participation so long as medical and health screening benchmarks are met. Other demographic values such as race, sex, and marital status are also not barriers to space flight participation and thus qualify as demographic variable descriptors. Collected demographic survey response representations in the calculated sample size were checked against Quickfacts (n.d.) data for proximal reflection of percentages.

The race demographic characteristics contained options for participants to indicate they are: White, Black/African American, American Indian/Native Alaskan, Asian, Pacific Islander/Native Hawaiian, and Two or more races. Demographics concerning sex were male or female. For the purpose of the study, the focus response is on *sex* as biologically determined at birth (male or female) rather than *gender,* which has become a broad term encompassing biological gender, gender identity, gender fluidity, transgender, and so forth. The U.S. Census Bureau (n.d.) also denotes sex as either male or female and thus to properly reflect generalizability of the sample gathered, those categorizations will be utilized in this study. Demographics concerning age ranged from 18 to 99+ years, and the highest education level achievement denoted as a categorical choice. The demographic variable for marital status was: married, never married, divorced, separated, and widowed. Household size demographic referenced the total number of people currently residing with the survey participant as a continuous-ratio variable and range from 1 to 9+. Number of children was a continuous ratio variable referring to the participant's claimed minors residing with them and range from 0 to 4+. The demographic variable for region choices included: Northeast, Midwest, South, and

West. Employment status demographic variable choices were: full time, part time, or not working. Class of employment demographic variable included: not applicable-not working, employee of private company, self-employed, private not-for-profit, and local/state/federal employee. Work sector demographic variable responses included: not applicable-not working, agriculture and related industries, mining, construction, manufacturing, wholesale trade, retail trade, transportation and utilities, information, financial activities, professional and business services, education and health services, leisure and hospitality, other services, and government worker. The demographic variable choices for income were on a continuous-ratio line scale, skip counted by unit increments of 2,500 from 0 to 250,000-plus.

Participant demographic responses were cataloged and compared against U.S. Census Bureau data to ensure the sample was representative of the U.S. population for generalizability of the findings. The demographic variables that were utilized in the research and their characteristics are summarized in Table 3.

Table 3

Demographic Variables Characteristics

Variable Name	Level of Measurement	Response Type
Sex	Categorical	Binary
Age	Continuous-Ratio	Numerical (18-99+)
Marital Status	Categorical	Multiple Choice
Race	Categorical	Multiple Choice
Region	Categorical	Multiple Choice
Highest Level of Education Achieved	Categorical	Multiple Choice

Household Size	Continuous-Ratio	Numerical (1-9+)
Number of Children	Continuous-Ratio	Numerical (1-4+)
Employment Status	Categorical	Multiple Choice
Income	Continuous-Ratio	Numerical (0-250,000+)
Work Sector	Categorical	Multiple Choice
Class of Employment	Categorical	Multiple Choice

Note. See Appendix B for aggregation.

Sample Size

A significant factor to consider when utilizing a survey research instrument is achieving an adequate response rate. SurveyMonkey denotes response rate as the number of surveys that received responses divided by the number of surveys sent out, multiplied by one-hundred and given as a percentage. SurveyMonkey (2018) claims that, on average, the response rate for an online survey can range from 20-30%. The response rate percentage may be increased by utilizing specific targeting and promotion techniques, such as in their Audience option features.

The sample size reflected a 95% confidence interval with a 5% margin of error. The margin of error is utilized to factor that the confidence interval will contain the actual value of a population parameter over many differing samples. The 5% margin of error was the baseline value given in the SurveyMonkey Audience recruitment and data gathering particulars. The confidence interval was chosen to research the upper and lower statistical values likely to occur in the data and represent the population mean.

According to the U.S. Census Bureau Quickfacts database (n.d.), there are currently 255,200,383 U.S. residents aged 18 years or older. Cochran's sample size formula (Glen, n.d.), as shown in Equation 1, was used to enumerate the target sample size.

$$n_0 = \frac{Z^2 * pq}{\varepsilon^2} \tag{1}$$

First, the Z value, as referenced in a z-table and squared, factors into a z-score of 1.96. Due to the supposition that the population estimate for the attribute is unknown, 50% will be utilized for *p*, which is expressed as .50; *q* is *1-p*, which factors to be .50. The margin of error, *ε*, is 5% or .05. Factoring all these into Equation 1, the sample frame is 385 participants. However, utilizing Cochran's formula as modified for calculating small populations (Glen, n.d.), as shown in Equation 2, the outcome yields a similar result of 384.99 survey participants.

$$n = \frac{n_0}{1 + ((n_0-1)/N)} \tag{2}$$

In this instance, N is represented by the number of U.S. residents aged 18 years or older at 255,200,285; the n_0 being factored at 385.

Sampling Strategy

A nonprobability convenience sample was delimited by respondents with access to the internet and a computing device with which to answer the survey questions. The response volume gathered was larger than the minimum required to best capture U.S. Census demographic ratios. The criteria were intended to reflect the generalizability of the results per representation of averages or ratios in the U.S. census figures. Utilizing SurveyMonkey Audience, administrative tools ensured targeting options gathered results, as defined by the survey director (SurveyMonkey, 2018). Close-ended screening questions with disqualification logic attempted to vet qualified participants who were allowed to partake in the survey. Disqualified survey participants were directed to a disqualification page and directed out of the survey.

SurveyMonkey Audience utilizes convenience sampling with provisions for the researcher to select qualifiers for survey participation, as drawn from their pool of Audience panelists (2018). In the case of this research project, the qualifiers requested was for the participant sample drawn from the panelist pool to match U.S. Census Bureau demographic ratios as closely as possible. The representative group of participants in this research project were thus linked by demographic percentages, a form of demographic balancing, as drawn from the available pool of SurveyMonkey Audience panelists to reflect the broader demographic representation of the entire U.S. population. Demographic balancing allowed for flexibility in gathering the convenience sample without strict adherence to pure quota ratios. Use of SurveyMonkey Audience panelists constitutes a convenience sample by virtue of the ease associated with utilizing an online association pool of possible participants who opt to take part in the research project (2018).

Non-probability sampling bias may have occurred because some members of the population are more likely to be included than others. Due to a number of factors concerning an online convenience sample, biases, including self-selection, non-response, and undercoverage, may be threats to the research outcomes (Bethlehem, 2010). Efforts to counter sample biases included defining a target population and a sampling frame which was accomplished via demographic inputs and screening questions. The sampling frame was also matched to the target population as much as possible, which was accomplished by measuring demographic ratios against the U.S. Census Bureau demographic data. Lastly, the online survey was constructed to be administered as efficiently as possible to the sampling frame. Undercoverage bias was expected to be countered by way of collecting more responses than defined by the calculated sample size.

Data Collection Process

The internet-based electronic questionnaire was distributed via SurveyMonkey, consisting of demographic inputs and Likert scale responses to collect the exploratory research data. An online survey was most appropriate since gathering required data from the general population poses unique difficulties due to random work schedules, dispersed domestic situations, and inadequate representation in public gathering areas. In addition, the use of screening questions ensured the participants were matched to the designated sampling frame, which was a U.S. resident 18 years of age or older. The use of an online questionnaire also allowed for the greatest potential success in reaching a target population. The questionnaire responses should have been easily answered in 7-9 minutes, factoring for no more than a total of nineteen questions (Chudoba, n.d.).

Design and Procedures

The target population was a generalized demographic makeup of U.S. residents, 18 years and older. SurveyMonkey's (https://www.surveymonkey.com/) internet-based survey instrumentation was used to host the online questionnaire to collect data from participants over a period of three weeks. The questionnaire was conducted as a cross-sectional study, utilizing Likert scale questions to determine responders' acceptance of conditions such as medical screening for commercial space flight participation, the implied liability and waivers conditional to embarkation, and inherent safety risks as elucidated in FAA medical screening guidance and 14 CFR part 460 regulations. The data were stored in databases to include Microsoft Excel spreadsheets and IBM SPSS output for retrieval during this research.

Apparatus and Materials

An advantage of a questionnaire instrument is that data can be obtained on large numbers of participants quickly and inexpensively. Two broad survey questionnaire types are descriptive and analytical. Analytical questionnaires deal with information about judgments, beliefs, and perspectives, while descriptive questionnaires pertain to information. An amalgamation of analytics and descriptives within the questionnaire was utilized in the research.

An e-mail was sent via SurveyMonkey survey web services to Audience participants providing a link, asking them to take part in this voluntary research. The questionnaire was transmitted online using SurveyMonkey survey web services. Participants were randomly sampled via sampling frame diagnostics provided by SurveyMonkey Audience as a convenience sample. Participants were also presented with an electronic consent form and instructions on how to complete the questionnaire. Screening questions were used to partition participants that did not meet the selection criteria of a U.S. resident at least 18 years of age. If participants did not meet the selection criteria, the survey ended automatically. Participants who responded affirmatively to the screening questions were presented with general questions to gather information on their demographic information for age, race, sex, marital status, highest level of education achieved, household size, number of children, region, employment status, class of employment, work sector, and income before engaging in questions utilizing seven-item Likert scale responses regarding the acceptance of space flight participation medical screening, safety risk, and implied liability particulars.

Sources of the Data

The primary source of data was collected and coded demographic and Likert scale responses to the survey. In addition, convenience sampling with stratification based on demographic responses was utilized. The survey instrument is included in Appendix B.

Ethical Consideration

Embry-Riddle Aeronautical University guidelines were adhered to before conducting this online questionnaire by filing an application seeking the approval of the Institutional Review Board (IRB). The IRB application is provided in Appendix A of this document. Informed consent was utilized, and voluntary participation noted by way of participants accepting the consent parameters. No unique participant information was utilized, to ensure the anonymity of participants.

This research collected information on participant's demographic information, judgments, beliefs, and perspectives. Hence, additional care was taken in question design to mitigate any distress or discomfort to participants while engaging the questionnaire. Furthermore, participants had the opportunity to discontinue at any time. No physical, psychological, financial, nor any other type of harm to participants was anticipated in this research. No direct interaction with the participants was likely in this research.

Measurement Instrument

Measurement is the assignment of numbers to a variable that provides the raw data for statistical analysis. The operational definition for this observable concept is that the object measured must be unambiguous so that the resulting observations being gauged are accurate and reliable (Vogt et al., 2012). Several different measurement scales are nominal, ordinal, interval, and ratio. The acceptance dependent variables utilize Likert scale ordinal numbers. Utilizing a nominal scale, labels or numbers are assigned to objects or events for identification, and the value or order provides no significance. The independent variables in this research were continuous or categorical in denomination.

As an element of measuring data, unit accumulation, and the dependent response variables, the Likert scale makes an efficient and effective data collection and aggregation method. The flexibility in utilizing Likert items and scales allows for composite response formulation and variable scoring methods (Boone & Boone, 2012). The Likert scale allows for interval and ordinal treatment of the responses for various statistical testing.

In ascertaining the Likert response scale for this research, certain factors were considered in the research measurement approach. As this research examined acceptance, the Likert scale effectively conducts patterning and summing responses to the individual items. A balance between too many and too few response scale options must be struck, as realism and certainty in the response data must be both valid and reliable to the researcher (Matell & Jacoby, 1972). Stability, reliability, and consistency must be considered in determining the number of Likert scale responses commensurate with the type of research under study. According to Preston and Colman (2000), the scoring correlation between an increasing number of responses is stable between five and 100 one-response choices. A seven-point Likert scale was utilized for this research to score survey responses for ease of participant utilization. Observations were scored via the degree of agreement to disagreement by the following indicators: (1) *Strongly Disagree*,

(2) *Disagree*, (3) *Somewhat Disagree*, (4) *Neither Agree nor Disagree*, (5) *Somewhat Agree*, (6) *Agree*, and (7) *Strongly Agree*. The study gathered responses from a sample of the population that spanned the general makeup of U.S. society to examine results by demographic variables (e.g., sex, education, race) which will enable further research and replication of effort as demographics change in space flight participation. As the current medical screening recommendations, safety risk, and implied liability acceptance variables are being assessed, demographic and Likert responses give only one set of possible outcomes regarding survey results concerning acceptance.

Pilot Study

The questionnaire was distributed to 30 participants to check feasibility, assessment procedures, methodology, and other validity and reliability factors. The number of participants in the pilot study was arrived at due to existing literature guidance regarding the usefulness of the results relative to any changes that may be needed to proceed further (Billingham et al., 2013; Connelly, 2008). As the total calculated population sample size exceeded 300 survey participants, a factor of 10% participation for a pilot survey would have become excessive.

The pilot survey sample was gathered online via SurveyMonkey Audience for seven days, after which the data were processed per the methodology given in this paper. As the output reflects expected parameters, the pilot survey data were included in the final research. If the output did not conform to expectations or the questions required participants to inordinately contact the survey director for clarifications, approximately 25% or greater, the data would not have been used, the survey instrument would have been adjusted for errors and concerns, and the updated survey instrument would have been resubmitted to the dissertation committee and IRB for re-approval. The pilot survey would have been rerun per the procedures given, and the process repeated further, if necessary.

OLR analysis of the pilot data was completed, however full and accurate interpretation of the pilot data was not feasible due to the small sample size utilized. Complete separation of the data, or perfect response prediction, manifested in the results due to the low number of data inputs. Full understanding of the issue came after further inquiry as OLR is sensitive to small sample sizes (Garson, 2014). With the understanding of the sensitivity to small sample sizes, OLR was determined to be feasible for this research as the Cochran's sample size formula allowed for a minimum of 385 participants for analysis.

The questionnaire utilized in this research is presented in Appendix B. The introductory section of the questionnaire included background information about the research to include purpose, eligibility criteria, confidentiality, and consent. In the introductory section, the participant was presented with the option to participate in the questionnaire or not participate, thus ensuring informed consent.

Variables and Scales

The continuous-ratio independent variables constitute survey participants' age, household size, number of children, and income. Categorical variables captured survey participants' sex, marital status, race, highest level of education achieved, region, employment status, work sector, and class of employment. Survey respondents were also asked to respond to the statements listed below, as reflected in current published FAA guidance and regulations, using a 7-point Likert scale, which served as the dependent variables:

Liability

- Space flight participants must execute a reciprocal waiver of claims with the FAA/DOT. The reciprocal waiver of claims is an official acknowledgment by the space flight operator, crew members, and space flight participant to hold each other harmless (absolves all parties of any liability) from bodily injury or property damage sustained, resulting from space flight and launch activities, regardless of fault.

Safety Risk

- Space flight participants must be made aware of the known hazards and risks that could result in serious injury, death, disability, or total/partial loss of physical and mental function.
- Space flight participants must be made aware that there are unknown hazards.
- The operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying crewmembers or space flight participants.
- Space flight participants must be informed of the safety records (i.e., accidents and incidents) of all private and U.S. Government launch/reentry vehicles.
- Space flight participants must be given the opportunity to ask questions.

Medical Screening

- Space flight participants must fill out and file a medical history questionnaire to disclose any preexisting medical conditions, history of illness or surgeries, and current medications which may result in death or injury during space flight or compromise the health and safety of other participants.
- The medical history questionnaire will also record participant height, weight, and blood pressure.
- Space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening.
- An electrocardiogram (EKG) will be required to records the participants' heart electrical activity and give an overview of cardiac health.

The Likert scale responses were utilized in an ordinal ranking method. Survey participants' responses were expected to be subjective between rating selections. As subjectiveness is not definitively measurable by quantitative means, the Likert ordinal ranking allows for a proximate interval variable to apply OLR analysis, as shown in Table 4. The Likert scale responses are ordered: 1 indicating *Strongly Disagree*, 2 indicating *Disagree*, 3 indicating *Somewhat Disagree*, 4 indicating *Neither Agree nor Disagree*, 5 indicating *Somewhat Agree*, 6 indicating *Agree*, and 7 indicating *Strongly Agree*.

Table 4

Dependent Variables Characteristics

Variable Name	Level of Measurement	Response Type

Liability	Interval	Likert (1-7)
Safety Risk	Interval	Likert (1-7)
Medical Screening	Interval	Likert (1-7)

Data Analysis Approach

A minimum number of 385 survey participants was determined using Cochran's sample size formula from the U.S. Census Bureau population of residents aged 18 years or older. Descriptive statistics were analyzed from IBM SPSS output to include the measures of central tendency (mean, median, and mode) and measures of variability (standard deviation) for participants' age, sex, race, marital status, highest education level achieved, region, household size, number of children, employment status, income, work sector, and class of employment (independent variables), and acceptance of medical screening, safety risk, and implied liability (dependent variables). Missing data were flagged, and an automated prompt was made in the survey for participants to go back and fill in missing responses. If the participant chose to submit the survey thereafter with missing responses, the questionnaire was flagged for inspection, examined for ambiguities, and discarded if necessary.

Several varied methods were examined for applicability in determining the best modeling and analysis techniques for this exploratory research. Multilevel modeling was not considered as the independent variables are not nested or hierarchical and could be measured detachedly. Also, as the survey instrument took a cross-sectional approach, there was no need to examine the measures over time. Furthermore, there was no need to look for and interpret latent variables per the research questions in this study, as exploratory factor analysis aims to validate latent measures of variables. Structural equation modeling was also unsuitable as the dependent variables were not to be studied over time, and causal relationships were not going to be stratified (Vogt et al., 2014). The utilization of OLR analysis was determined to be the most advantageous for this research due to the use of Likert responses as ranked interval units, and categorical and continuous independent variables. OLR is an extension of logistic regression modeling by which probabilities are ascertained by examination of the dependent variables (Adejumo & Adetunji, 2013).

Polytomous universal model (PLUM) factors categorical outcomes with more than two ordered categories and can fit five types of generalized linear models for OLR outcomes, including probit and complementary log-log models. OLR in PLUM is proportional odds models, meaning that the odds it models are for each ordered category compared to all lower-ordered categories and that the odds ratio is the same regardless of whether comparing category 4 to 3 and below or category 3 to 2 and below (Grace-Martin, n.d.; Lund & Lund, 2018). Inputting variables into IBM SPSS for OLR, ordinally ranked dependent variables are placed in the *dependent* input window, while categorical independent variables are placed in the *factors* input window, and continuous independent variables are input into the *covariate* window. The *case processing summary* output from IBM SPSS shows the percentage of cases per category.

Data Analysis Process

The independent variables are used in OLR to predict the acceptance factors by demographics as the formula of the odds ratio will form a regression model, as shown in Equation 3.

$$\text{Log } 1/(Y-1)=b_0+b_1X_1+b_2X_2+b_3X_3\ldots b_nX_n \quad (3)$$

Equation 3 demonstrates the use of coefficients to calculate cumulative predictive probabilities from the logistic regression model for each case. The coefficients for the probability odds will be reflected as statistical output factored by IBM SPSS computations. The odds ratio for a variable utilized in OLR represents a change in the odds per a one-unit increase in that variable, holding all other variables constant (Fagerland & Hosmer, 2016).

Model fitting information demonstrates if the model improves our ability to predict the outcome, showing how well the model fits the data and is statistically significant when less than .001. The goodness-of-fit statistic is interpreted in terms of non-failure to reject the null results when the output is less than .05. Pseudo R-square measures calculate the continuous outcome variables such that the model explains a specified percentage of the variance in the dependent variable. The test of parallel lines analyzes the proportional odds assumptions by testing the null results that the odds for each explanatory variable are consistent across different thresholds of the outcome variable and is not statistically significant when less than .05. Parameter estimates calculate the log-odds ratio. To determine the odds ratio from the log-odds ratio, one must exponentiate a variable estimate value by the location variable in a parameter estimates table to derive the necessary odds ratio and upper and lower 95% confidence intervals (Lund & Lund, 2018).

The test of parallel lines utilizes the -2 log likelihood statistic to compare the fitted location model to a varying location parameters model and binomial logistic regression by demonstrating significance in differences within the test of parallel lines table to determine if the model is a good fit. To determine if independent variables have statistically significant effects on the dependent variables, the p-values are examined to see if they are less than the significance level and thus provide enough evidence to reject the null results (Garson, 2014).

Assumptions

To use OLR for data analysis, four basic assumptions must be conditionally met. The first assumption that must be satisfied is that the dependent variable is measurable at the ordinal level by way of ranking, such as utilized in the Likert response ratings to acceptability for space flight participation guidance and regulations. The second assumption constitutes the need for the independent variables to be continuous, interval, ratio, or categorical (Adejumo & Adetunji, 2013). This assumption is satisfied by the demographic variable inputs being treated as continuous or categorical based on participant responses.

The third assumption that must be satisfied to utilize OLR data analysis is that there is no multicollinearity between the categorical independent variables. Multicollinearity is tested through logistic regression where the coefficients for tolerance and variance inflation factors (VIF) can be analyzed to ascertain if two or more independent variables are highly correlated. This issue was determined by statistical analysis for the variables constituting sex, race, highest level of education achieved, marital status, region, employment status, class of employment, and work sector. Due to the number of groupings within each of these variables, appropriate testing and evaluative processes will be expended to ensure no multicollinearity is present. This test is accomplished by creating dummy variables corresponding to the number of response units per variable, less one unit response per variable. For example, suppose a categorical independent variable has three choices. In that case, a respondent can only choose one, leaving two unused response units for which dummy variables will need to be created to check for multicollinearity in the statistical analysis. Thus, when applied to the categorical independent variables in this exploratory research, the total number of dummy variables required to test for multicollinearity is forty-one in number: one for sex, five for race, four for marital status, eight for highest level of education achieved, three for region, two for employment status, four for class of employment, and fourteen for work sector.

The final assumption regarding the assumption of proportional odds involves odds ratio testing for each independent variable to ensure an identical effect is apparent at each cumulative split of the ordinal dependent variable. An odds ratio gives the change in odds for a unit increase in continuous and categorical predictor variables. Another interpretation is that odds ratio denotes the constant effect of a predictor variable on the chances that one outcome will occur. IBM SPSS tests this in a full likelihood ratio test which compares the fitted location model to a model with varying location parameters and separate binomial logistic regressions on cumulative dichotomous dependent variables (Lund & Lund, 2018). The proportional odds assumption presumes that odds ratios are the same across categories, derived by exponentiating the coefficients. Multinomial logistic regression then estimates a separate binary logistic regression model for each dummy variable generated in the third assumption for conducting OLR. The result is *M-1* binary logistic regression models. Each one defines the effect of the predictor variables on the probability of success in that category compared to the reference category (Grace-Martin, n.d.). As each model has its own intercept and regression coefficients, the predictor variables can demonstrate a differing effect for each category.

Participant Demographics

A random sample of at least 385 U.S. resident participants, 18 years of age or older who had access to a computing device and internet service, of any sex, race, education level, and from any geographical region of the U.S. was solicited to take part in this research survey. Participants were recruited through SurveyMonkey Audience members. SurveyMonkey Audience allows researchers to obtain pseudo-random samples via targeted inputs such as specified demographic frequencies for solicitation to participate (SurveyMonkey, 2018). In this way, the ratio of demographic frequencies can be obtained to reflect U.S. Census Bureau reports for the generalizability of the results.

Reliability Assessment Method

Cronbach's alpha was examined for internal consistency of the three categories of the Likert-scale items (liability, safety risk, and medical screening). Values from 0.7-0.8 reflect an acceptable level, while 0.8-0.95 indicate good reliability. Cronbach's alpha values below 0.7 indicate some problems such as low responses or poor inter-relatedness between variables. Values above 0.95 may indicate redundancy and over-inter-relatedness (Hair et al., 2010). Results of the pilot study were used to assess the initial internal consistency of the survey scales. In addition, the pilot study utilized Cronbach's alpha to demonstrate appropriate reliability.

Validity Assessment Method

Validity is assessed to ensure that what was being measured is what the research purports to measure (Shadish et al., 2002). Content validity is assured as survey statements are drawn directly from 14 CFR and FAA Medical Guidance (Antuñano et al., 2006). Criterion validity is an estimate of the extent to which a measure agrees with a gold standard (Hochberg, 2015). In this research it is assessed by the test of parallel lines which compares the proportional odds model to a model with varying location parameters, which are supposed to be similar across response categories. The goodness-of-fit statistic also assesses validity by factoring in if the sample data represents the expectations of the actual population. The OLR odds ratio exponents of the demographic categories allow for comparative predictive analysis regarding the acceptance of the criteria.

External validity refers to the degree to which inferences can be applied to the targeted population, that is, the generalizability of the study's findings (Shadish et al., 2002). To this end, survey participant demographic characteristics were compared to the current U.S. Census Bureau QuickFacts database (n.d.) for parity and general representativeness of the results. If collected demographics did not represent U.S. Census Bureau figures during the collection period, the sampling administration toolset would have been adjusted to factor in under-represented populations.

Summary

This chapter provided a detailed overview of the research methodology for this research. First, detailed information on the research methodology and design was elucidated. Next, a description of the variables and the data collection steps, including the population, sample sizes, and sampling strategies, were presented. The exploratory research utilized an electronic questionnaire instrument to collect data. The data collection processes, participant procurement activities, and ethical considerations were presented. Measurement instrument validity and reliability issues were discussed, and methods to check and handle issues were outlined. Finally, data preparation and analysis techniques for testing used in this research were presented.

Chapter IV: Results

This chapter provides the analysis results to explain the findings for significant general public acceptance of the current guidance and regulations for space flight participation. Throughout the following sections I will provide descriptive statistics, reliability and validity testing results, and inferential analysis outcomes of all demographic. Where applicable variables are reported as to whether they had positive, negative, or null effects on likelihood of space tourism.

Demographics Results

A total of 650 survey responses were collected utilizing SurveyMonkey. The survey was opened for 3 weeks. After data collection was complete, incomplete survey response participants and non-qualifying respondents who failed to meet age and residency screening requirements were removed. This resulted in 607 useable participants remaining for further analysis (296 males, 311 females, mean age = 46.25, SD = 16.924). All survey respondents data are listed in Table 5. Differences between the values gathered in Table 5 and those of the U.S. Census Bureau can be attributed to attrition differences, as the survey utilized a cross-sectional convenience sample and the U.S. Census Bureau updates its data continuously. Non-probability sampling bias is also a factor in online survey sample gathering and participation.

Table 5

Comparison of Demographic Variables Between Survey Participants and U.S. Census Bureau

	Survey Participants Median Value	Survey Participant SD	U.S. Census Bureau Median Value
Age (in years)	45.00	16.923	38.50
Household size (number of occupants including participant)	2.00	1.566	2.62
Number of children residing with participant	0.00	1.139	0.56
Annual income (in U.S. Dollars)	60,000	54814.241	62,843

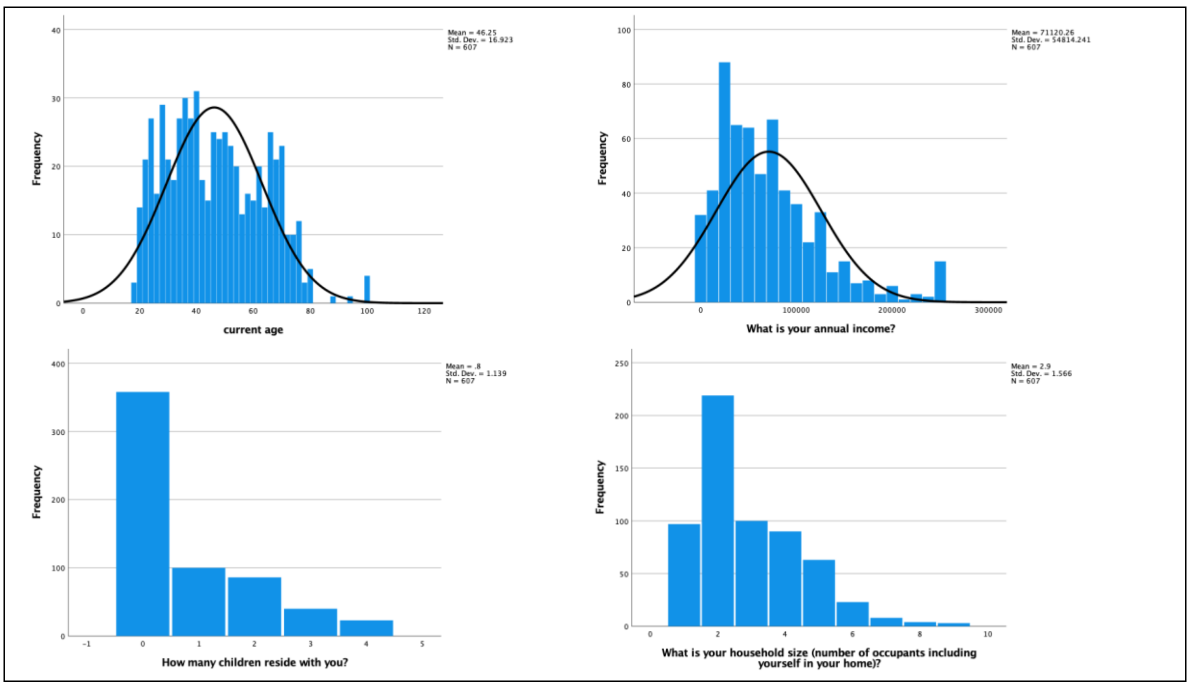
Note: n = 607 for survey participants; median values for U.S. Census Bureau from U.S. Census Bureau. (n.d.). *QuickFacts*. Retrieved from https://www.census.gov/quickfacts/fact/table/US/PST045218

The independent categorical variables, shown in Table C4 (see Appendix C), compare the percentages of the survey participants with U.S. Census Bureau values, as well as the survey participant frequencies. Differences between survey participant and U.S. Census Bureau ratios are derived from limitations of the survey cross-sectional data collection approach and U.S. Census data attrition factors. The percentages represent a parity such that the generalizability of the results for the U.S. population can be inferred. SurveyMonkey webservices demographic factors consider participant age, gender, region, and income, allowing for participant input in other contributing demographic factors (2018).

A graphical representation of survey participant continuous variable demographic frequencies is given in Table 6. Data attrition and changes in formats between U.S. Census Bureau figures and the data collected for this research presented a challenge in reflecting generalizability of the findings relative to the continuous independent variables.

Table 6

Survey Participant Continuous Variable Demographic Frequencies



Descriptive Statistics

The dependent variables examined the acceptance of current medical screening guidance, implied liability, and safety risk regulations. The descriptive statistics shown in Table C6 (see Appendix C) tabulate the mean, median, and standard deviation of the responses for each acceptance question. Skewness and kurtosis statistics per dependent variable are also listed. Outliers within the variables exist and are depicted via boxplots found in Figures D1 through D10, located in Appendix D, labeled according to each dependent variable. It is noted that the acceptance question *space flight participants must be made aware that there are unknown hazards* received the highest mean at 6.0. The acceptance question *requiring space flight participants execute a reciprocal waiver of claims* received the lowest mean score at 4.74. No other dependent variable mean responses ranked below a 5.00 score. The standard deviations for all responses ranged from 1.423 to 1.75.

Reliability and Validity Testing Results

Each acceptance question was modeled and analyzed utilizing OLR, PLUM, and general linear (GENLIN) models, which generated a large amount of data for interpretation. The objective is to interpret the effects of the independent variables on the dependent variables. Categorical independent variables odds ratios are used to interpret what degree of likelihood of acceptance on a singular dependent variable. The odds ratios and their significance indicate whether the effect is more likely, less likely, or there is no effect on acceptance of the dependent variable. Continuous variables (e.g., "Age," measured in years) interpret how a single unit increase or decrease in that variable (e.g., a one-year increase or decrease in age) associates with the odds ratio of the dependent variable having a higher or lower value.

Because the model utilizes many categorical independent variables and various categories, the covariate patterns generate warnings in SPSS output that there are 3636 (85.7%) cells with zero frequencies. A comparison of the individual odds ratios in GENLIN and PLUM model output identified identical odds ratios per each model. However, the assumption of proportional odds is not readily apparent, as assessed by full likelihood ratio tests comparing the fit of the proportional odds location models to models with varying location parameters. For example, in the PLUM assessment for the first dependent variable regarding the execution of a reciprocal waiver of claims, $x^2(225)=364.749$, p=<.001. This result is similarly displayed across the remaining nine dependent variables output. It is important to note that while the assumption of proportional odds is an indicator of accuracy, it can be sensitive to outliers, volume of data, volume of response categories, and similarities between response categories (Garson, 2014). Nevertheless, the output demonstrates a degree of predictive quality and quantifies numerical relationships between variables.

Lacking readily apparent proportional odds, an examination of the proportional odds was conducted via separate binomial logistic regressions which were used to compare and contrast proportionality of odds by the categorical splits between the variable responses, as seen in Table C8 (Appendix C). Some variables demonstrated issues with odds ratios as the cumulative splits fell outside subjective determinations to violate the assumption of proportional odds. The odds ratios should not differ significantly at each different categorical threshold, therefore the assumption of proportional odds for certain variables is not tenable. The continuous independent variables all met the assumption of proportional odds within the test for multicollinearity as they were not highly correlated.

The goodness-of-fit statistic indicates how well the model fits the data based on how well the data is predicted by the model and corresponds to the data actually collected (Field, 2014). The deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data for the question pertaining to *space flight participants must* *execute a reciprocal waiver of claims with the FAA/DOT*, $x^2(3585) = 2141.79$, p = 1.000. At issue with the deviance significance statistic is perfect model representation (*p* = 1.000). This condition is prevalent when there are many cells with zero frequencies and small expected frequencies, as is the case with the SPSS statistical model output (Lund & Lund, 2018). The remainder of the deviance goodness-of-fit exponents is listed in Table C6 in Appendix C. The likelihood ratio test looks at the change in model fit when comparing a full model to an intercept-only model by examining the difference in the -2 log likelihood between them as a x^2 distribution with degrees of freedom equal to the difference in the number of parameters (Lund & Lund, 2018). Regarding the likelihood ratio testing, the final model demonstrated statistical significance in predicting the dependent variables over and above the intercept-only model, $X^2(45) = 78.645$ to 119.060, $p < .001$, except for the dependent variable involving *space flight participants must execute a reciprocal waiver of claims with the FAA/DOT* which had a $p > .001$. Pseudo R-square Nagelkerke output calculates the continuous outcome variable such that the model explains 11.8% to 19.0% of the variance in the dependent variables. Pseudo R-square Cox and Snell output similarly explain 11.5% to 17.8% of variance in the dependent variables.

Chronbach’s alpha was utilized to test reliability of the survey instrument. This was appropriate to the research as the dependent variables utilized Likert scale responses. The internal consistency of the survey instrument was favorable at $a = .934$.

The test of parallel lines, which is a key determinate for the assumption of proportional odds, compares the model fit between two differing cumulative odds models. The proportional odds model is listed as a ‘null hypothesis’ and a cumulative odds model without the proportional odds assumption is listed as ‘general,’ where the slope coefficients are allowed to be different for each cumulative logit (Lund & Lund, 2018). In each instance, the results indicated the differences between the two models to be large and statistically significant ($p < .05$), which warranted interpreting the proportionality of odds results from the separate binomial logistic regressions on cumulative dichotomous dependent variables to affirm validity, as seen in Table C8 in Appendix C. The comparisons of the odds ratios are fragmented between the dichotomous categorical splits. While there are proportional odds ratios between certain categories, they are few in number per the dependent variables. These findings do, however, indicate the best demographic variable factors to determine acceptance among guidance and regulations for space flight participation.

Multicollinearity occurs when two or more independent variables are highly correlated, leading to technical issues in factoring OLR and problems understanding which variables contribute to the explanation of the dependent variables. A linear regression test for collinearity diagnostics was run to check for multicollinearity and satisfy the assumption that no multicollinearity exists to interpret the OLR results correctly. As demonstrated in Table 7, the tolerance values are greater than 0.1 (the lowest is 0.401), and VIF values are much less than 10, indicating no collinearity within the data set.

Table 7

Test for Multicollinearity

Independent Variable	Tolerance	VIF
Coefficients Collinearity Statistics		
The race you identify with is:	0.950	1.053
The sex you identify as is:	0.903	1.108
What is the highest level of education you have completed?	0.795	1.258
Your current age is:	0.685	1.460
Your marital status is:	0.778	1.286
What is your household size (number of occupants including yourself in your home)?	0.401	2.491
How many children reside with you?	0.412	2.430
In which region of the United States do you reside?	0.979	1.021
What is your employment status?	0.512	1.952
What is your class of employment?	0.600	1.668
What is your work sector?	0.480	2.083
What is your annual income?	0.741	1.350

Regression Analysis Results

Overall model fit for each dependent variable modeled will be presented below. Deviance goodness-of-fit and likelihood ratio statistics will be reported. Cumulative odds OLR with proportional odds was run to determine the effect of independent demographic variables on the dependent likert-scale ordinal variables. The dependent variable odds ratios and associated output are contained in Table C7 (See Appendix C).

Interpretation of the results will focus on the research questions posed:

- What demographic factors significantly influence public acceptance of safety risks, liability, and medical screening for space flight participation?

- How do these demographic factors affect public acceptance of the safety risks, liability, and medical screening for space flight participation?

Odds ratios greater than 1.000 suggest an increased likelihood of being more inclined toward acceptance of the dependent variable as values on the independent variable increase. An odds ratio of less than 1.000 suggests a decrease in probability with increases in the independent variable. An odds ratio equal to 1.000 suggests there will be no predictive change in the likelihood of being in a higher value as the values on the independent variable increase. In the following paragraphs which interpret the findings, dependent variables are denoted by italicized text to set them apart.

Only output that presented categories of significant findings ($p \leq 0.05$) and increased likelihood of acceptance (odds ratios greater than 1.000) will be reviewed. While there were categories that demonstrated greater likelihood of acceptance based on the odds ratios, the significance was insufficient to warrant interpretation. Similarly, there are other categories with the proper significance but conversely demonstrate decreased probability of acceptance. A closer comparison of acceptance based on the odds ratios and significance can be found in Table C5 and Table C7 (see Appendix C).

Liability

Regarding *space flight participants must execute a reciprocal waiver of claims with the FAA/DOT*, deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 2141.791$, $p = 1.000$. Per the likelihood ratio test, the final model predicted the dependent variable over and above the intercept-only model,

$x^2(45) = 74.152$, $p < .004$. An increase in household size was associated with an increase in the odds of acceptance, with an odds ratio of 1.180, 95% CI [1.015, 1.371], Wald $x^2(1) = 4.644$, $p = 0.031$. Per this dependent variable, the more residents that reside with a potential space flight participant, the more likely they will accept this guidance.

Safety Risks

Regarding the question *space flight participants must be made aware of the known hazards…*, deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1574.167$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 109.224$, $p < .001$. In the instance of this dependent variable, there were no categories that indicated greater likelihood of acceptance (odds ratio greater than 1.000) and demonstrated significance ($p < 0.050$). While the model demonstrated a good fit to the data provided, there were no discernable categories of significance which contributed to likely acceptance of this dependent variable.

For the dependent variable *space flight participants must be made aware that there are unknown hazards*, deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1544.393$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 81.247$, $p < .001$. The odds of category marital status never married being more likely to accept this dependent variable was 2.349, 95% CI [0.999, 5.522] times that of the reference category marital status widowed, a statistically significant effect, Wald $x^2(1) = 3.833$, $p = .050$. An increase in age (expressed in years) was associated with an increase in the odds acceptance, with an odds ratio of 1.012, 95%

CI [1.000, 1.025], Wald $x^2(1) = 3.828$, $p = 0.050$. For this dependent variable, those potential space flight participants most likely to accept this guidance will not have been married. Likewise, as participant age increases, the likelihood of acceptance is also expected to increase.

Regarding *the operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying crewmembers or space flight participants,* deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1736.557$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 98.149$, $p < .001$. An increase in age (expressed in years) was associated with an increase in the odds acceptance, with an odds ratio of 1.017, 95% CI [1.005, 1.030], Wald $x^2(1) = 7.858$, $p = 0.005$. Regarding this dependent variable, the older a potential spaceflight participant is, the more likely they are to accept this guidance.

Model fit of *space flight participants must be informed of the safety records…* as reflected by deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1672.723$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 88.252$, $p < .001$. The odds of category employment status full time being more likely to accept this dependent variable was 2.625, 95% CI [1.112, 6.199] times that of the reference category employment status not working, a statistically significant effect, Wald $x^2(1) = 4.849$, $p = 0.028$. This dependent variable demonstrates that spaceflight participants that have full time employment status are most likely to accept this guidance over other employment status categories.

Regarding *space flight participants must be given the opportunity to ask the space flight operator questions,* deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1573.326$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 119.060$, $p < .001$. An increase in age (expressed in years) was associated with an increase in the odds acceptance, with an odds ratio of 1.017, 95% CI [1.004, 1.029], Wald $x^2(1) = 6.997$, $p = 0.008$. Per this dependent variable, increases in potential space flight participant age is a key factor to consider regarding likelihood of acceptance.

Medical Screening

Per *space flight participants must fill out and file a medical history questionnaire*… the deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1606.960$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 78.645$, $p < .001$. The odds of category employment class self-employed being more likely to accept this dependent variable was 2.712, 95% CI [1.353, 5.435] times that of the reference category employment class local/state/federal employee, a statistically significant effect, Wald $x^2(1) = 7.908$, $p = 0.005$. This dependent variable demonstrates that potential space flight participants which are self-employed are more likely to accept this guidance over others in the same category.

Model fit of *space flight participants will be required to provide their height, weight, and blood pressure in their medical history questionnaire* per the deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1656.650$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 111.187$, $p < .001$. In the instance of this dependent variable, there were no demographic categories that indicated greater likelihood of acceptance (odds ratio greater than 1.000) and demonstrated significance ($p < 0.050$).

Regarding the question *space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening*, deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1660.622$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 89.451$, $p < .001$. The odds of category employment status full time being more likely to accept this dependent variable was 2.388, 95% CI [1.018, 5.598] times that of the reference category employment status not working, a statistically significant effect, Wald $x^2(1) = 4.008$, $p = 0.045$. For this dependent variable, potential space flight participants that are currently employed full time are more likely to accept this guidance than others in the same category.

Model fit of the final question regarding *an electrocardiogram (EKG) will be required to record the participant's heart electrical activity and give an overview of cardiac health* per the deviance goodness-of-fit statistic indicated that the model was a good fit to the observed data, $x^2(3585) = 1676.374$, $p = 1.000$. The likelihood ratio test indicated the final model predicted the dependent variable over and above the intercept-only model, $x^2(45) = 92.656$, $p < .001$. In the instance of this dependent variable, there were no categories that indicated greater likelihood of acceptance (odds ratio greater than 1.000) and demonstrated significance ($p < 0.050$).

Summary

This chapter examined the output and analysis of the data, which was modeled and analyzed utilizing SPSS OLR and modeled in PLUM and GENLIN. Demographic results and descriptive statistics were given, and the generalizability of the data was discussed. Reliability, validity, and other analyses were explored concerning the output, with charts and tables tabulating and explaining the findings. Interpretation of the dependent variable odds ratios and significance relative to the categories were described. The next chapter will discuss the observations from the output, conclusions drawn, and recommendations for future research.

Table 8

Summary of Significant Findings

	Liability	**Safety Risks**					**Medical Screening**	
Dependent variable	Execute waiver of claims	Aware that there are unknown hazards		Launch and reentry vehicles not certified as safe	Opportunity to ask questions	Informed of safety records	General medical tests	Medical history questionnaire
Demographic variable	Household Size	Never married	Age	Age	Age	Full-time employment	Full-time employment	Self-employed
Odds ratio	1.180	2.349	1.012	1.017	1.017	2.625	2.388	2.712

Note. There was no significant likely acceptance found regarding dependent variables: *Made aware of known hazards, Provide height, weight, and blood pressure,* and *Electrocardiogram (EKG) required*.

Chapter V: Discussion, Conclusions, and Recommendations

This chapter will conclude this exploratory research of a quantitative OLR analysis utilizing survey instrumentation to assess public acceptance of medical screening guidance, safety risks, and implied liability regulations for space flight participation as factored by demographic variables. Based on the demographic categories, the research has provided the likelihood of acceptance of the current guidance and regulations for space flight participation. This research also added to the body of knowledge concerning space flight participation, utilization of OLR for statistical analysis using survey instrumentation, and acceptance of significance by employing predictive analysis of demographic variables.

Discussion

This exploratory research began with the perceptions and concepts of public acceptance and explored them as applied in prior research concerning user acceptance of technology, high-risk activities, and other social constructs. A thorough review of prior research concerning acceptance provided an opportunity for this effort as there has not been a published quantitative study pertaining to significant and likely acceptance of current guidance and regulations for commercial space flight participation using survey instrumentation. Ordinally ranked dependent variable Likert responses were utilized to predict acceptance based on independent demographic categories. This predictive quality lends itself to generating the odds of various demographics to accept the guidance and regulations for space flight participation.

Contemporary literature lacks adequate quantitative research to counterpoint assertions made regarding space flight participation and demographic acceptance factors.

Few publications utilized survey instrumentation or regression analysis to quantitatively assess space flight participation factors. In particular, medical and legal literature primarily utilized qualitative subject matter expert analyses in their approach to their research. Literary analogies based on user acceptance of technological advents in transportation and hazard tolerance in high-risk activities utilized survey instrumentation and statistical analysis. In most instances, usefulness, financials, intent, and behaviors associated with space flight participation were the focus of previous research publications.

The research presented in this paper represents an innovative union of survey instrumentation and OLR statistical analysis to quantitatively explore significant public acceptance of current medical screening guidance, safety risks, and implied liability regulations. The utilization of demographic categories to predict odds ratios for acceptance factorization is a unique and novel approach to assessing potential populations inclined to partake in commercial space flight. Furthermore, the methodology and analysis approach add to the body of knowledge for further research and understanding of the commercial space flight field. In examining current guidance and regulations for space flight participation, this research quantifies contemporary acceptance against possible future changes and adaptations to the guidance and regulations.

First Research Question

"What demographic factors significantly influence public acceptance of safety risks, liability, and medical screening for space flight participation?" This first research question is determined by seeking out those demographic variable categories of significance with increased likeliness odds ratios for acceptance of the dependent variable. While three of the dependent variables had no significant odds ratios associated with acceptance, the remainder of the dependent variable demonstrated specific demographic effects relative to acceptance of the various guidance and regulations for space flight participation. In the following paragraphs, this question will be answered in tandem with the second research question.

Second Research Question

"How do these demographic factors affect public acceptance of the safety risks, liability, and medical screening for space flight participation?" This second question is answered by the inferences drawn from the OLR output and statistical assumptions. As an exploratory cross-sectional study, acceptance of the dependent variables depends upon interpretation of the results in a broader context as applied to the general population. A combined approach to answering this second research question with the first research question will be relayed in the following paragraphs.

The demographic variable pertaining to *space flight participants must execute a reciprocal waiver of claims with the FAA/DOT* showed that per a one-unit increase in household size, participants would exhibit a 1.180 odds ratio increase in acceptance of this guidance. As a significant finding over other categories, it demonstrates the importance of larger households likelihood to accept this guidance for space flight participation. There may be a correlation between either a household with many children, multigenerational housing situation, or having many non-family residents in one domicile that increases likely acceptance of this dependent variable.

Significant odds ratio output regarding *space flight participants must be made aware that there are unknown hazards* were found with those of a marital status category of never having been married with an odds ratio of 2.349. A one-unit increase in age also demonstrated an acceptance effect on this dependent variable with an odds ratio of 1.012. These differences in the ratios show while both are significant factors for acceptance of this guidance, those that have never married demonstrates a substantial increase in likelihood for acceptance. Alone or in combination, these two demographic categories demonstrate acceptance of this guidance greater than other categories.

The dependent variable regarding *operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles* showed that per a one unit increase in age, a 1.017 odds ratio was associated with acceptance of this guidance. Increase in age was also a factor in likely acceptance of the dependent variable *space flight participants must be given the opportunity to ask the space flight operator questions* with a 1.017 odds ratio as well. This demonstrates that as the population becomes more mature, acceptance of these regulations for space flight participation is likely to increase.

Regarding acceptance of the guidance *space flight participants must be informed of the safety records*, survey participants who had full-time employment status were likely to be more accepting than other categories with a 2.625 odds ratio. Full-time employment status was also a key to likely acceptance of *space flight participants must undertake general medical tests*, as a 2.388 odds ratio was presented in the output. This demonstrates that job security and steady income are key contributors to acceptance of these dependent variables.

A significant odds ratio for likely acceptance of *space flight participants must fill out and file a medical history questionnaire* was found with those who were self-employed. The odds ratio of acceptance was 2.712, demonstrating that survey participants who were independent and confident in their workplace employment class were more likely to accept this guidance to partake in space flight.

The three dependent variables which had no significant odds ratios for likely acceptance relative to demographic variables included *space flight participants must be made aware of the known hazards, will be required to provide their height, weight, and blood pressure in their medical history questionnaire,* and *an electrocardiogram (EKG) will be required to record the participant's heart electrical activity*. The lack of significant likely acceptance of these dependent variables indicate that the population has no particular regard for the acceptability of these guidance and regulations.

In summary, significant likely acceptance of the dependent variables for space flight participation medical screening guidance, safety risk and liability regulations could be found in demographics which aligned with increases in age and household size, those who never married, the full-time employed and those self-employed. These demographics tend to indicate that maturity and the security that comes with employment afford increased acceptance for space flight participation. Similarly, an increase in household size and marital status effect acceptance likelihood for the guidance and regulations associated with spaceflight participation. Resident situations and familial status seemingly affect acceptance based on interpersonal proximities.

Conclusions

The conclusions to this exploratory research are based on the interpretation of the OLR output and analysis. The potential for future research into the unexplored areas is promising for the benefit of the public and space tourism community. The contributions of this research will be of use to other researchers in terms of the analysis and interpretations in future studies concerning space flight participation. Insights gained from the methodology itself could also benefit future researchers interested in predictive acceptance studies.

Theoretical Contributions

The generalizability of the findings is based on the parity demonstrated between U.S. Census Bureau values of the U.S. population and the sample gathered for the research survey instrument. While there were demographic variables either over or underrepresented in the sample gathered, it did demonstrate broad generalizability based on the parity between U.S. Census Bureau ratios and those represented in the sample.

Existing literature has not quantified acceptance relative to demographics with the level of rigor utilized in this research effort. Spector (2020) is a chief example among publications pointedly making the argument that further research is needed to determine relationships between demographics and space travel intention. Many previously published papers inferred acceptance of spaceflight guidance and regulations by acquiescence of public participation in their research. Thus, the goals of this current research are unique in their aims.

Prior research relative to survey instrumentation, demographics, and their investigations were examined to demonstrate how this current research has furthered the body of knowledge. Beard and Starzyk (2002) for example utilized select respondents based on socioeconomics to ascertain affordability and commercial revenue projections of the space tourism industry. The lack of demographic acceptance identifiers limited the applicability of their findings. Chang (2017) also utilized a survey to collect demographic information though this study was focused on the novelty and public attitudes regarding space tourism perceptions. The generalizability of this publication was limited to the Taiwanese population as consumer attitudes towards space flight were the focus of this research.

Reddy et al. (2012) studied acceptance of recommendations, and participant reasoning for space flight participation. While this research was closest to the type of methodology, results, and findings in this current research, the generalizability was limited to the United Kingdom and the findings restricted to availability and reasoning for space flight participation. Springer (2012) utilized an opinion survey of aerospace industry workers to ascertain risk acceptance of the regulations for space flight participation. While this research involved Likert responses and demographic collection, the quantitative rigor was lacking, and findings were limited to participant opinions with fractional generalizability for the population.

This research concerning the public acceptance of medical screening recommendations, safety risk, and implied liability requirements utilized a novel quantitative analysis approach to determine the findings. No prior research had determined acceptance predictors based on demographics utilizing survey instrumentation and Likert scale responses factored by OLR. The publication of this research presents a novel way to determine acceptance based on demographics and significance. Further study of non-significant likely odds ratios, and significant less likely odds ratios could be of benefit to future studies. The methodology, in utilizing OLR, pushed the limits of ordinal regression techniques. Lessons learned in terms of sample size intimations, number of response categories, Likert scale considerations, and number of variables will aid future researchers in not only space flight participation studies, but in terms of OLR applicability in general.

This research fills a gap by studying acceptance for current guidance and regulations to partake in space flight. Prior research of varying rigor examined public enthusiasm, financial possibilities, and likeliness to partake in commercial space tourism. This research will aid psychometric research of attitudinal behaviors, market viability and behaviors, and identify key demographic acceptance identifiers. This research may also inform changes to guidance, rulemaking efforts, and regulatory amendments by providing a quantitative methodology to analyze public acceptance. The research will also advance understanding of acceptance identifiers as conjoined with demographic influences relative to administrative conditions for space flight participation due to utilization of OLR analysis.

Practical Contributions

From this research, significant demographic categories that displayed likely acceptance of the guidance and regulations for space flight participations as reflected in their associated odds ratios included increases in age, increases in household size, never married marital status, full-time employment status, and self-employment class. The guidance and regulations that demonstrated likely acceptance based on these demographic variables leave opportunities for expansion among the remaining categories through further study. Dependent variables which had non-significant odds ratios associated with likely acceptance also present unique insights for future study. Nonetheless, the independent variables that indicated significant likely acceptance are of interest to specific recommendations.

In as far as how household size impacts acceptance of executing a reciprocal waiver of claims for spaceflight participation, analysis of participant dependent numbers could reveal insights into other forms of acceptance such as risk. Correlative analysis between household size and increases in acceptance may signal participants more willing to be more adventurous and take on risky activities. This may be beneficial toward targeted marketing of space tourism to larger families or multigenerational domiciles.

An interesting finding of significance regarded those who have never been married and acceptance of guidance requiring space flight participant awareness of unknown hazards seems to indicate a desire on the part of individuals in this category to be aware of potential risks and possibly hazard aversion on their part. Similarly, increased likelihood of acceptance of the guidance regarding space flight participant be made aware that the U.S government does not certify launch or recovery vehicles was distinguished by an increase in age. A study regarding risk and hazard acceptance for space flight participation could lead to better market penetration techniques as well as benefit industry exposure campaigns. Similarly, increases in age indicate acceptance of the guidance and a cohort or longitudinal study centered on this advent may yield insights as to changes in attitudes over time.

Safety and risk management fields may find use in extrapolating how space flight participants that are of full-time employment status are more likely to accept the regulation covering informed conveyance of spaceflight safety records. The significance of this group over others may generate insight as to the relationship between safety record information and the type of worker the space flight participant is. The risk acceptance of these individuals based on safety record acknowledgement may be useful to risk interpretation, odds factorization involving risk, and user intent of high-risk activities. Moreover, participant interest in specific space flight safety records could be of interest in a behavioral intent study to ascertain which aspects of spaceflight are deemed most important to participants.

An increase in age indicated more likely acceptance of the regulation pertaining to being given the opportunity to ask questions of the space tourism operator. This finding has potential in a qualitative study about the most likely types of questions based on maturity operators are likely to engage with. Moreover, how these questions are posed, the timeliness in asking them, and the selected mode of delivery and receivership could be valuable to the industry and administration. The findings could define industry standards for conveyance and breadth of dissemination techniques which could impact societal awareness of space tourism.

Likely acceptance of the guidance pertaining to space flight participants filling out and filing a medical history questionnaire was significant to those who were self-employed. This finding would be of great interest to the aerospace medical community in how best to exploit this category of space flight participant and expand significant acceptance into other categories of this demographic category. A behavioral analysis of employment class and acceptance of medical history questionnaires may be useful to aerospace medicine as it seeks to derive medical and health data for future research. The first step of course being gaining broad acceptance of filing medical history questionnaires to eventually gaining use of that data for further investigations as to space flight participant health as part of a cohort study. The benefits from this type of investigation may have impacts across many facets of the medical and health industry.

Likely acceptance of the guidance pertaining to space flight participants undertaking general medical tests to assess overall physical health, urinalysis, hearing, and vision screening was found with those of full-time employment status. The opportunity to study why this category was more significantly accepting of this guidance over others would be of great interest to the medical field in a behavioral analysis study. Finding ways to either broaden acceptance of this guidance or adapting it to encourage others may lead to expansion of medical data for advanced studies on human physiology and human spaceflight impacts.

In summary, the presented research would be of great interest to space tourism professionals by aiding in identifying populations accepting of the current guidance and regulations. Inferences drawn may be applied and studied as both changes in the population occur, and human space flight doctrine and policies are adapted over time. Targeted marketing and information development will be able to take advantage of the acceptance criterion to identify subgroups and individuals. The disparities between interest and acceptance will allow for better efficiency and effectiveness to promote space flight participation. There are business case and economic implications to be gained from the prediction of acceptance parameters as the field would endeavor to gain acceptance across as broad a demographically diverse population as possible. These facets could inform a population of current guidance and regulations and how best to influence future proposed guidance and regulations based on a prediction of significant acceptance by demographic variables.

Insurance policy contracting and indemnification services will also derive information on potential space flight participants when factored with willingness, intent, and sufficiency of disposable capital. Measures could be examined regarding human space flight participation and injury or loss of life relative to the acceptance factors as predicted by demographics. Odds, probability, and likelihood assessments based on demographic predictors of acceptance of the current guidance and regulations could benefit insurance estimations, clausal exemptions to policy, and tort law application.

There will also be interest in legal, administrative, and possible recommendations stemming from demographic acceptance identifiers based on the current guidance and regulations for space flight participation. Examination of the demographic indicators found within this study that were less likely to accept space flight participation guidance and regulations, juxtaposed against those that are willing to accept, have the potential to influence modification, adaptations, and proposed guidance and regulations yet to come. Utilizing the methodology in this research, a variety of proposed changes to guidance and regulations for space flight participation could be quantified by demographic acceptance in an effort to determine those most broadly acceptable to the public. Quantifying acceptance of changes to legal particulars involving space tourism could be studied with more rigor. It would be of interest to the space tourism industry and government administration agencies how best to craft acceptable guidance and regulations that are broad-based yet effectively managed.

Limitations of the Findings

OLR presented particular challenges for utilization in the application of a pilot survey. There were issues with complete separation of the data because too small of a sample size was utilized in the pilot study regression analysis. The resultant errors indicated a perfect predictive effect regarding slope coefficients because there was not enough data to factor against. Reference materials did not readily denote the likely minimum number of responses necessary to utilize OLR; some ranges varied from 100 to 500 depending on the author. OLR is also prone to violation of the assumption of proportional odds given too many response categories within the variables. Within OLR tests of parallel lines, the proportional odds assumption was regularly violated, as assessed by a full likelihood ratio test comparing the fit of the proportional odds location model to a model with varying location parameters, which warranted assessing separate binomial logistic regressions on cumulative dichotomous dependent variables, as shown in Table C8 (see Appendix C). Reference materials often advised running OLR with fewer complex variables, combining similar response categories, or assessing the output utilizing multinomial logistic regression (Garson, 2014). The results inferred that variable response categories should contain no more than seven response categories, lest interpretation of the results become confounded.

Participant ratios indicated some disparities as compared to U.S. Census Bureau demographic percentages, as shown in Table C4 (see Appendix C). Non-probability sampling bias likely occurred due to some members of the population being more likely to be included in the sample than others. Factors concerning the use of an online convenience sample, and biases, including self-selection, non-response, and undercoverage were likely to affect the final demographic percentages. Differing survey applications such as in-person or telephone sampling may reduce these probable biases.

Recommendations

This research has provided an opportunity for further endeavors to advance the body of knowledge in various fashions. Interpretation of demographic predictors of acceptance for space flight participation has yielded facets that may be further explored in new research. Quantitative analyses of outstanding issues regarding the acceptance of medical screening guidance, safety risk, and implied liability regulations have the potential to shape and influence the space tourism field in the future. Subdividing the guidance and regulations for further analysis based on acceptance per specific demographic responses could yield advances in specific niches for study. Multinomial logistic regression is an option for factoring such data as has been utilized in this research though loss of ordinal treatment, and factorization is likely to yield differing results. Further inquiry involved with this research and derived areas for additional study provides ample opportunities for other researchers to probe.

Recommendations for Governmental Agencies and Space Tourism Industry

The results of this research could be of interest to the commercial space tourism industry as the findings could be leveraged to identify target populations based on the demographic tendencies for acceptance of the current guidance and regulations. There are also ramifications for governmental sectors in crafting future doctrine, policy, guidance, and regulations regarding the acceptance criteria for the general public. Insurance and indemnity services may also find the results of acceptance based on demographics of interest to their services and determination of risk factors. Servicing additional space flight participant products such as policy riders and additional coverage options may be future opportunities for the industry.

The demographics that relayed specified significance toward likely acceptance of the guidance and regulations should be further engaged in study on their own merits for further expansion of the body of knowledge. Similarly, determining how to resolve for those demographics that did not display significance toward likely acceptance of the guidance and regulations as currently construed should be investigated as well in future studies relative to the space tourism industry. Of note in this research were the demographics for increases in household size, increases in age, those who have never married, full-time employment status, and the self-employed as they displayed significant odds ratios associated with acceptance of the guidance and regulations. In particular increases in age and full-time employment demonstrated the broadest likely acceptance across the dependent variables. Further investigations utilizing behavioral intent, psychometric analysis, and cohort studies may expand the breadth of knowledge concerning public acceptance and human spaceflight.

Medical field personnel involved in space tourism may find the results useful in future studies of acceptance factors for passive and invasive medical screening, diagnostics, and data gathering. Prior literature has identified the need for physiological data gathering to identify and predict human space flight medical areas of concern. The methodology may help craft a study to examine broad-based demographic effects of medical and health studies for space flight participation.

Recommendations for Future Research Methodology

In the event this study were to be replicated, it may benefit the analysis to utilize fewer demographic variables. Biased responses based on the volume of independent variables may present issues inducing error into the interpretation of the final results because of participant fatigue, confusion regarding the number of response categories, and evasiveness of sensitive areas such as income. Another aspect that may be addressed would be the number of demographic response categories overall due to similarities between responses and the vagueness of participant awareness of such particular choices. By drawing down the number of independent variables and response categories therein, there may be opportunities to interpret response odds ratios better and increase the validity of the findings.

Quality of predictive variables, sample size, outliers, and multicollinearity must be carefully considered in OLR (Garson, 2014). Analysis could be pursued utilizing multinomial logistic regression, though this induces different issues with interpreting the results. While similar to OLR, multinomial logistic regression results are more general with smaller statistical power. There are also issues with the loss of ordinal information concerning dependent variables when factored.

Research concerning the acceptance of medical screening guidance, implied liability, and safety risk regulations could utilize a longitudinal survey. The effects of acceptance over time as the space tourism industry begins continuous and regular operations would be of interest to many. Ensuring responsiveness of an adequate sample size would be a concern, particularly given that the survey instrument would need to maintain consistency throughout. Individual research into specific guidance and regulations for space flight participation may also yield finite results.

Recommendations for Future Research

Psychometric analysis of acceptance criterion would be of interest in various disciplines in the space tourism field. Building public acceptance, what it is, and how it is determined would undoubtedly be of interest regarding medical screening, health data gathering, and long-term space flight physiological effects. Public acceptance of medical and health data gathering techniques, study, and distribution in its own right is a rich area for further research.

Predictive analysis based on risk acceptance would be worthwhile to the space tourism industry, particularly how expectations management couples with the actual experience. Aspects of safety acceptance or rejection for space flight participation could be based on experience, novelty, demographic inputs, and similar events. The research could utilize a mixed method of observation, interviews, or surveys to ascertain the results.

Space flight participant acceptance of implied liability for partaking in the experience also presents opportunities for future research. While willingness and intent have been previously explored, acceptance of liability waivers, participant limitations for risk, and indemnification particulars would be of interest to various stakeholders. Methods for researching this field could include surveys, interviews, experimental designs, or mixed methods.

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Appendix A

Permission to Conduct Research

Embry-Riddle Aeronautical University
Application for IRB Approval
EXEMPT Determination Form

Principal Investigator: Cory J. Trunkhill

Other Investigators: Dr. Robert Joslin

Role: Student **Campus:** Worldwide **College:** Aviation/Aeronautics

Project Title: Public Acceptance of Medical Screening Recommendations, Safety Risks, and Implied Liability for Space Tourism Participants

Review Board Use Only

Initial Reviewer: Teri Gabriel **Date:** 04/06/2021 **Approval #:** 21-110

Determination: Exempt

Dr. Beth Blickensderfer
IRB Chair Signature: Elizabeth L. Blickensderfer, Ph.D. Digitally signed by Elizabeth L. Blickensderfer, Ph.D. Date: 2021.04.13 16:00:43 -04'00'

Brief Description:

The purpose of this research is to measure and analyze public acceptance of safety risks, implied liabilities, and current medical screening guidance for space tourism participation based on demographic variables. An online self-administered survey questionnaire will be utilized to collect data for this research project via SurveyMonkey.

This research falls under the **EXEMPT** category as per 45 CFR 46.104:

☑ (2) Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (Applies to Subpart B [Pregnant Women, Human Fetuses and Neonates] and does not apply for Subpart C [Prisoners] except for research aimed at involving a broader subject population that only incidentally includes prisoners.)

Modification of Previously Approved IRB

Campus:	Worldwide	College:	COA
Applicant:	Cory Trunkhill	Degree Level:	Doctorate
ERAU ID:	0895773	ERAU Affiliation:	Student
Project Title:	Public Acceptance of Medical Screening Recommendations, Safety Risks, and Implied Liabilities Requirements for Space Flight Participation		
Principal Investigator:	Cory J Trunkhill		
Sumbission Date:	11/16/2021		
Beginning Date:	12/06/2021		
IRB Approval #:	21-110		

Modification of Approved IRB
APPROVAL

__✓ Validated to meet the criteria for Exempt or Expedited Status.

IRB Approver Signature: *Teri Gabriel, IRB Director*

Date of Approval: November 17, 2021

Questions

1. **Change of Protocol due to:**

   Revised survey/questionnaire

   There were changes to the title of the project to better capture the purpose of the research. The Consent Form has been amended to reflect current IRB formating. There were also more independent variables added to the survey instrument, which increased the number of survey questions related to demographic inputs. Question 3 pertaining to highest level of education achieved was changed to reflect categorical responses. Questions 6 and 7 was added to capture demographics regarding household size and number of children residing with the survey participant as continuous-interval responses. Question 8 was added to capture the demographics regarding the region of the U.S. the participant resides in as a categorical response. Questions 9, 10, and 11 capture participant employment status, class of employment, and work sector as categorical responses. Finally, Question 12 was added to factor participant annual income as a continuous-interval variable.

2. **Have you started the recruitment process?**

   No

3. **Have you received any complaints or experienced unanticipated problems with this project?**

   No

Appendix B

Data Collection Device

The following questions are designed to gather demographic information. After these, you will be presented with questions that will gauge your acceptance of current space flight participant health screening, implied indemnification, and safety risk. You may discontinue at any time and withdraw from the survey. Your information and presented answers will not be shared or disseminated to any 3rd party entities.

For the following questions, please indicate your demographic preferences.

1. The race you identify with is:
   a) White
   b) Black/African American
   c) American Indian/Native Alaskan
   d) Asian
   e) Pacific Islander/Native Hawaiian
   f) Two or more races

2. The sex you identify as is:
   a) Male
   b) Female

3. What is the highest level of education you have completed?
   a) Less than 8th Grade (no diploma)
   b) 9-12th Grade (no diploma)
   c) High School diploma or equivalent
   d) Some College (no Associates or 4-year degree)
   e) Associates degree
   f) Bachelors degree
   g) Masters degree
   h) Professional degree (such as DDS or JD)
   i) Doctorate (such as PhD or EdD)

4. Your current age is:
   ____ (fill number)

5. Your marital status is:
   a) Never Married
   b) Married
   c) Divorced
   d) Separated
   e) Widowed

6. What is your household size (number of occupants including yourself in your home)?

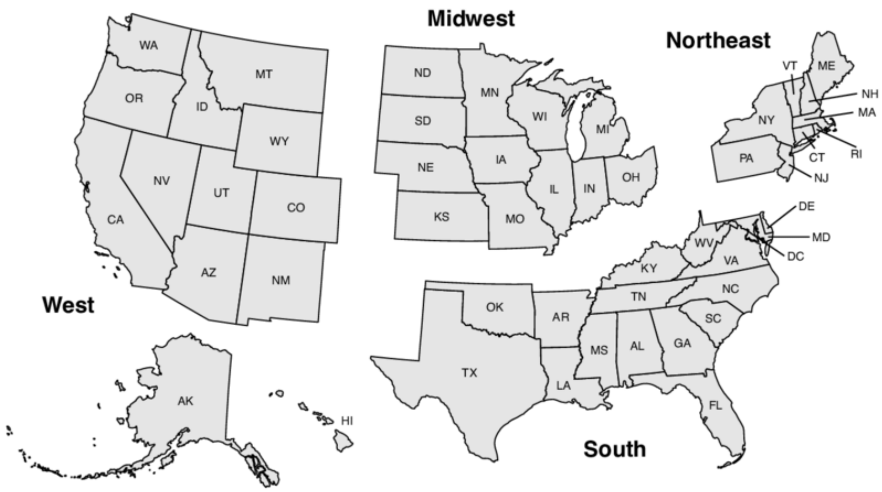
____ (fill number)

7. How many children reside with you?
   ____ (fill number)

8. In which region of the United States do you reside (see graphic below)?
   a) Northeast
   b) Midwest
   c) South
   d) West

Figure 2

Respondent Region



9. What is your employment status?
   a) Full time
   b) Part time
   c) Not working

10. What is your class of employment?
   a) Not Applicable – Not Working
   b) Employee of a Private Company
   c) Self-Employed
   d) Private Not-For-Profit
   e) Local/State/Federal Employee

11, What is your work sector?
   a) Not Applicable – Not Working
   b) Agriculture and related industries
   c) Mining
   d) Construction

e) Manufacturing
f) Wholesale trade
g) Retail trade
h) Transportation and utilities
i) Information
j) Financial activities
k) Professional and business services
l) Education and health services
m) Leisure and hospitality
n) Other services
o) Government worker

12. What is your annual income?
____ (fill number)

For the following statements please indicate your level of favorability utilizing the following seven-point scale: (1) Strongly Disagree, (2) Disagree, (3) Somewhat Disagree, (4) Neither Agree nor Disagree, (5) Somewhat Agree, (6) Agree, (7) Strongly Agree

13. Space flight participants must execute a reciprocal waiver of claims with the FAA/DOT. The reciprocal waiver of claims is an official acknowledgement by the space flight operator, crew members, and space flight participant to hold each other harmless (absolves all parties of any liability) from bodily injury or property damage sustained, resulting from space flight and launch activities, regardless of fault.

14. Space flight participants must be made aware of the known hazards and risks that could result in serious injury, death, disability, or total/partial loss of physical and mental function.

15. Space flight participants must be made aware that there are unknown hazards.

16. The operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying crewmembers or space flight participants.

17. Space flight participants must be informed of the safety records (i.e., accidents and incidents) of all, private and U.S. Government, launch/reentry vehicles.

18. Space flight participants must be given the opportunity to ask the space flight operator questions.

19. Space flight participants must fill out and file a medical history questionnaire to disclose any preexisting medical conditions, history of illness or surgeries, and current medications which may result in death or injury during space flight, or compromise the health and safety of other participants.

20. Space flight participants will be required to provide their height, weight, and blood pressure in their medical history questionnaire.

21. Space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening.

22. An electrocardiogram (EKG) will be required to record the participant's heart electrical activity and give an overview of cardiac health.

Thank you for participating in this survey.

If you have any questions about this research project, you can contact the research director at trunk2de@my.erau.edu. If you have concerns about the treatment of research participants, please contact the Embry-Riddle Aeronautical University Institutional Review Board at 386-226-7179 or via email teri.gabriel@erau.edu.

APPENDIX C

Tables

Table C1

Components of the Dependent Variable for Safety Risks

Resource	Safety Risk Variables
14 CFR	**§ 460.45 Operator informing space flight participant of risk**. (a) Before receiving compensation or making an agreement to fly a space flight participant, an operator must satisfy the requirements of this section. An operator must inform each space flight participant in writing about the risks of the launch and reentry, including the safety record of the launch or reentry vehicle type. An operator must present this information in a manner that can be readily understood by a space flight participant with no specialized education or training, and must disclose in writing— (1) For each mission, each known hazard and risk that could result in a serious injury, death, disability, or total or partial loss of physical and mental function; (2) That there are hazards that are not known; and (3) That participation in space flight may result in death, serious injury, or total or partial loss of physical or mental function. (b) An operator must inform each space flight participant that the United States Government has not certified the launch vehicle and any reentry vehicle as safe for carrying crew or space flight participants. (c) An operator must inform each space flight participant of the safety record of all launch or reentry vehicles that have carried one or more persons on board, including both U.S. government and private sector vehicles. This information must include— (1) The total number of people who have been on a suborbital or orbital space flight and the total number of people who have died or been seriously injured on these flights; and (2) The total number of launches and reentries conducted with people on board and the number of catastrophic failures of those launches and reentries. (d) An operator must describe the safety record of its vehicle to each space flight participant. The operator's safety record must cover launch and reentry accidents and human space flight incidents that occurred during and after vehicle verification performed in accordance with § 460.17, and include— (1) The number of vehicle flights; (2) The number of accidents and human space flight incidents as defined by section 401.5; and (3) Whether any corrective actions were taken to resolve these accidents and human space flight incidents. (e) An operator must inform a space flight participant that he or she may request additional information regarding any accidents and human space flight incidents reported.

	(f) Before flight, an operator must provide each space flight participant an opportunity to ask questions orally to acquire a better understanding of the hazards and risks of the mission, and each space flight participant must then provide consent in writing to participate in a launch or reentry. The consent must— (1) Identify the specific launch vehicle the consent covers; (2) State that the space flight participant understands the risk, and his or her presence on board the launch vehicle is voluntary; and (3) Be signed and dated by the space flight participant.

Note. Data for Table C1 derived from Federal Aviation Administration (2006), *Human Space Flight Requirements for Crew and Space Flight Participants*.

Table C2

Components of the Dependent Variable for Liability

Resource	Liability Variables
14 CFR	**§ 460.49 Space flight participant waiver of claims against U.S. Government**. Each space flight participant must execute a reciprocal waiver of claims with the Federal Aviation Administration of the Department of Transportation in accordance with the requirements of § 440 of this chapter.

Note. Data for Table C2 derived from Federal Aviation Administration (2006), *Human Space Flight Requirements for Crew and Space Flight Participants*.

Table C3

Components of the Dependent Variable for Medical Screening

Resource	Questionnaire	
Guidance for Medical Screening of Commercial Aerospace Passengers (2006)	Prospective aerospace passengers should complete a questionnaire about their medical history of any of the following conditions: • Otitis, sinusitis, bronchitis, asthma, or other respiratory disorders • Dizziness or vertigo • Fainting spells, or any other loss of consciousness • Seizures • Tuberculosis • Surgery and other hospital admissions • Visits to physicians in the last 3 years • Recent significant trauma • History of decompression syndrome (DCS) • Anemia or other blood disorders	• Heart or circulatory disorders, including implanted pacemaker or defibrillator • Mental disorders • Claustrophobia • Attempted suicide • Use of medications • Alcohol or drug dependence or abuse • Date of last menstrual period, current pregnancy, recent post-partum (less than 6 weeks), or recent spontaneous or voluntary termination of pregnancy • Diabetes • Cancer • Rejection for life or health insurance
	Prospective orbital aerospace passengers should complete a questionnaire about their medical history if they have a history of any of the following conditions: • Otitis, sinusitis, bronchitis, asthma, upper respiratory infections, or other respiratory disorders • Allergies • Dizziness or vertigo • Significant motion sickness requiring medication • Fainting spells or any other loss of consciousness • Seizures, convulsions, epilepsy, stroke, muscular weakness, or paralysis	• Mental disorders (including depression, anxiety, fear of flying, fear of heights, fear of closed spaces, fear of open spaces, etc.)• Attempted suicide • Use of medications • Alcohol or drug dependence or abuse • Date of last menstrual period, current pregnancy, recent post-partum (less than 6 weeks), or recent spontaneous or voluntary termination of pregnancy • Severe hay fever or allergies • History of pneumothorax (collapsed lung) • Kidney stones or blood in urine

	• Tuberculosis, hepatitis, AIDS, or other chronic infectious disorder • Surgery, recent or remote, or other admission to hospital • Recent significant trauma • Anemia or other blood disorders • Heart or circulatory disorders, including implanted pacemaker or defibrillator • Uncontrolled high or low blood pressure	• Gallstones or gallbladder disease • Diabetes • Cancer • History of radiation treatment or occupational exposure to radiation • Rejection for life or health insurance • History of decompression syndrome (DCS) • History of previous space flights
	Physical Examination assessments of Passengers in Orbital aerospace flights Prospective aerospace orbital passengers should receive a general physical examination that includes: • Vital signs (heart rate, respiratory rate, temperature, blood pressure) • Head, face, neck, and scalp • Nose, sinuses, mouth, throat, ears (including eardrum integrity and function, Eustachian tube function) • Ophthalmological evaluation (including pupil function, ocular motility) • Lungs and chest • Heart (including precordial activity, rhythm, sounds, murmurs)	Peripheral vascular system • Abdomen and viscera (including hernia) • Genitourinary system • Upper and lower extremities • Spine • Lymphatics • Rectal, pelvic, and breast examination should be performed only if indicated by medical history • General neurological evaluation • General psychiatric evaluation (appearance, behavior, mood, communication, and memory)
	Medical Testing of Passengers in Orbital aerospace flights Prospective passengers in Orbital Aerospace Flights should complete the following general medical tests:	Pre-flight Medical Interview and Physical Examination requirements for Passengers in Orbital aerospace flights Prior (within one to two weeks) to the actual departure of an orbital commercial aerospace flight, all passengers should be

	• Routine hematology • Clinical chemistry (serum) • Urinalysis • Resting EKG • Chest X-rays (PA & lateral) • Visual acuity (corrected) • Pregnancy testing (optional) • Hearing (conversational voice at 6 ft) • Tympanometry and/or tonometry (if clinically indicated) • Pulmonary function testing (if clinically indicated)	subjected to an abbreviated pre-flight medical interview and physical examination. The purpose of this pre-flight medical screening is to ensure that these passengers have not developed medical conditions that may have occurred since the last medical clearance was issued. Such a pre-flight medical screening should include vital signs and a brief medical history and physical examination concentrating on the following: eye, ear, nose, throat, cardiopulmonary, gastrointestinal tract, musculoskeletal, and neurological systems. A brief mental status assessment should also be obtained. Because of the potential hazards of aerospace flight (including exposure to solar and cosmic radiation, acceleration, and microgravity), it is recommended that a female of child-bearing age be offered a pregnancy test. Operators may wish to consider excluding pregnant women from participating in aerospace flights.

Note. Data for Table C3 derived from Antuñano et al. (2006), *Guidance for Medical Screening of Commercial Aerospace Passengers.*

Table C4

Survey Participant Versus U.S. Census Bureau Demographic Percentages

Independent Variables		Survey Respondent Frequency	Survey Respondent %	U.S. Census Bureau %
Race	White	468	77.1	76.3
	Black/African American	49	8.1	13.4
	American Indian/Native Alaskan	8	1.3	1.3
	Asian	52	8.6	5.9
	Pacific Islander/Native Hawaiian	5	0.8	0.2
	Two or more Races	25	4.1	2.8
Sex	Male	296	48.8	49.2
	Female	311	51.2	50.8
Highest Level of Education Achieved	Less than 8th Grade (no diploma)	5	0.8	0.8
	9-12th Grade (no diploma)	5	0.8	0.8
	High School diploma or equivalent	78	12.9	21.5
	Some College (no Associates or 4-year degree)	134	22.1	17.2
	Associates degree	67	11.0	6.4
	Bachelors degree	194	32.0	15.0
	Masters degree	85	14.0	6.3
	Professional degree (such as DDS or JD)	26	4.3	1.5
	Doctorate (such as PhD or EdD)	13	2.1	1.0
Marital Status	Never Married	184	30.3	46.0
	Married	319	52.6	38.8
	Divorced	64	10.5	9.0
	Separated	11	1.8	1.5
	Widowed	29	4.8	4.6
U.S. Region	Northeast	119	19.6	17.8
	Midwest	140	23.1	21.8
	South	213	35.1	38.5
	West	135	22.2	21.8

Employment Status	Full time	328	54.0	60.6
	Part time	102	16.8	13.4
	Not working	177	29.2	22.4
Class of Employment	Not Applicable/Not Working	161	26.5	0.0
	Employee of a Private Company	236	38.9	80.0
	Self-Employed	76	12.5	5.8
	Private Not-for-Profit	36	5.9	0.2
	Local/State/Federal Employee	98	16.1	14.0
Work Sector	Not Applicable/Not Working	147	24.2	0.0
	Agriculture and related Industries	11	1.8	1.5
	Mining	3	0.5	0.4
	Construction	26	4.3	4.9
	Manufacturing	34	5.6	7.9
	Wholesale trade	8	1.3	3.7
	Retail trade	49	8.1	9.7
	Transportation and utilities	18	3.0	4.0
	Information	25	4.1	1.7
	Financial activities	24	4.0	5.7
	Professional and business services	31	5.1	13.2
	Education and health services	105	17.3	15.1
	Leisure and hospitality	16	2.6	8.7
	Other services	72	11.9	4.9
	Government worker	38	6.3	14.2

Note. Data derived from U.S. Census Bureau (n.d.) and U.S. Bureau of Labor Statistics (n.d.)

Table C5

Summary of Acceptance Results

Dependent Variable	Acceptance Odds Ratio > 1.000 and p < 0.050	Odds Ratio > 1.000, p > 0.050	Odds Ratio < 1.000 and p < 0.050
Space flight participants must execute a reciprocal waiver of claims with the FAA/DOT.	Increase in household size	Marital: married Marital: separated Emp Status: full time Emp Class: self-employed Work Sector: not applicable/not working Work Sector: transportation and utilities Work Sector: information Work Sector: professional and business services Work Sector: leisure and hospitality	Edu: less than 8th grade (no diploma) Edu: high school diploma or equivalent Edu: some college (no associates or 4-year degree) Edu: bachelors degree Edu: professional degree (such as DDS or JD) Work Sector: wholesale trade
Space flight participants must be made aware of the known hazards and risks that could result in serious injury, death, disability, or total/partial loss of physical and mental function.		Race: White Race: American Indian/Native Alaskan Marital: never married Marital: married Marital: divorced Emp Status: full time Emp Class: not applicable/not working Emp Class: self-employed Work Sector: not applicable/not working	Edu: less than 8th grade (no diploma) Edu: 9-12th grade (no diploma) Work Sector: agriculture and related industries Work Sector: mining Work Sector: manufacturing Work Sector: wholesale trade

Space flight participants must be made aware that there are unknown hazards.	Marital: never married Increase in age (expressed in years)	Marital: married Marital: divorced Emp Status: full time Emp Class: not applicable/not working Emp Class: employee of a private company Emp Class: self employed	Edu: less than 8th grade (no diploma) Work Sector: agriculture and related industries Work Sector: wholesale trade Work Sector: transportation and utilities Work Sector: information
The operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying crewmembers or space flight participants.	Increase in age (expressed in years)	Marital: never married Marital: married Marital: divorced Emp Status: full time Emp Class: employee of a private company Emp Class: self-employed Work Sector: not applicable/not working	Race: Pacific Islander/native Hawaiian Sex: Male Edu: less than 8th grade (no diploma) Work Sector: agriculture and related industries Work Sector: mining
Space flight participants must be informed of the safety records (i.e., accidents and incidents) of all, private and U.S. Government, launch/reentry vehicles.	Emp Status: full time	Edu: some college (no associates or 4-year degree) Edu: associates degree Edu: bachelors degree Edu: masters degree Edu: professional degree (such as DDS or JD) Emp Status: part time Emp Class: not applicable/not working Emp Class: self-employed Work Sector: not applicable/not working Work Sector: wholesale trade	Sex: Male Edu: less than 8th grade (no diploma) Work Sector: agriculture and related industries Work Sector: mining

		Work Sector: leisure and hospitality	
Space flight participants must be given the opportunity to ask the space flight operator questions.	Increase in age (expressed in years)	Marital: never married Marital: married Emp Status: full time Emp Class: not applicable/not working Emp Class: self-employed Work Sector: not applicable/not working Work Sector: wholesale trade Work Sector: professional and business services Work Sector: leisure and hospitality	Sex: Male Edu: less than 8th grade (no diploma) Edu: 9-12th grade (no diploma) Edu: high school diploma or equivalent Region: Northwest Work Sector: agriculture and related industries Work Sector: mining
Space flight participants must fill out and file a medical history questionnaire to disclose any preexisting medical conditions, history of illness or surgeries, and current medications which may result in death or injury during spaceflight, or compromise	Emp Class: self-employed	Edu: masters degree Marital: married Emp Status: full time Emp Class: not applicable/not working Emp Class: private not-for-profit	Race: Black/African American Race: Asian Edu: less than 8th grade (no diploma) Work Sector: agriculture and related industries Work Sector: manufacturing

Space participants will be required to provide their height, weight, and blood pressure in their medical history questionnaire.		Race: White Race: American Indian/Native Alaskan Race: Asian Race: Pacific Islander/Native Hawaiian Marital: married Emp Status: full time Emp Class: self-employed Work Sector: not applicable/not working Work Sector: leisure and hospitality	Edu: less than 8th grade (no diploma) Edu: high school diploma or equivalent Work Sector: agriculture and related industries Work Sector: mining Work Sector: manufacturing Work Sector: wholesale trade
Space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening.	Emp Status: full time	Race: Pacific Islander/Native Hawaiian Edu: some college (no associates or 4-year degree) Edu: masters degree Marital: married Emp Class: not applicable/not working Emp Class: employee of a private company Emp Class: self-employed Work Sector: not applicable/not working	Edu: less than 8th grade (no diploma) Work Sector: agriculture and related industries

An electrocardiogram (EKG) will be required to record the participant's heart electrical activity and give an overview of cardiac health.		Edu: some college (no associates or 4-year degree) Edu: associates degree Edu: bachelors degree Edu: masters degree Edu: professional degree (such as DDS or JD) Marital: never married Marital: married Emp Status: full time Emp Class: not applicable/not working Emp Class: employee of a private company Emp Class: self-employed Work Sector: mining	Race: Asian Sex: Male Edu: less than 8th grade (no diploma)

Table C6

Dependent Variable Descriptive Statistics

	Space flight participants must execute a reciprocal waiver of claims with the FAA/DOT.	Space flight participants must be made aware of the known hazards and risks that could result in serious injury, death, disability, or total/partial loss of physical and mental function.	Space flight participants must be made aware that there are unknown hazards.	The operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying crewmembers or space flight participants.	Space flight participants must be informed of the safety records (i.e., accidents and incidents) of all, private and U.S. Government, launch/reentry vehicles.	Space flight participants must be given the opportunity to ask the space flight operator questions.	Space flight participants must fill out and file a medical history questionnaire to disclose any preexisting medical conditions, history of illness or surgeries, and current medications which may result in death or injury during space flight, or compromise	Space participants will be required to provide their height, weight, and blood pressure in their medical history questionnaire.	Space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening.	An electrocardiogram (EKG) will be required to record the participant's heart electrical activity and give an overview of cardiac health.
	607	607	607	607	607	607	607	607	607	607
Missing	0	0	0	0	0	0	0	0	0	0
Mean	4.74	5.91	6	5.74	5.86	5.94	5.95	5.82	5.85	5.84
Median	5	7	7	6	6	7	7	6	6	6
Std. Deviation	1.75	1.6	1.473	1.546	1.477	1.437	1.423	1.522	1.462	1.436
Skewness	-0.558	-1.576	-1.757	-1.332	-1.514	-1.458	-1.567	-1.491	-1.5	-1.431
Kurtosis	-0.54	1.673	2.626	1.19	1.918	1.595	2.164	1.686	1.897	1.712
Goodness-of-Fit (Deviance)	2141.79	1574.17	1544.39	1736.56	1672.72	1573.33	1606.96	1656.65	1660.62	1686.37

Note. The dependent variables were ranked by participants as ordinally factored on a seven-point Likert scale.

Table C7

SPSS Dependent Variable Odds Ratios and Associated Data Output

Dependent Variable	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
Space flight participants must execute a reciprocal waiver of claims with the FAA/DOT. The reciprocal waiver of claims is an official acknowledgement by the space flight operator, crew members, and space flight participant to hold each other harmless (absolves all parties of any liability) from bodily injury or property damage sustained, resulting from space flight and launch activities, regardless of fault.	Race: White	1.229	0.580	2.604	0.290	0.590
	Race: Black/African American	1.334	0.542	3.284	0.392	0.530
	Race: American Indian/Native Alaskan	1.948	0.462	8.207	0.826	0.363
	Race: Asian	0.984	0.405	2.389	0.991	0.971
	Race: Pacific Islander/Native Hawaiian	1.454	0.252	8.395	0.175	0.676
	Sex: Male	1.173	0.859	1.602	1.008	0.315
	Edu: less than 8th grade (no diploma)	0.028	0.004	0.209	12.191	<0.001
	Edu: 9-12th grade (no diploma)	0.187	0.027	1.278	2.923	0.087
	Edu: high school diploma or equivalent	0.234	0.075	0.736	6.182	0.013
	Edu: some college (no associates or 4-year degree)	0.254	0.084	0.762	5.976	0.015
	Edu: associates degree	0.410	0.131	1.284	2.343	0.126
	Edu: bachelors degree	0.338	0.117	0.981	3.978	0.046
	Edu: masters degree	0.482	0.163	1.427	1.737	0.188
	Edu: professional degree (such as DDS or JD)	0.207	0.060	0.709	6.281	0.012
	Marital: never married	0.968	0.440	2.126	0.007	0.935
	Marital: married	1.213	0.593	2.482	0.280	0.596
	Marital: divorced	1.124	0.503	2.513	0.082	0.776
	Marital: separated	1.245	0.341	4.545	0.110	0.741
	Region: Northwest	0.838	0.532	1.319	0.584	0.445
	Region: Midwest	0.838	0.539	1.302	0.617	0.432
	Region: South	0.940	0.629	1.403	0.092	0.762
	Emp Status: full time	1.524	0.664	3.499	0.988	0.320
	Emp Status: part time	0.805	0.342	1.895	0.246	0.620
	Emp Class: not applicable/not working	0.617	0.223	1.707	0.866	0.352
	Emp Class: employee of a private company	0.819	0.500	1.344	0.622	0.430
	Emp Class: self-employed	1.223	0.645	2.320	0.380	0.537
	Emp Class: private not-for-profit	0.988	0.478	2.041	0.001	0.988
	Work Sector: not applicable/not working	2.179	0.752	6.258	2.055	0.152
	Work Sector: agriculture and related industries	0.291	0.078	1.081	3.398	0.065
	Work Sector: mining	0.177	0.020	1.581	2.401	0.121
	Work Sector: construction	0.804	0.300	2.153	0.188	0.664
	Work Sector: manufacturing	1.060	0.419	2.681	0.015	0.903
	Work Sector: wholesale trade	0.169	0.039	0.741	5.563	0.018

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Work Sector: retail trade	0.980	0.407	2.360	0.002	0.964
	Work Sector: transportation and utilities	1.600	0.542	4.719	0.725	0.394
	Work Sector: information	1.349	0.504	3.610	0.355	0.551
	Work Sector: financial activities	1.471	0.558	3.874	0.609	0.435
	Work Sector: professional and business services	1.759	0.689	4.490	1.393	0.238
	Work Sector: education and health services	1.215	0.591	2.500	0.280	0.596
	Work Sector: leisure and hospitality	1.757	0.569	5.426	0.959	0.327
	Work Sector: other services	1.030	0.464	2.288	0.005	0.943
	Increase in age (expressed in years)	1.010	0.999	1.022	3.152	0.076
	Increase in household size	1.180	1.015	1.371	4.644	0.031
	Increase in resident children	0.825	0.673	1.012	3.397	0.065
	Increase in income	1.000	1.000	1.000	2.697	0.101

Dependent Variable	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
Space flight participants must be made aware of the known hazards and risks that could result in serious injury, death, disability, or total/partial loss of physical and mental function	Race: White	1.412	0.641	3.111	0.733	0.392
	Race: Black/African American	1.142	0.440	2.965	0.075	0.785
	Race: American Indian/Native Alaskan	2.338	0.483	11.303	1.115	0.291
	Race: Asian	0.721	0.283	1.836	0.470	0.493
	Race: Pacific Islander/Native Hawaiian	0.733	0.118	4.565	0.110	0.740
	Sex: Male	0.865	0.613	1.221	0.681	0.409
	Edu: less than 8th grade (no diploma)	0.025	0.003	0.211	11.577	<0.001
	Edu: 9-12th grade (no diploma)	0.118	0.016	0.862	4.438	0.035
	Edu: high school diploma or equivalent	0.400	0.112	1.427	1.994	0.158
	Edu: some college (no associates or 4-year degree)	0.712	0.207	2.443	0.292	0.589
	Edu: associates degree	0.888	0.247	3.199	0.033	0.856
	Edu: bachelors degree	1.168	0.352	3.881	0.064	0.800
	Edu: masters degree	1.033	0.303	3.521	0.003	0.958
	Edu: professional degree (such as DDS or JD)	0.597	0.152	2.341	0.548	0.459
	Marital: never married	1.455	0.615	3.444	0.729	0.393
	Marital: married	1.493	0.681	3.272	1.003	0.317
	Marital: divorced	1.629	0.670	3.960	1.158	0.282
	Marital: separated	0.650	0.170	2.485	0.396	0.529
	Region: Northwest	0.816	0.495	1.346	0.634	0.426
	Region: Midwest	0.985	0.601	1.613	0.004	0.951
	Region: South	0.802	0.514	1.252	0.942	0.332
	Emp Status: full time	1.786	0.743	4.292	1.681	0.195
	Emp Status: part time	0.929	0.378	2.280	0.026	0.871
	Emp Class: not applicable/not working	1.284	0.440	3.747	0.210	0.647

	Category	**Odd Ratio**	**95% CI**		**Wald χ2(1)**	***p***
	Emp Class: employee of a private company	1.153	0.673	1.974	0.267	0.605
	Emp Class: self-employed	1.336	0.666	2.679	0.664	0.415
	Emp Class: private not-for-profit	0.757	0.350	1.636	0.501	0.479
	Work Sector: not applicable/not working	1.562	0.489	4.988	0.567	0.451
	Work Sector: agriculture and related industries	0.216	0.054	0.867	4.675	0.031
	Work Sector: mining	0.019	0.002	0.197	11.040	<0.001
	Work Sector: construction	0.497	0.169	1.464	1.609	0.205
	Work Sector: manufacturing	0.348	0.126	0.960	4.159	0.041
	Work Sector: wholesale trade	0.205	0.045	0.925	4.250	0.039
	Work Sector: retail trade	0.730	0.274	1.946	0.395	0.530
	Work Sector: transportation and utilities	0.762	0.228	2.547	0.195	0.659
	Work Sector: information	0.953	0.306	2.966	0.007	0.934
	Work Sector: financial activities	0.621	0.211	1.827	0.748	0.387
	Work Sector: professional and business services	1.105	0.371	3.293	0.032	0.858
	Work Sector: education and health services	0.716	0.316	1.623	0.641	0.423
	Work Sector: leisure and hospitality	1.056	0.302	3.696	0.007	0.932
	Work Sector: other services	0.796	0.324	1.958	0.246	0.620
	Increase in age (expressed in years)	1.002	0.989	1.014	0.071	0.790
	Increase in household size	0.943	0.804	1.107	0.510	0.475
	Increase in resident children	0.986	0.792	1.228	0.015	0.902
	Increase in income	1.000	1.000	1.000	2.094	0.148
Dependent Variable	**Category**	**Odd Ratio**	**95% CI**		**Wald χ2(1)**	***p***
Space flight participants must be made aware that there are unknown hazards	Race: White	0.913	0.403	2.072	0.047	0.829
	Race: Black/African American	0.886	0.331	2.375	0.058	0.810
	Race: American Indian/Native Alaskan	1.198	0.247	5.821	0.050	0.823
	Race: Asian	0.589	0.225	1.542	1.163	0.281
	Race: Pacific Islander/Native Hawaiian	0.232	0.038	1.401	2.536	0.111
	Sex: Male	0.767	0.543	1.081	2.293	0.130
	Edu: less than 8th grade (no diploma)	0.013	0.002	0.114	15.398	<0.001
	Edu: 9-12th grade (no diploma)	0.188	0.024	1.457	2.559	0.110
	Edu: high school diploma or equivalent	0.299	0.077	1.157	3.057	0.080
	Edu: some college (no associates or 4-year degree)	0.511	0.137	1.907	0.998	0.318
	Edu: associates degree	0.377	0.097	1.464	1.986	0.159
	Edu: bachelors degree	0.598	0.166	2.154	0.619	0.431
	Edu: masters degree	0.554	0.150	2.046	0.784	0.376
	Edu: professional degree (such as DDS or JD)	0.442	0.103	1.895	1.210	0.271
	Marital: never married	2.349	0.999	5.522	3.833	0.050

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Marital: married	1.763	0.813	3.823	2.060	0.151
	Marital: divorced	1.295	0.545	3.077	0.343	0.558
	Marital: separated	0.815	0.212	3.133	0.089	0.765
	Region: Northwest	0.731	0.443	1.206	1.503	0.220
	Region: Midwest	0.909	0.556	1.487	0.145	0.703
	Region: South	0.684	0.438	1.066	2.813	0.094
	Emp Status: full time	1.814	0.739	4.452	1.691	0.193
	Emp Status: part time	1.103	0.440	2.765	0.044	0.834
	Emp Class: not applicable/not working	1.343	0.454	3.969	0.284	0.594
	Emp Class: employee of a private company	1.406	0.824	2.401	1.562	0.211
	Emp Class: self-employed	1.758	0.873	3.540	2.495	0.114
	Emp Class: private not-for-profit	1.117	0.513	2.436	0.078	0.780
	Work Sector: not applicable/not working	1.215	0.381	3.879	0.108	0.742
	Work Sector: agriculture and related industries	0.076	0.019	0.305	13.217	0.000
	Work Sector: mining	0.228	0.024	2.125	1.687	0.194
	Work Sector: construction	0.463	0.157	1.368	1.943	0.163
	Work Sector: manufacturing	0.371	0.133	1.032	3.606	0.058
	Work Sector: wholesale trade	0.187	0.042	0.841	4.776	0.029
	Work Sector: retail trade	0.706	0.263	1.893	0.479	0.489
	Work Sector: transportation and utilities	0.282	0.087	0.906	4.516	0.034
	Work Sector: information	0.336	0.115	0.984	3.961	0.047
	Work Sector: financial activities	0.577	0.196	1.696	1.000	0.317
	Work Sector: professional and business services	1.062	0.350	3.225	0.011	0.916
	Work Sector: education and health services	0.592	0.261	1.344	1.569	0.210
	Work Sector: leisure and hospitality	0.858	0.242	3.040	0.056	0.813
	Work Sector: other services	0.590	0.240	1.451	1.322	0.250
	Increase in age (expressed in years)	1.012	1.000	1.025	3.828	0.050
	Increase in household size	0.966	0.823	1.134	0.182	0.669
	Increase in resident children	1.018	0.818	1.268	0.027	0.870
	Increase in income	1.000	1.000	1.000	2.701	0.100

Dependent Variable	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
The operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying	Race: White	0.672	0.301	1.499	0.944	0.331
	Race: Black/African American	0.444	0.171	1.151	2.792	0.095
	Race: American Indian/Native Alaskan	0.644	0.145	2.854	0.336	0.562
	Race: Asian	0.424	0.166	1.087	3.190	0.074
	Race: Pacific Islander/Native Hawaiian	0.136	0.023	0.805	4.839	0.028
	Sex: Male	0.719	0.517	0.999	3.859	0.049

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
crewmembers or space flight participants	Edu: less than 8th grade (no diploma)	0.005	0.001	0.048	21.925	<0.001
	Edu: 9-12th grade (no diploma)	0.378	0.053	2.717	0.934	0.334
	Edu: high school diploma or equivalent	0.308	0.091	1.045	3.571	0.059
	Edu: some college (no associates or 4-year degree)	0.535	0.164	1.744	1.075	0.300
	Edu: associates degree	0.477	0.141	1.622	1.403	0.236
	Edu: bachelors degree	0.644	0.205	2.023	0.567	0.451
	Edu: masters degree	0.949	0.294	3.062	0.008	0.931
	Edu: professional degree (such as DDS or JD)	0.871	0.229	3.318	0.041	0.840
	Marital: never married	2.211	0.966	5.061	3.524	0.060
	Marital: married	1.651	0.779	3.499	1.714	0.191
	Marital: divorced	1.219	0.525	2.829	0.213	0.645
	Marital: separated	0.465	0.125	1.734	1.300	0.254
	Region: Northwest	0.752	0.466	1.216	1.349	0.245
	Region: Midwest	0.853	0.534	1.362	0.444	0.505
	Region: South	0.709	0.463	1.086	2.501	0.114
	Emp Status: full time	1.520	0.634	3.643	0.880	0.348
	Emp Status: part time	1.000	0.408	2.451	0.000	0.999
	Emp Class: not applicable/not working	1.155	0.400	3.340	0.071	0.790
	Emp Class: employee of a private company	1.489	0.892	2.488	2.315	0.128
	Emp Class: self-employed	1.426	0.732	2.779	1.090	0.296
	Emp Class: private not-for-profit	1.151	0.541	2.450	0.134	0.715
	Work Sector: not applicable/not working	1.658	0.549	5.009	0.804	0.370
	Work Sector: agriculture and related industries	0.241	0.063	0.927	4.287	0.038
	Work Sector: mining	0.090	0.010	0.804	4.646	0.031
	Work Sector: construction	0.776	0.277	2.177	0.232	0.630
	Work Sector: manufacturing	0.541	0.206	1.422	1.552	0.213
	Work Sector: wholesale trade	0.275	0.064	1.191	2.981	0.084
	Work Sector: retail trade	0.829	0.330	2.083	0.159	0.690
	Work Sector: transportation and utilities	0.803	0.258	2.506	0.142	0.706
	Work Sector: information	0.484	0.175	1.343	1.941	0.164
	Work Sector: financial activities	0.754	0.274	2.073	0.299	0.584
	Work Sector: professional and business services	1.519	0.541	4.260	0.630	0.427
	Work Sector: education and health services	0.740	0.346	1.586	0.599	0.439
	Work Sector: leisure and hospitality	0.844	0.259	2.751	0.079	0.778
	Work Sector: other services	0.769	0.332	1.781	0.376	0.540
	Increase in age (expressed in years)	1.017	1.005	1.030	7.858	0.005
	Increase in household size	0.927	0.794	1.082	0.917	0.338
	Increase in resident children	1.085	0.878	1.340	0.569	0.451

Dependent Variable	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Increase in income	1.000	1.000	1.000	1.422	0.233
Space flight participants must be informed of the safety records (i.e., accidents and incidents) of all private and U.S. Government launch/reentry vehicles	Race: White	0.834	0.378	1.845	0.200	0.655
	Race: Black/African American	0.617	0.239	1.594	0.993	0.319
	Race: American Indian/Native Alaskan	0.407	0.094	1.767	1.439	0.230
	Race: Asian	0.734	0.287	1.875	0.418	0.518
	Race: Pacific Islander/Native Hawaiian	0.195	0.033	1.146	3.272	0.070
	Sex: Male	0.648	0.465	0.903	6.573	0.010
	Edu: less than 8th grade (no diploma)	0.046	0.006	0.351	8.835	0.003
	Edu: 9-12th grade (no diploma)	0.713	0.103	4.950	0.117	0.732
	Edu: high school diploma or equivalent	0.942	0.296	3.002	0.010	0.919
	Edu: some college (no associates or 4-year degree)	1.764	0.576	5.398	0.989	0.320
	Edu: associates degree	1.356	0.425	4.329	0.265	0.607
	Edu: bachelors degree	1.892	0.643	5.572	1.339	0.247
	Edu: masters degree	2.362	0.780	7.154	2.312	0.128
	Edu: professional degree (such as DDS or JD)	2.150	0.602	7.682	1.388	0.239
	Marital: never married	1.055	0.445	2.500	0.015	0.903
	Marital: married	0.987	0.448	2.176	0.001	0.975
	Marital: divorced	0.707	0.294	1.700	0.601	0.438
	Marital: separated	0.798	0.204	3.113	0.106	0.745
	Region: Northwest	0.872	0.538	1.414	0.309	0.579
	Region: Midwest	0.897	0.561	1.437	0.204	0.652
	Region: South	0.803	0.523	1.234	1.000	0.317
	Emp Status: full time	2.625	1.112	6.199	4.849	0.028
	Emp Status: part time	1.375	0.570	3.317	0.502	0.478
	Emp Class: not applicable/not working	1.739	0.606	4.989	1.060	0.303
	Emp Class: employee of a private company	1.092	0.651	1.831	0.111	0.739
	Emp Class: self-employed	1.538	0.784	3.014	1.570	0.210
	Emp Class: private not-for-profit	0.846	0.400	1.792	0.190	0.663
	Work Sector: not applicable/not working	1.770	0.580	5.405	1.005	0.316
	Work Sector: agriculture and related industries	0.228	0.059	0.886	4.557	0.033
	Work Sector: mining	0.072	0.008	0.649	5.508	0.019
	Work Sector: construction	0.524	0.186	1.474	1.501	0.221
	Work Sector: manufacturing	0.464	0.176	1.228	2.389	0.122
	Work Sector: wholesale trade	1.239	0.258	5.947	0.072	0.789
	Work Sector: retail trade	0.754	0.297	1.918	0.350	0.554
	Work Sector: transportation and utilities	1.185	0.365	3.841	0.080	0.778
	Work Sector: information	0.561	0.199	1.581	1.196	0.274
	Work Sector: financial activities	0.623	0.224	1.734	0.821	0.365

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Work Sector: professional and business services	0.988	0.357	2.735	0.001	0.981
	Work Sector: education and health services	0.660	0.305	1.428	1.115	0.291
	Work Sector: leisure and hospitality	1.209	0.360	4.059	0.094	0.759
	Work Sector: other services	0.627	0.268	1.465	1.163	0.281
	Increase in age (expressed in years)	1.008	0.996	1.020	1.514	0.218
	Increase in household size	0.905	0.775	1.057	1.581	0.209
	Increase in resident children	1.077	0.870	1.332	0.462	0.497
	Increase in income	1.000	1.000	1.000	1.633	0.201
Dependent Variable	**Category**	**Odd Ratio**	**95% CI**		**Wald χ2(1)**	***p***
Space flight participants must be given the opportunity to ask the space flight operator questions	Race: White	0.875	0.388	1.972	0.104	0.747
	Race: Black/African American	0.436	0.166	1.147	2.831	0.092
	Race: American Indian/Native Alaskan	0.914	0.193	4.317	0.013	0.909
	Race: Asian	0.530	0.204	1.377	1.697	0.193
	Race: Pacific Islander/Native Hawaiian	0.239	0.040	1.439	2.443	0.118
	Sex: Male	0.577	0.409	0.815	9.783	0.002
	Edu: less than 8th grade (no diploma)	0.008	0.001	0.071	19.026	<0.000
	Edu: 9-12th grade (no diploma)	0.112	0.014	0.871	4.377	0.036
	Edu: high school diploma or equivalent	0.214	0.056	0.823	5.039	0.025
	Edu: some college (no associates or 4-year degree)	0.382	0.103	1.408	2.090	0.148
	Edu: associates degree	0.315	0.082	1.210	2.830	0.093
	Edu: bachelors degree	0.421	0.119	1.497	1.785	0.182
	Edu: masters degree	0.642	0.176	2.342	0.451	0.502
	Edu: professional degree (such as DDS or JD)	0.262	0.063	1.091	3.386	0.066
	Marital: never married	1.712	0.704	4.166	1.404	0.236
	Marital: married	1.444	0.638	3.267	0.776	0.378
	Marital: divorced	1.141	0.459	2.835	0.080	0.777
	Marital: separated	1.144	0.287	4.557	0.036	0.849
	Region: Northwest	0.473	0.287	0.777	8.712	0.003
	Region: Midwest	0.865	0.528	1.418	0.330	0.566
	Region: South	0.655	0.418	1.026	3.414	0.065
	Emp Status: full time	1.922	0.790	4.678	2.072	0.150
	Emp Status: part time	1.156	0.464	2.881	0.097	0.755
	Emp Class: not applicable/not working	1.645	0.560	4.828	0.821	0.365
	Emp Class: employee of a private company	1.149	0.678	1.945	0.266	0.606
	Emp Class: self-employed	1.486	0.745	2.963	1.265	0.261
	Emp Class: private not-for-profit	1.014	0.469	2.193	0.001	0.971
	Work Sector: not applicable/not working	1.755	0.558	5.513	0.927	0.336

	Category	Odd Ratio	95% CI		Wald $\chi2(1)$	*p*
	Work Sector: agriculture and related industries	0.123	0.031	0.481	9.059	0.003
	Work Sector: mining	0.057	0.006	0.519	6.462	0.011
	Work Sector: construction	0.559	0.197	1.589	1.190	0.275
	Work Sector: manufacturing	0.555	0.207	1.487	1.371	0.242
	Work Sector: wholesale trade	1.568	0.308	7.971	0.294	0.588
	Work Sector: retail trade	1.118	0.429	2.914	0.052	0.819
	Work Sector: transportation and utilities	0.684	0.214	2.186	0.411	0.521
	Work Sector: information	0.719	0.251	2.062	0.376	0.540
	Work Sector: financial activities	0.652	0.232	1.836	0.656	0.418
	Work Sector: professional and business services	1.293	0.451	3.712	0.228	0.633
	Work Sector: education and health services	0.655	0.300	1.431	1.125	0.289
	Work Sector: leisure and hospitality	2.312	0.630	8.483	1.597	0.206
	Work Sector: other services	0.647	0.274	1.528	0.985	0.321
	Increase in age (expressed in years)	1.017	1.004	1.029	6.997	0.008
	Increase in household size	0.919	0.785	1.076	1.093	0.296
	Increase in resident children	1.075	0.865	1.335	0.421	0.517
	Increase in income	1.000	1.000	1.000	2.289	0.130

Dependent Variable	Category	Odd Ratio	95% CI		Wald $\chi2(1)$	*p*
Space flight participants must fill out and file a medical history questionnaire to disclose any preexisting medical conditions, history of illness or surgeries, and current dedications which may result in death or injury during space flight or compromise the health and safety of other participants	Race: White	0.457	0.194	1.073	3.235	0.072
	Race: Black/African American	0.354	0.130	0.965	4.123	0.042
	Race: American Indian/Native Alaskan	0.321	0.071	1.456	2.169	0.141
	Race: Asian	0.301	0.112	0.809	5.660	0.017
	Race: Pacific Islander/Native Hawaiian	0.439	0.066	2.925	0.725	0.395
	Sex: Male	0.877	0.627	1.229	0.579	0.447
	Edu: less than 8th grade (no diploma)	0.035	0.004	0.281	9.973	0.002
	Edu: 9-12th grade (no diploma)	0.407	0.055	2.997	0.779	0.378
	Edu: high school diploma or equivalent	0.505	0.145	1.764	1.146	0.284
	Edu: some college (no associates or 4-year degree)	0.879	0.262	2.952	0.044	0.834
	Edu: associates degree	0.740	0.211	2.589	0.222	0.637
	Edu: bachelors degree	0.968	0.299	3.134	0.003	0.956
	Edu: masters degree	1.294	0.389	4.308	0.176	0.675
	Edu: professional degree (such as DDS or JD)	0.653	0.170	2.509	0.385	0.535
	Marital: never married	0.889	0.376	2.106	0.071	0.790
	Marital: married	1.224	0.554	2.702	0.250	0.617
	Marital: divorced	1.025	0.424	2.479	0.003	0.956
	Marital: separated	1.183	0.296	4.729	0.057	0.812
	Region: Northwest	0.707	0.433	1.155	1.922	0.166

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Region: Midwest	0.921	0.570	1.490	0.112	0.738
	Region: South	0.767	0.494	1.189	1.408	0.235
	Emp Status: full time	1.657	0.680	4.039	1.234	0.267
	Emp Status: part time	0.847	0.340	2.106	0.128	0.720
	Emp Class: not applicable/not working	1.649	0.562	4.839	0.830	0.362
	Emp Class: employee of a private company	1.234	0.733	2.078	0.625	0.429
	Emp Class: self-employed	2.712	1.353	5.435	7.908	0.005
	Emp Class: private not-for-profit	1.204	0.559	2.595	0.225	0.635
	Work Sector: not applicable/not working	1.131	0.361	3.549	0.045	0.832
	Work Sector: agriculture and related industries	0.189	0.048	0.747	5.643	0.018
	Work Sector: mining	0.210	0.023	1.895	1.932	0.165
	Work Sector: construction	0.438	0.152	1.263	2.332	0.127
	Work Sector: manufacturing	0.324	0.120	0.875	4.946	0.026
	Work Sector: wholesale trade	0.484	0.106	2.202	0.882	0.348
	Work Sector: retail trade	0.416	0.161	1.075	3.276	0.070
	Work Sector: transportation and utilities	0.788	0.240	2.592	0.153	0.695
	Work Sector: information	0.502	0.173	1.452	1.619	0.203
	Work Sector: financial activities	0.600	0.210	1.715	0.910	0.340
	Work Sector: professional and business services	0.639	0.228	1.789	0.727	0.394
	Work Sector: education and health services	0.650	0.294	1.436	1.136	0.287
	Work Sector: leisure and hospitality	1.080	0.315	3.701	0.015	0.903
	Work Sector: other services	0.687	0.286	1.647	0.709	0.400
	Increase in age (expressed in years)	1.002	0.990	1.014	0.117	0.732
	Increase in household size	0.949	0.812	1.109	0.436	0.509
	Increase in resident children	0.944	0.762	1.169	0.282	0.596
	Increase in income	1.000	1.000	1.000	1.691	0.193

Dependent Variable	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
Space flight participants will be required to provide their height, weight, and blood pressure in their medical history questionnaire	Race: White	1.246	0.572	2.715	0.307	0.580
	Race: Black/African American	0.932	0.366	2.378	0.022	0.883
	Race: American Indian/Native Alaskan	1.341	0.307	5.865	0.152	0.697
	Race: Asian	1.212	0.481	3.057	0.166	0.683
	Race: Pacific Islander/Native Hawaiian	2.256	0.331	15.379	0.690	0.406
	Sex: Male	0.844	0.605	1.177	0.998	0.318
	Edu: less than 8th grade (no diploma)	0.020	0.002	0.164	13.332	<0.000
	Edu: 9-12th grade (no diploma)	0.231	0.031	1.721	2.046	0.153
	Edu: high school diploma or equivalent	0.257	0.072	0.912	4.420	0.036
	Edu: some college (no associates or 4-year degree)	0.535	0.157	1.829	0.994	0.319

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Edu: associates degree	0.616	0.172	2.203	0.556	0.456
	Edu: bachelors degree	0.518	0.157	1.706	1.171	0.279
	Edu: masters degree	0.606	0.180	2.045	0.650	0.420
	Edu: professional degree (such as DDS or JD)	0.437	0.112	1.706	1.418	0.234
	Marital: never married	1.071	0.462	2.479	0.025	0.873
	Marital: married	1.560	0.724	3.364	1.289	0.256
	Marital: divorced	1.160	0.490	2.742	0.114	0.736
	Marital: separated	0.446	0.118	1.690	1.410	0.235
	Region: Northwest	0.697	0.432	1.126	2.174	0.140
	Region: Midwest	0.918	0.574	1.467	0.129	0.719
	Region: South	1.018	0.661	1.565	0.006	0.937
	Emp Status: full time	2.239	0.939	5.340	3.302	0.069
	Emp Status: part time	0.794	0.327	1.930	0.259	0.611
	Emp Class: not applicable/not working	1.119	0.388	3.226	0.043	0.836
	Emp Class: employee of a private company	0.905	0.537	1.525	0.141	0.708
	Emp Class: self-employed	1.464	0.744	2.882	1.215	0.270
	Emp Class: private not-for-profit	1.039	0.480	2.248	0.009	0.923
	Work Sector: not applicable/not working	1.443	0.467	4.459	0.405	0.525
	Work Sector: agriculture and related industries	0.217	0.056	0.848	4.830	0.028
	Work Sector: mining	0.068	0.008	0.612	5.755	0.016
	Work Sector: construction	0.382	0.135	1.083	3.278	0.070
	Work Sector: manufacturing	0.364	0.136	0.975	4.040	0.044
	Work Sector: wholesale trade	0.074	0.017	0.331	11.637	0.001
	Work Sector: retail trade	0.663	0.258	1.706	0.726	0.394
	Work Sector: transportation and utilities	0.762	0.237	2.450	0.208	0.648
	Work Sector: information	0.359	0.127	1.017	3.720	0.054
	Work Sector: financial activities	0.705	0.250	1.990	0.436	0.509
	Work Sector: professional and business services	0.724	0.263	1.995	0.389	0.533
	Work Sector: education and health services	0.746	0.339	1.643	0.528	0.467
	Work Sector: leisure and hospitality	2.016	0.568	7.155	1.177	0.278
	Work Sector: other services	0.669	0.282	1.587	0.834	0.361
	Increase in age (expressed in years)	1.006	0.994	1.019	1.100	0.294
	Increase in household size	0.933	0.799	1.090	0.764	0.382
	Increase in resident children	0.949	0.767	1.173	0.237	0.627
	Increase in income	1.000	1.000	1.000	0.174	0.677
Dependent Variable	**Category**	**Odd Ratio**	**95% CI**		**Wald χ2(1)**	***p***
	Race: White	1.027	0.469	2.246	0.004	0.948

	Category	Odd Ratio	95% CI		Wald $\chi2(1)$	*p*
Space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening	Race: Black/African American	0.847	0.332	2.163	0.120	0.729
	Race: American Indian/Native Alaskan	0.533	0.124	2.297	0.713	0.398
	Race: Asian	1.021	0.403	2.584	0.002	0.965
	Race: Pacific Islander/Native Hawaiian	1.568	0.240	10.258	0.220	0.639
	Sex: Male	0.899	0.647	1.249	0.405	0.524
	Edu: less than 8th grade (no diploma)	0.044	0.006	0.342	8.918	0.003
	Edu: 9-12th grade (no diploma)	0.451	0.065	3.111	0.654	0.419
	Edu: high school diploma or equivalent	0.671	0.208	2.161	0.447	0.504
	Edu: some college (no associates or 4-year degree)	1.263	0.408	3.904	0.164	0.685
	Edu: associates degree	1.056	0.326	3.417	0.008	0.928
	Edu: bachelors degree	1.103	0.371	3.278	0.031	0.861
	Edu: masters degree	1.229	0.403	3.748	0.132	0.717
	Edu: professional degree (such as DDS or JD)	0.646	0.183	2.276	0.463	0.496
	Marital: never married	0.614	0.265	1.419	1.304	0.253
	Marital: married	1.234	0.572	2.658	0.287	0.592
	Marital: divorced	0.846	0.358	1.996	0.146	0.702
	Marital: separated	0.496	0.131	1.884	1.060	0.303
	Region: Northwest	0.767	0.477	1.234	1.196	0.274
	Region: Midwest	1.031	0.647	1.645	0.017	0.897
	Region: South	1.050	0.685	1.607	0.050	0.824
	Emp Status: full time	2.388	1.018	5.598	4.008	0.045
	Emp Status: part time	1.182	0.493	2.832	0.140	0.708
	Emp Class: not applicable/not working	1.291	0.452	3.689	0.228	0.633
	Emp Class: employee of a private company	1.271	0.759	2.129	0.832	0.362
	Emp Class: self-employed	1.448	0.743	2.822	1.185	0.276
	Emp Class: private not-for-profit	0.564	0.268	1.185	2.285	0.131
	Work Sector: not applicable/not working	2.318	0.765	7.018	2.211	0.137
	Work Sector: agriculture and related industries	0.204	0.053	0.786	5.338	0.021
	Work Sector: mining	0.360	0.040	3.255	0.827	0.363
	Work Sector: construction	0.475	0.170	1.329	2.009	0.156
	Work Sector: manufacturing	0.449	0.170	1.185	2.617	0.106
	Work Sector: wholesale trade	0.373	0.085	1.630	1.717	0.190
	Work Sector: retail trade	0.785	0.310	1.985	0.262	0.609
	Work Sector: transportation and utilities	0.781	0.248	2.457	0.179	0.672
	Work Sector: information	0.545	0.194	1.533	1.323	0.250
	Work Sector: financial activities	0.738	0.266	2.050	0.339	0.560
	Work Sector: professional and business services	0.889	0.330	2.398	0.054	0.816
	Work Sector: education and health services	0.910	0.424	1.955	0.058	0.810

	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
	Work Sector: leisure and hospitality	0.699	0.216	2.255	0.360	0.549
	Work Sector: other services	0.906	0.389	2.112	0.052	0.819
	Increase in age (expressed in years)	1.000	0.988	1.011	0.007	0.935
	Increase in household size	0.918	0.787	1.071	1.180	0.277
	Increase in resident children	0.989	0.801	1.222	0.010	0.920
	Increase in income	1.000	1.000	1.000	0.140	0.709

Dependent Variable	Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
An electrocardiogram (EKG) will be required to record the participant's heart electrical activity and give an overview of cardiac health	Race: White	0.461	0.200	1.064	3.292	0.070
	Race: Black/African American	0.477	0.178	1.275	2.177	0.140
	Race: American Indian/Native Alaskan	0.673	0.143	3.173	0.251	0.616
	Race: Asian	0.323	0.123	0.850	5.242	0.022
	Race: Pacific Islander/Native Hawaiian	0.727	0.106	4.975	0.105	0.746
	Sex: Male	0.707	0.509	0.982	4.287	0.038
	Edu: less than 8th grade (no diploma)	0.020	0.002	0.168	12.901	<0.001
	Edu: 9-12th grade (no diploma)	1.081	0.158	7.384	0.006	0.937
	Edu: high school diploma or equivalent	1.179	0.376	3.704	0.080	0.778
	Edu: some college (no associates or 4-year degree)	2.989	0.987	9.049	3.753	0.053
	Edu: associates degree	2.158	0.682	6.825	1.714	0.190
	Edu: bachelors degree	2.024	0.698	5.871	1.686	0.194
	Edu: masters degree	2.021	0.681	5.998	1.607	0.205
	Edu: professional degree (such as DDS or JD)	1.635	0.472	5.662	0.602	0.438
	Marital: never married	1.227	0.537	2.805	0.235	0.628
	Marital: married	1.669	0.786	3.546	1.775	0.183
	Marital: divorced	1.100	0.473	2.558	0.049	0.825
	Marital: separated	0.584	0.155	2.198	0.633	0.426
	Region: Northwest	0.857	0.531	1.382	0.402	0.526
	Region: Midwest	0.786	0.493	1.252	1.028	0.311
	Region: South	0.820	0.536	1.255	0.834	0.361
	Emp Status: full time	1.930	0.821	4.538	2.270	0.132
	Emp Status: part time	0.969	0.403	2.331	0.005	0.944
	Emp Class: not applicable/not working	1.985	0.687	5.736	1.604	0.205
	Emp Class: employee of a private company	1.416	0.846	2.370	1.756	0.185
	Emp Class: self-employed	1.279	0.660	2.478	0.530	0.466
	Emp Class: private not-for-profit	0.673	0.321	1.412	1.098	0.295
	Work Sector: not applicable/not working	1.150	0.378	3.499	0.060	0.806
	Work Sector: agriculture and related industries	0.291	0.076	1.123	3.207	0.073
	Work Sector: mining	2.292	0.184	28.581	0.415	0.520

Category	Odd Ratio	95% CI		Wald χ2(1)	*p*
Work Sector: construction	0.396	0.142	1.104	3.136	0.077
Work Sector: manufacturing	0.474	0.179	1.252	2.268	0.132
Work Sector: wholesale trade	0.336	0.077	1.463	2.112	0.146
Work Sector: retail trade	0.713	0.283	1.794	0.516	0.472
Work Sector: transportation and utilities	0.773	0.247	2.418	0.196	0.658
Work Sector: information	0.605	0.216	1.693	0.916	0.339
Work Sector: financial activities	0.749	0.271	2.074	0.309	0.578
Work Sector: professional and business services	1.029	0.381	2.778	0.003	0.955
Work Sector: education and health services	0.839	0.392	1.795	0.204	0.651
Work Sector: leisure and hospitality	0.509	0.158	1.634	1.288	0.256
Work Sector: other services	0.687	0.297	1.590	0.769	0.380
Increase in age (expressed in years)	1.007	0.995	1.019	1.430	0.232
Increase in household size	0.885	0.758	1.034	2.356	0.125
Increase in resident children	1.166	0.942	1.444	1.991	0.158
Increase in income	1.000	1.000	1.000	0.011	0.915

Table C8

Separate Binomial Logistic Regressions

Dependent Variable	Independent Demographic Variable Category	Cat 1 B (Parameter Estimate)	Cat 1 Exp(B) (Odds Ratio)	Cat 2 B (Parameter Estimate)	Cat 2 Exp(B) (Odds Ratio)	Cat 3 B (Parameter Estimate)	Cat 3 Exp(B) (Odds Ratio)	Cat 4 B (Parameter Estimate)	Cat 4 Exp(B) (Odds Ratio)	Cat 5 B (Parameter Estimate)	Cat 5 Exp(B) (Odds Ratio)	Cat 6 B (Parameter Estimate)	Cat 6 Exp(B) (Odds Ratio)
Space flight participants must execute a reciprocal waiver of claims with the FAA/DOT. The reciprocal waiver of claims is an official acknowledgement by the space flight operator, crew members, and space flight participant to hold each other harmless (absolves all parties of any liability) from bodily injury or property damage sustained, resulting from space flight and launch activities, regardless of fault.	race1	-0.548	0.578	-0.515	0.598	-0.444	0.641	-0.175	0.839	-0.059	0.943	0.274	1.316
	race2	-2.053	0.128	-0.980	0.375	-0.730	0.482	0.149	1.161	-0.049	0.952	-0.344	0.709
	race3	-19.584	0.000	-20.156	0.000	-20.684	0.000	-0.011	0.989	0.427	1.533	-0.893	0.410
	race4	-1.786	0.168	-0.486	0.615	-0.040	0.961	-0.214	0.808	0.205	1.227	1.101	3.007
	race5	-18.620	0.000	-19.246	0.000	-19.806	0.000	0.880	2.411	0.153	1.165	-0.991	0.371
	sex1	-0.112	0.894	-0.074	0.929	0.061	1.063	-0.285	0.752	-0.437	0.646	-0.072	0.930
	edu1	20.313	663614371.066	21.342	1857370348.666	22.696	7189736904.070	2.766	15.899	3.714	41.013	20.717	993949252.808
	edu2	19.236	226050656.616	19.156	208547506.680	18.950	169755344.094	2.631	13.894	2.726	15.276	19.658	344602231.866
	edu3	19.040	185743886.841	19.273	234521496.878	20.087	529128195.308	1.735	5.670	2.278	9.759	0.654	1.924
	edu4	18.010	66352538.308	18.994	177377589.090	20.112	542447099.683	1.518	4.564	2.248	9.465	0.703	2.020
	edu5	18.104	72853049.149	18.821	149298460.403	19.843	414485190.325	1.032	2.806	1.452	4.273	0.412	1.509
	edu6	17.905	59691604.572	18.551	113884476.840	19.663	346390029.949	1.322	3.752	2.059	7.842	0.363	1.437
	edu7	17.852	56599423.477	18.834	151127045.485	19.565	314030196.681	0.920	2.510	1.598	4.943	0.118	1.125
	edu8	18.620	122033545.640	19.698	358713284.424	20.434	749013735.430	1.889	6.614	2.561	12.950	0.296	1.344
	age	0.002	1.002	0.001	1.001	-0.012	0.988	-0.011	0.989	-0.011	0.989	-0.007	0.993

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
marital1	1.252	3.497	1.779	5.922	-0.074	0.929	0.185	1.203	0.174	1.190	-0.066	0.936
marital2	1.449	4.257	1.389	4.009	-0.151	0.860	-0.040	0.961	-0.161	0.851	-0.449	0.639
marital3	1.534	4.636	1.235	3.440	0.118	1.125	-0.075	0.927	-0.266	0.766	-0.149	0.862
marital4	-16.576	0.000	2.624	13.788	0.525	1.691	-0.164	0.849	-0.690	0.502	-0.394	0.674
housesize	0.138	1.148	0.031	1.031	-0.237	0.789	-0.176	0.839	-0.154	0.857	-0.274	0.760
children	-0.228	0.796	-0.088	0.915	0.190	1.209	0.099	1.104	0.253	1.289	0.514	1.673
region1	0.173	1.189	0.377	1.458	0.343	1.409	0.307	1.359	-0.008	0.992	0.127	1.135
region2	0.988	2.685	0.746	2.108	0.471	1.602	-0.018	0.983	-0.002	0.998	0.049	1.050
region3	0.727	2.069	0.401	1.493	0.010	1.011	0.163	1.178	0.068	1.071	-0.089	0.915
stat1	-0.049	0.952	0.023	1.023	-1.085	0.338	-0.572	0.564	0.078	1.082	-0.381	0.683
stat2	0.080	1.083	0.374	1.454	-0.007	0.993	0.038	1.038	0.803	2.231	0.096	1.101
emp1	1.217	3.376	0.180	1.197	-0.061	0.941	0.499	1.648	0.640	1.897	0.385	1.469
emp2	0.300	1.350	-0.293	0.746	-0.108	0.897	0.150	1.161	0.456	1.577	0.323	1.381
emp3	0.123	1.131	-0.366	0.693	-0.782	0.457	-0.132	0.877	0.281	1.324	-0.625	0.535
emp4	0.914	2.494	0.476	1.609	0.131	1.140	0.187	1.206	0.125	1.133	-0.719	0.487
wk1	-1.430	0.239	-0.535	0.586	-0.899	0.407	-0.805	0.447	-0.274	0.761	-0.920	0.398
wk2	-0.194	0.824	1.480	4.394	1.644	5.175	1.515	4.551	0.941	2.564	0.921	2.511
wk3	1.881	6.563	2.468	11.800	1.986	7.284	0.903	2.467	20.030	499902904.780	19.153	207930817.756
wk4	-2.104	0.122	0.137	1.146	0.768	2.156	0.404	1.498	0.243	1.275	0.167	1.182
wk5	-1.001	0.367	-0.556	0.573	0.154	1.167	0.081	1.084	-0.265	0.767	0.267	1.305
wk6	2.441	11.489	2.015	7.498	1.915	6.785	1.113	3.044	20.555	845171174.252	19.427	273454704.376
wk7	-0.899	0.407	0.090	1.094	0.243	1.274	0.177	1.194	-0.014	0.986	-0.271	0.763
wk8	-0.161	0.852	-0.727	0.483	0.045	1.046	-0.137	0.872	-1.045	0.352	-0.281	0.755
wk9	-18.671	0.000	-0.321	0.726	-0.013	0.988	-0.421	0.656	-0.438	0.645	0.122	1.130

	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
	wk10	-0.198	0.820	-0.525	0.591	0.089	1.093	0.012	1.013	-0.383	0.682	-1.146	0.318
	wk11	-1.592	0.204	-0.575	0.563	-0.164	0.849	-0.286	0.752	-0.932	0.394	-0.569	0.566
	wk12	-0.637	0.529	-1.008	0.365	-0.058	0.944	-0.215	0.807	-0.176	0.838	-0.112	0.894
	wk13	-1.066	0.344	-1.569	0.208	-0.719	0.487	-0.506	0.603	-0.449	0.638	-0.252	0.777
	wk14	-0.877	0.416	-0.546	0.579	-0.271	0.763	0.031	1.031	0.302	1.352	0.093	1.097
	income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
Space flight participants must be made aware of the known hazards and risks that could result in serious injury, death, disability, or total/partial loss of physical and mental function.	race1	-0.592	0.553	-0.918	0.399	-0.967	0.380	-0.881	0.414	-0.133	0.875	-0.421	0.657
	race2	-1.467	0.231	-1.760	0.172	-0.747	0.474	-0.440	0.644	0.620	1.858	-0.421	0.656
	race3	-17.889	0.000	-19.490	0.000	-0.682	0.506	-0.292	0.747	-0.316	0.729	-1.174	0.309
	race4	-2.113	0.121	-1.834	0.160	-0.806	0.447	-1.184	0.306	-0.060	0.941	0.843	2.323
	race5	-16.011	0.000	-20.112	0.000	-19.831	0.000	-0.268	0.765	1.090	2.975	0.273	1.314
	sex1	-0.218	0.804	-0.157	0.854	-0.416	0.660	-0.065	0.937	0.111	1.118	0.261	1.299
	edu1	18.140	75513607.932	21.536	2253862256.310	23.223	12173435204.629	4.334	76.275	23.738	20388312984.074	22.046	3754295136.628
	edu2	20.020	495053388.102	20.519	814922678.913	20.444	756595763.848	3.771	43.431	2.714	15.096	1.627	5.086
	edu3	18.592	118713804.063	19.064	190273970.899	19.433	275174995.880	1.551	4.715	0.990	2.692	0.671	1.955
	edu4	16.992	23964149.923	17.792	53305764.163	18.218	81677958.744	0.902	2.465	0.462	1.588	0.340	1.404
	edu5	-0.736	0.479	17.877	58069786.699	18.010	66290264.634	0.397	1.488	0.292	1.339	0.090	1.094

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
edu6	16.065	9479310.141	17.353	34392425.650	17.786	53011946.756	-0.085	0.918	-0.190	0.827	-0.136	0.873
edu7	16.717	18197269.869	17.498	39744672.945	18.420	99922443.982	0.351	1.421	-0.253	0.777	-0.025	0.975
edu8	16.130	10118993.548	16.020	9067446.409	17.499	39783282.602	0.608	1.836	1.020	2.774	0.324	1.382
age	0.030	1.031	0.011	1.011	-0.010	0.990	-0.005	0.995	-0.012	0.988	0.001	1.001
marital1	21.531	2243379621.064	0.808	2.242	-0.766	0.465	-0.221	0.802	0.150	1.162	-0.643	0.526
marital2	19.921	448379751.147	-0.932	0.394	-1.192	0.304	-0.531	0.588	-0.054	0.948	-0.465	0.628
marital3	20.780	1058093322.564	0.301	1.351	-0.716	0.489	-0.440	0.644	-0.079	0.924	-0.581	0.559
marital4	23.850	22800306615.325	2.985	19.784	1.209	3.351	0.539	1.714	0.574	1.775	-0.053	0.949
housesize	0.463	1.589	0.070	1.072	0.006	1.006	0.066	1.068	0.042	1.043	0.014	1.014
children	-0.419	0.658	-0.144	0.866	0.024	1.025	-0.185	0.831	-0.052	0.950	0.092	1.096
region1	-0.099	0.906	-0.158	0.854	0.576	1.779	0.647	1.910	0.448	1.566	0.090	1.094
region2	0.885	2.424	0.933	2.543	1.357	3.885	0.609	1.838	0.262	1.300	-0.144	0.866
region3	-0.397	0.673	0.381	1.464	0.291	1.337	0.490	1.632	0.440	1.552	0.189	1.208
stat1	-1.218	0.296	-0.475	0.622	-0.188	0.828	-0.609	0.544	-1.160	0.314	-0.697	0.498
stat2	-0.881	0.414	0.537	1.711	0.587	1.799	0.213	1.238	-0.598	0.550	-0.074	0.928
emp1	-0.475	0.622	1.171	3.227	0.504	1.656	0.173	1.189	-1.002	0.367	-0.816	0.442
emp2	-0.637	0.529	-0.053	0.948	-0.051	0.951	0.108	1.115	-0.178	0.837	-0.244	0.783
emp3	-0.196	0.822	0.362	1.437	-0.542	0.582	-0.322	0.725	-0.582	0.559	-0.283	0.753
emp4	1.038	2.823	1.298	3.661	0.728	2.072	0.564	1.758	0.122	1.129	0.025	1.025
wk1	-1.538	0.215	-2.035	0.131	-0.672	0.511	-0.581	0.559	0.098	1.103	-0.225	0.798

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
wk2	-0.870	0.419	-0.974	0.377	1.478	4.385	1.698	5.462	2.054	7.797	1.811	6.119
wk3	3.271	26.338	3.697	40.343	24.161	31111161399.244	23.820	22115377073.760	23.021	9951644334.206	21.415	1997474581.858
wk4	0.035	1.036	-0.953	0.385	0.175	1.191	0.620	1.859	1.182	3.260	0.597	1.817
wk5	-19.940	0.000	-0.871	0.419	0.930	2.533	1.096	2.991	1.488	4.430	1.182	3.261
wk6	1.762	5.824	0.959	2.610	1.301	3.673	1.278	3.591	2.378	10.780	1.675	5.338
wk7	-1.478	0.228	-1.780	0.169	0.410	1.508	0.364	1.439	0.624	1.867	0.214	1.239
wk8	-19.306	0.000	-2.311	0.099	-1.467	0.231	0.347	1.414	0.502	1.653	0.405	1.499
wk9	-16.285	0.000	-17.696	0.000	-17.760	0.000	0.310	1.364	-0.133	0.876	-0.022	0.978
wk10	-17.929	0.000	-0.897	0.408	0.147	1.158	1.164	3.203	1.534	4.638	0.129	1.138
wk11	-0.353	0.703	-1.262	0.283	-0.799	0.450	-0.248	0.780	0.279	1.322	-0.083	0.920
wk12	-1.139	0.320	-1.454	0.234	-0.145	0.865	0.776	2.172	0.836	2.307	0.272	1.313
wk13	0.194	1.214	-1.066	0.344	0.697	2.008	0.240	1.271	0.689	1.992	-0.028	0.972
wk14	-1.185	0.306	-1.537	0.215	0.074	1.077	0.793	2.211	1.172	3.229	-0.012	0.988
income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
Space flight participants must be made aware that there are unknown hazards.	race1	16.803	19831294.636	1.591	4.906	0.114	1.121	0.132	1.141	0.109	1.115	0.025	1.026
	race2	-14.200	0.000	0.167	1.182	0.420	1.521	0.370	1.448	0.556	1.744	-0.015	0.985
	race3	15.539	5604662.642	-16.302	0.000	-19.286	0.000	0.633	1.882	0.145	1.156	-0.029	0.971
	race4	-0.792	0.453	0.620	1.859	-0.897	0.408	-0.498	0.608	-0.138	0.871	0.964	2.623

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
race5	3.623	37.455	-15.524	0.000	-17.992	0.000	0.765	2.150	1.602	4.964	2.102	8.184
sex1	0.333	1.396	0.030	1.031	-0.381	0.683	-0.191	0.826	-0.172	0.842	0.494	1.639
edu1	21.192	1598685045.662	5.196	180.592	4.260	70.777	3.419	30.552	24.613	48892856668.487	22.835	8266322232.969
edu2	-0.445	0.641	-18.920	0.000	0.398	1.489	2.206	9.076	2.466	11.781	1.146	3.145
edu3	16.961	23232947.135	0.534	1.705	0.004	1.004	0.924	2.520	1.573	4.820	1.156	3.177
edu4	15.539	5602174.382	-0.284	0.753	-1.050	0.350	0.658	1.932	0.991	2.695	0.620	1.859
edu5	16.272	11659741.800	0.546	1.727	0.023	1.024	0.825	2.282	1.113	3.042	0.984	2.674
edu6	13.288	589848.823	-1.751	0.174	-0.912	0.402	0.030	1.030	0.720	2.055	0.642	1.901
edu7	13.906	1094273.078	-0.845	0.430	-0.905	0.405	0.032	1.033	0.448	1.566	0.713	2.039
edu8	-2.729	0.065	-18.274	0.000	-0.723	0.485	0.368	1.445	1.254	3.503	0.883	2.418
age	-0.063	0.939	-0.064	0.938	-0.044	0.956	-0.023	0.978	-0.017	0.983	-0.007	0.993
marital1	15.206	4016687.505	-0.494	0.610	-0.615	0.541	0.532	1.703	0.004	1.004	-1.322	0.266
marital2	16.587	15982131.207	0.230	1.258	-0.378	0.686	0.427	1.533	-0.057	0.944	-0.884	0.413
marital3	16.607	16310633.660	0.045	1.046	0.181	1.199	0.951	2.588	0.436	1.546	-0.596	0.551
marital4	-0.171	0.843	-18.055	0.000	0.857	2.357	0.971	2.640	1.057	2.877	0.160	1.173
housesize	-0.307	0.736	-0.287	0.750	0.106	1.112	0.086	1.089	0.023	1.024	0.011	1.011
children	-0.106	0.899	0.283	1.327	-0.098	0.907	-0.134	0.874	0.005	1.005	0.032	1.033
region1	16.072	9551018.926	-0.182	0.834	0.095	1.100	0.334	1.397	0.426	1.531	0.367	1.444

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
region2	16.696	17819165.327	-0.405	0.667	-0.338	0.713	-0.107	0.898	0.340	1.405	0.186	1.205
region3	16.701	17914467.114	0.010	1.010	0.055	1.057	0.400	1.492	0.624	1.867	0.375	1.455
stat1	-0.450	0.638	-0.303	0.738	0.165	1.179	-0.792	0.453	-1.223	0.294	-0.745	0.475
stat2	0.478	1.613	0.549	1.731	1.119	3.061	-0.154	0.857	-0.676	0.509	-0.321	0.725
emp1	1.444	4.239	0.777	2.175	1.046	2.847	-0.206	0.814	-1.037	0.354	-0.644	0.525
emp2	-1.677	0.187	-1.574	0.207	0.020	1.021	-0.482	0.617	-0.332	0.717	-0.237	0.789
emp3	-2.209	0.110	-1.652	0.192	-0.140	0.869	-0.528	0.590	-0.894	0.409	-0.524	0.592
emp4	2.657	14.255	0.829	2.292	1.107	3.025	0.486	1.626	-0.279	0.757	-0.259	0.772
wk1	15.105	3632194.935	-1.574	0.207	-0.793	0.452	0.294	1.342	0.176	1.192	-0.135	0.874
wk2	2.039	7.681	2.031	7.618	2.454	11.640	2.749	15.622	3.393	29.768	2.294	9.912
wk3	37.501	1934599726696100000.000	4.695	109.385	2.602	13.497	2.585	13.263	1.539	4.659	1.184	3.266
wk4	18.974	173952244.936	1.471	4.352	0.324	1.383	1.113	3.043	1.220	3.386	0.562	1.754
wk5	0.285	1.329	2.071	7.930	1.099	3.001	1.856	6.396	1.366	3.919	0.665	1.945
wk6	-0.253	0.776	-19.290	0.000	0.906	2.475	2.533	12.589	1.918	6.806	1.570	4.807
wk7	15.044	3415641.162	0.286	1.331	0.191	1.210	0.998	2.713	0.568	1.765	0.198	1.219
wk8	0.331	1.393	-17.717	0.000	0.037	1.038	1.794	6.016	2.091	8.096	1.417	4.125
wk9	20.048	509131407.221	1.637	5.142	0.962	2.616	1.949	7.021	1.362	3.906	0.895	2.447
wk10	1.020	2.772	-16.981	0.000	1.250	3.491	1.719	5.579	0.956	2.601	0.307	1.359

	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
	wk11	17.930	61213802.761	0.342	1.407	-0.114	0.892	-0.225	0.798	-1.040	0.353	-0.128	0.880
	wk12	15.710	6648569.860	-0.951	0.386	-0.513	0.599	0.813	2.254	0.495	1.641	0.557	1.746
	wk13	-0.246	0.782	-18.231	0.000	-0.898	0.407	1.182	3.260	0.670	1.955	0.056	1.057
	wk14	16.070	9528370.350	0.011	1.011	-0.360	0.698	1.394	4.030	1.368	3.926	0.130	1.139
	income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
The operator must inform space flight participants that the U.S. Government does not certify launch/reentry vehicles as safe for carrying crewmembers or space flight participants.	race1	-0.926	0.396	-1.166	0.312	-0.810	0.445	-0.128	0.880	0.593	1.809	0.800	2.226
	race2	0.469	1.599	-0.530	0.589	-0.036	0.965	0.950	2.585	1.449	4.261	0.648	1.912
	race3	-18.095	0.000	-0.586	0.557	-0.662	0.516	0.701	2.016	0.444	1.559	0.784	2.190
	race4	-18.491	0.000	-18.459	0.000	-1.223	0.294	-0.017	0.983	0.919	2.508	1.830	6.232
	race5	-18.834	0.000	-20.006	0.000	-19.499	0.000	2.651	14.165	2.596	13.408	2.410	11.139
	sex1	0.904	2.470	0.901	2.462	0.423	1.527	0.164	1.178	0.198	1.219	0.462	1.587
	edu1	25.631	135399644715.956	22.652	6883770578.074	24.165	31235694171.047	23.370	14112154998.451	3.465	31.971	22.244	4575952010.513
	edu2	5.677	292.161	-3.410	0.033	-0.218	0.804	21.933	3353472809.519	1.494	4.453	0.385	1.470
	edu3	21.995	3565844502.414	18.509	109179302.774	20.325	671561074.448	21.035	1365381185.989	1.116	3.052	0.920	2.508
	edu4	18.584	117716608.775	16.421	13543385.047	19.415	270224352.236	20.578	864947898.692	0.634	1.886	0.421	1.524

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
edu5	20.526	820940356.843	18.793	145141282.498	20.220	604655351.237	20.494	795104738.842	0.481	1.617	0.521	1.684
edu6	17.282	32035853.038	16.592	16067667.628	19.031	184026466.502	19.920	447720260.981	0.354	1.425	0.457	1.579
edu7	1.153	3.168	15.395	4850905.239	17.082	26208274.726	19.098	196842614.482	-0.384	0.681	0.127	1.135
edu8	-0.015	0.985	-0.750	0.472	17.769	52107409.445	19.250	229252694.637	-0.125	0.883	0.256	1.291
age	-0.074	0.928	-0.049	0.953	-0.033	0.968	-0.010	0.990	-0.018	0.982	-0.016	0.984
marital1	11.514	100090.065	-3.088	0.046	-1.252	0.286	-0.094	0.911	-0.301	0.740	-1.209	0.298
marital2	14.794	2661667.994	-2.472	0.084	-0.853	0.426	-0.153	0.858	-0.212	0.809	-0.820	0.441
marital3	12.121	183697.599	-2.349	0.095	-0.927	0.396	-0.074	0.928	-0.083	0.920	-0.412	0.663
marital4	-1.927	0.146	-1.157	0.315	0.334	1.396	1.044	2.841	1.502	4.491	0.511	1.668
housesize	1.271	3.565	0.198	1.219	0.060	1.062	0.149	1.161	0.123	1.131	0.005	1.005
children	-1.272	0.280	0.058	1.060	0.137	1.146	-0.214	0.807	-0.119	0.888	-0.001	0.999
region1	1.123	3.075	0.082	1.085	-0.135	0.874	0.227	1.255	0.365	1.441	0.479	1.614
region2	2.492	12.084	1.621	5.061	0.565	1.760	0.170	1.186	0.125	1.133	0.281	1.324
region3	1.738	5.685	0.827	2.287	0.346	1.414	0.461	1.586	0.595	1.813	0.360	1.433
stat1	0.507	1.660	0.660	1.934	-0.074	0.928	-0.473	0.623	-0.452	0.636	-0.462	0.630
stat2	1.166	3.208	1.768	5.857	0.757	2.132	-0.088	0.916	-0.230	0.794	-0.045	0.956
emp1	2.866	17.564	0.925	2.522	-0.245	0.783	-0.358	0.699	-0.171	0.843	-0.209	0.811
emp2	-1.993	0.136	-1.817	0.163	-1.213	0.297	-0.467	0.627	-0.312	0.732	-0.267	0.765
emp3	1.262	3.533	0.161	1.175	-0.143	0.866	-0.229	0.795	-0.375	0.687	-0.237	0.789
emp4	2.640	14.010	1.401	4.058	0.478	1.613	0.378	1.459	-0.030	0.970	-0.348	0.706

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
wk1	15.450	5127275.719	17.823	54996586.228	0.396	1.486	-0.825	0.438	-0.819	0.441	-0.400	0.670
wk2	17.168	28567835.599	19.418	271138265.398	1.980	7.239	-0.094	0.910	1.125	3.080	1.526	4.600
wk3	2.600	13.469	21.369	1907081684.946	3.987	53.898	2.111	8.255	1.706	5.505	20.898	1191415583.379
wk4	18.039	68275611.008	18.165	77406075.227	0.662	1.938	-0.517	0.596	-0.253	0.777	0.242	1.274
wk5	19.063	190095885.805	20.555	844985299.034	1.587	4.890	-0.445	0.641	0.462	1.587	0.662	1.939
wk6	24.082	28747027109.323	19.388	263153377.281	0.770	2.160	1.615	5.028	2.162	8.690	0.769	2.158
wk7	17.740	50607071.795	19.990	480519263.951	1.517	4.557	-0.173	0.841	0.074	1.077	0.032	1.032
wk8	0.394	1.482	1.993	7.340	-0.192	0.826	-0.157	0.855	0.741	2.098	0.219	1.245
wk9	3.341	28.239	2.543	12.722	0.885	2.422	-0.136	0.873	0.671	1.957	0.782	2.186
wk10	1.709	5.526	18.734	136861898.169	0.035	1.035	-0.185	0.831	0.273	1.314	0.161	1.175
wk11	20.156	566964650.607	19.513	298121417.411	1.190	3.287	-0.799	0.450	-0.750	0.473	-0.528	0.590
wk12	17.861	57154113.406	17.599	43966625.966	0.345	1.412	-0.082	0.921	0.129	1.138	0.374	1.454
wk13	16.925	22418816.317	18.324	90780226.615	1.350	3.859	-0.184	0.832	0.194	1.214	0.047	1.048
wk14	18.158	76909840.126	18.945	168867303.304	0.726	2.066	0.007	1.007	0.428	1.535	-0.002	0.998
income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

Dependent Variable	Independent Demographic Variable Category	Cat 1 B (Parameter Estimate)	Cat 1 Exp(B) (Odds Ratio)	Cat 2 B (Parameter Estimate)	Cat 2 Exp(B) (Odds Ratio)	Cat 3 B (Parameter Estimate)	Cat 3 Exp(B) (Odds Ratio)	Cat 4 B (Parameter Estimate)	Cat 4 Exp(B) (Odds Ratio)	Cat 5 B (Parameter Estimate)	Cat 5 Exp(B) (Odds Ratio)	Cat 6 B (Parameter Estimate)	Cat 6 Exp(B) (Odds Ratio)
Space flight participants must be informed of the safety records (i.e., accidents and incidents) of all, private and U.S. Government, launch/reentry vehicles.	race1	17.339	33910940.609	-0.056	0.945	0.208	1.231	-0.251	0.778	-0.026	0.974	0.348	1.416
	race2	16.283	11795405.407	0.599	1.820	1.151	3.160	0.565	1.759	0.659	1.934	0.326	1.386
	race3	1.870	6.485	-17.625	0.000	1.574	4.825	1.403	4.068	0.794	2.212	0.582	1.789
	race4	-1.362	0.256	-17.700	0.000	-1.233	0.292	-0.542	0.581	-0.364	0.695	0.904	2.469
	race5	3.744	42.274	-17.346	0.000	-17.544	0.000	2.788	16.252	1.590	4.904	1.677	5.351
	sex1	0.320	1.377	-0.120	0.887	0.021	1.021	0.157	1.170	0.299	1.349	0.636	1.888
	edu1	1.086	2.962	6.285	536.627	5.194	180.148	3.200	24.544	4.408	82.117	20.890	1181714080.680
	edu2	-17.118	0.000	-15.844	0.000	-19.550	0.000	1.256	3.510	1.623	5.068	-0.447	0.640
	edu3	1.119	3.061	2.052	7.782	0.711	2.035	0.495	1.640	0.607	1.836	-0.641	0.527
	edu4	-0.571	0.565	0.351	1.421	-0.165	0.848	-0.068	0.935	-0.026	0.974	-1.032	0.356
	edu5	-1.064	0.345	1.000	2.719	0.212	1.237	-0.006	0.994	0.249	1.283	-0.754	0.470
	edu6	-2.331	0.097	-1.020	0.361	-0.675	0.509	-0.554	0.575	0.009	1.009	-1.040	0.354
	edu7	-18.827	0.000	-18.004	0.000	-18.969	0.000	-1.318	0.268	-0.604	0.547	-1.107	0.330
	edu8	-1.653	0.191	-1.879	0.153	-1.876	0.153	-0.298	0.743	-0.651	0.522	-0.947	0.388
	age	0.003	1.003	-0.043	0.958	-0.049	0.952	-0.017	0.983	-0.015	0.985	-0.003	0.997
	marital1	15.233	4126362.499	-0.719	0.487	-1.032	0.356	0.741	2.098	0.637	1.890	-0.412	0.662
	marital2	16.688	17675074.816	-0.125	0.883	0.065	1.068	0.777	2.176	0.481	1.617	-0.235	0.791
	marital3	15.489	5332221.561	-0.885	0.413	0.626	1.870	1.093	2.982	1.112	3.039	0.042	1.043
	marital4	-0.409	0.664	0.059	1.061	-1.148	0.317	-0.660	0.517	0.755	2.127	0.138	1.147

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
housesize	0.686	1.985	-0.109	0.897	0.047	1.049	-0.016	0.984	0.156	1.169	0.063	1.065
children	-0.510	0.600	0.364	1.440	0.084	1.088	0.083	1.086	-0.170	0.843	-0.046	0.955
region1	0.794	2.212	2.657	14.250	0.732	2.080	0.642	1.901	0.110	1.117	0.098	1.103
region2	2.286	9.836	3.059	21.306	0.869	2.385	0.686	1.986	0.171	1.187	-0.020	0.981
region3	0.879	2.408	2.128	8.401	0.464	1.590	0.563	1.756	0.296	1.345	0.174	1.190
stat1	-3.671	0.025	-1.006	0.366	-1.399	0.247	-0.948	0.387	-1.448	0.235	-0.732	0.481
stat2	-3.225	0.040	-0.420	0.657	-1.063	0.345	-0.491	0.612	-1.027	0.358	0.073	1.076
emp1	-2.831	0.059	0.951	2.588	-0.658	0.518	-0.132	0.876	-0.907	0.404	-0.859	0.424
emp2	-1.598	0.202	-0.127	0.880	-1.379	0.252	-0.235	0.790	0.034	1.035	-0.063	0.939
emp3	-2.439	0.087	0.014	1.014	-1.062	0.346	-0.492	0.611	-0.284	0.753	-0.433	0.648
emp4	-0.626	0.535	1.563	4.771	-0.101	0.904	0.464	1.590	0.662	1.938	-0.195	0.823
wk1	16.422	13547612.424	15.864	7754190.681	0.030	1.031	-0.907	0.404	-1.383	0.251	0.032	1.032
wk2	-1.305	0.271	19.533	304223144.953	3.184	24.132	0.734	2.083	1.091	2.978	2.296	9.935
wk3	0.886	2.425	20.721	997295547.628	6.298	543.623	2.751	15.662	1.649	5.202	21.472	2114874015.540
wk4	19.787	392259055.675	18.826	149924839.508	2.575	13.127	0.996	2.706	-0.261	0.770	0.661	1.936
wk5	0.497	1.644	19.317	245044735.101	2.531	12.567	0.577	1.781	0.283	1.327	0.943	2.567
wk6	2.978	19.656	0.663	1.940	2.370	10.693	-0.044	0.957	0.017	1.018	-0.485	0.616
wk7	19.255	230399642.032	19.299	240755913.757	3.514	33.576	1.000	2.719	-0.652	0.521	0.216	1.241
wk8	0.612	1.845	0.974	2.648	-16.707	0.000	-0.811	0.444	-1.701	0.182	0.341	1.407
wk9	2.984	19.765	0.761	2.140	-15.803	0.000	-0.486	0.615	-0.398	0.671	1.076	2.932
wk10	1.635	5.131	-0.130	0.878	-17.071	0.000	1.439	4.217	-0.069	0.934	0.479	1.615

	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
	wk11	18.425	100433521.823	18.127	74556375.421	2.498	12.161	0.102	1.108	-0.562	0.570	0.027	1.028
	wk12	18.175	78217121.145	18.265	85604022.778	1.742	5.710	0.499	1.647	-0.280	0.755	0.560	1.751
	wk13	18.680	129603972.888	18.641	124678976.562	2.028	7.597	0.017	1.017	-0.751	0.472	-0.072	0.930
	wk14	18.549	113682584.580	17.876	57985929.460	2.251	9.502	1.011	2.748	-0.083	0.920	0.288	1.333
	income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
Space flight participants must be given the opportunity to ask the space flight operator questions.	race1	18.632	123568254.639	19.739	373702781.482	0.486	1.626	-0.095	0.910	0.391	1.479	-0.182	0.834
	race2	4.435	84.350	19.028	183637418.434	2.191	8.947	1.251	3.492	1.311	3.708	0.219	1.245
	race3	5.413	224.343	1.879	6.547	-18.144	0.000	-0.136	0.873	0.743	2.102	-0.140	0.870
	race4	-3.065	0.047	19.038	185420551.064	0.237	1.267	0.285	1.330	0.937	2.553	0.574	1.776
	race5	10.800	49023.833	2.942	18.956	-16.820	0.000	2.015	7.498	2.775	16.040	0.637	1.891
	sex1	1.525	4.594	0.593	1.809	0.665	1.945	0.116	1.123	0.558	1.747	0.651	1.917
	edu1	12.635	307117.652	3.761	42.992	5.339	208.211	4.532	92.947	5.115	166.574	23.215	12079883310.136
	edu2	-5.793	0.003	-20.968	0.000	-19.657	0.000	2.581	13.214	3.075	21.653	2.634	13.934
	edu3	10.181	26399.938	-1.189	0.305	0.008	1.008	1.685	5.394	2.692	14.763	1.281	3.599

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
edu4	7.805	2452.522	-3.297	0.037	-1.072	0.342	0.799	2.223	2.010	7.466	1.011	2.748
edu5	-12.221	0.000	-2.898	0.055	-0.788	0.455	1.149	3.156	2.210	9.117	1.193	3.298
edu6	5.645	282.922	-3.640	0.026	-1.467	0.231	0.365	1.441	1.720	5.584	1.117	3.055
edu7	-10.295	0.000	-3.483	0.031	-2.687	0.068	-0.709	0.492	1.257	3.514	0.671	1.956
edu8	-6.544	0.001	-21.090	0.000	0.188	1.207	1.391	4.017	2.342	10.402	1.276	3.582
age	-0.001	0.999	-0.056	0.946	-0.033	0.968	-0.012	0.988	-0.011	0.989	-0.015	0.985
marital1	11.987	160607.206	16.123	10053948.132	-0.187	0.829	0.802	2.231	0.004	1.004	-0.955	0.385
marital2	15.007	3293106.655	16.541	15259824.960	0.369	1.446	0.587	1.798	-0.213	0.809	-0.623	0.536
marital3	-2.659	0.070	13.909	1097850.817	-0.300	0.741	0.767	2.153	0.112	1.119	-0.370	0.691
marital4	2.987	19.816	18.250	84292451.043	0.172	1.187	0.767	2.153	-0.484	0.616	-0.152	0.859
housesize	0.878	2.405	-0.723	0.485	-0.066	0.936	0.013	1.013	0.025	1.026	0.140	1.151
children	-0.904	0.405	0.498	1.645	0.080	1.083	-0.117	0.889	0.054	1.056	-0.127	0.881
region1	12.905	402298.289	-0.429	0.651	0.068	1.070	0.947	2.579	0.993	2.700	0.784	2.190
region2	19.454	281017672.188	0.450	1.568	-0.202	0.817	0.265	1.304	0.432	1.541	0.153	1.166
region3	15.761	6995817.591	0.069	1.071	0.277	1.320	0.866	2.376	0.777	2.175	0.299	1.348
stat1	-6.254	0.002	-1.635	0.195	-1.010	0.364	-0.728	0.483	-0.459	0.632	-0.915	0.401
stat2	-5.696	0.003	0.212	1.236	0.153	1.165	-0.093	0.911	-0.259	0.772	-0.494	0.610
emp1	-6.148	0.002	0.611	1.842	0.042	1.043	-0.200	0.819	-0.731	0.481	-0.916	0.400
emp2	-6.260	0.002	-2.073	0.126	0.034	1.035	0.235	1.265	-0.075	0.928	-0.177	0.838
emp3	-7.833	0.000	-0.998	0.369	-1.255	0.285	-0.416	0.660	-0.527	0.590	-0.149	0.861
emp4	-1.553	0.212	0.909	2.482	0.799	2.223	0.603	1.828	-0.124	0.884	-0.227	0.797

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
wk1	11.414	90550.638	-2.228	0.108	-1.261	0.283	0.006	1.006	-0.629	0.533	-0.427	0.652
wk2	2.181	8.853	2.666	14.387	2.457	11.670	2.683	14.636	1.539	4.660	3.136	23.011
wk3	39.965	227262343706344000.000	6.190	487.953	4.597	99.171	3.135	23.000	21.883	3188185827.136	21.226	1652655829.560
wk4	19.748	377038301.181	3.091	21.988	1.458	4.298	1.138	3.121	0.063	1.065	0.379	1.462
wk5	17.250	31014212.045	2.621	13.743	1.505	4.502	1.062	2.891	0.127	1.136	0.650	1.915
wk6	3.187	24.219	-18.463	0.000	-17.381	0.000	-18.897	0.000	-1.134	0.322	-0.149	0.861
wk7	14.282	1594125.320	-0.029	0.971	1.304	3.682	1.008	2.739	0.006	1.006	-0.338	0.713
wk8	-3.994	0.018	-16.886	0.000	-18.298	0.000	1.071	2.919	-0.391	0.676	0.846	2.330
wk9	1.869	6.479	-15.246	0.000	-17.522	0.000	-0.383	0.681	-0.561	0.571	0.733	2.081
wk10	-2.914	0.054	2.177	8.817	1.496	4.463	1.024	2.785	0.175	1.192	0.321	1.378
wk11	18.387	96661945.502	1.384	3.992	1.361	3.899	0.349	1.417	-0.535	0.585	-0.309	0.734
wk12	12.981	434259.271	-0.082	0.922	0.333	1.396	0.904	2.469	0.411	1.508	0.422	1.525
wk13	0.003	1.003	-16.577	0.000	-1.348	0.260	-0.069	0.933	-0.695	0.499	-0.663	0.515
wk14	16.841	20599517.863	-0.652	0.521	0.686	1.986	1.181	3.257	0.579	1.785	0.103	1.109
income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

Dependent Variable	Independent Demographic Variable Category	Cat 1 B (Parameter Estimate)	Cat 1 Exp(B) (Odds Ratio)	Cat 2 B (Parameter Estimate)	Cat 2 Exp(B) (Odds Ratio)	Cat 3 B (Parameter Estimate)	Cat 3 Exp(B) (Odds Ratio)	Cat 4 B (Parameter Estimate)	Cat 4 Exp(B) (Odds Ratio)	Cat 5 B (Parameter Estimate)	Cat 5 Exp(B) (Odds Ratio)	Cat 6 B (Parameter Estimate)	Cat 6 Exp(B) (Odds Ratio)
Space flight participants must fill out and file a medical history questionnaire to disclose any preexisting medical conditions, history of illness or surgeries, and current medications which may result in death or injury during space flight, or compromise the health and safety of other participants.	race1	17.404	36187109.772	18.163	77299620.310	0.825	2.282	0.195	1.216	0.880	2.410	0.732	2.080
	race2	13.148	512835.818	18.033	67858871.354	0.993	2.700	0.691	1.996	1.421	4.143	0.839	2.314
	race3	17.079	26129269.007	1.621	5.057	-17.506	0.000	0.052	1.053	1.427	4.166	1.622	5.063
	race4	-0.919	0.399	-0.407	0.665	0.237	1.267	0.366	1.442	1.012	2.752	1.367	3.924
	race5	2.851	17.310	0.205	1.227	-17.950	0.000	0.945	2.572	1.580	4.854	0.517	1.677
	sex1	-0.391	0.677	-0.434	0.648	0.177	1.194	-0.068	0.935	0.100	1.105	0.221	1.247
	edu1	19.957	464712758.254	20.102	537011492.437	23.247	12474984799.458	3.977	53.352	2.966	19.407	2.093	8.109
	edu2	-1.266	0.282	-2.816	0.060	-1.453	0.234	1.805	6.081	2.610	13.595	0.332	1.394
	edu3	15.431	5027874.482	16.293	11914378.163	19.465	284074894.173	1.516	4.556	1.571	4.809	0.023	1.023
	edu4	13.728	916435.231	15.050	3435991.799	18.001	65700343.942	0.537	1.711	0.847	2.332	-0.168	0.846
	edu5	12.757	346924.382	15.725	6751219.246	19.577	317818913.183	1.236	3.442	1.429	4.175	-0.345	0.708
	edu6	13.611	814900.377	14.814	2713476.286	18.349	93055106.585	0.148	1.159	0.732	2.080	-0.252	0.777
	edu7	-3.079	0.046	14.629	2255099.103	18.478	105951647.111	0.121	1.129	0.971	2.639	-0.696	0.499
	edu8	-2.534	0.079	-1.674	0.188	1.094	2.986	0.918	2.505	1.521	4.578	0.116	1.123
	age	0.017	1.018	-0.016	0.984	-0.015	0.986	-0.010	0.990	-0.002	0.998	-0.002	0.998
	marital1	15.123	3695323.262	16.937	22674169.419	-0.674	0.510	0.237	1.267	0.737	2.091	-0.249	0.780

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
marital2	15.826	7469211.732	16.474	14268979.309	-1.429	0.239	-0.288	0.750	0.070	1.072	-0.189	0.828
marital3	15.245	4176993.980	16.158	10409187.380	-1.201	0.301	0.221	1.247	0.535	1.707	-0.317	0.728
marital4	1.659	5.253	-0.414	0.661	-19.788	0.000	-1.152	0.316	0.399	1.491	0.199	1.220
housesize	1.489	4.434	0.174	1.190	0.083	1.086	0.066	1.068	0.107	1.112	-0.010	0.990
children	-1.392	0.249	-0.009	0.991	0.216	1.242	0.000	1.000	0.091	1.095	0.059	1.060
region1	15.143	3773255.921	0.549	1.732	-0.583	0.558	0.415	1.515	0.726	2.066	0.312	1.366
region2	17.157	28250006.022	1.512	4.537	0.852	2.344	0.405	1.499	0.062	1.064	0.089	1.093
region3	16.383	13030163.518	1.123	3.073	-0.069	0.933	0.461	1.586	0.482	1.619	0.286	1.331
stat1	0.447	1.564	0.591	1.805	-0.046	0.955	-0.614	0.541	-0.928	0.395	-0.646	0.524
stat2	1.241	3.458	1.924	6.845	0.951	2.589	0.109	1.116	-0.257	0.774	-0.043	0.958
emp1	1.303	3.681	0.950	2.585	0.091	1.095	-0.014	0.986	-0.650	0.522	-1.054	0.348
emp2	-2.318	0.098	-1.319	0.267	-1.047	0.351	-0.173	0.841	-0.107	0.899	-0.070	0.933
emp3	-1.640	0.194	-0.998	0.369	-1.285	0.277	-0.923	0.397	-0.742	0.476	-0.936	0.392
emp4	1.959	7.089	1.893	6.640	1.377	3.964	0.836	2.306	0.001	1.001	-0.672	0.510
wk1	13.877	1063932.396	17.242	30777563.365	18.127	74539928.871	-0.461	0.631	0.101	1.106	0.121	1.129
wk2	16.830	20372670.522	19.047	187108285.934	20.014	492171489.449	1.283	3.606	1.628	5.096	2.573	13.111
wk3	0.514	1.671	1.032	2.806	1.105	3.019	-18.969	0.000	2.580	13.199	21.560	2308599511.620
wk4	16.971	23475065.970	17.861	57118037.863	19.387	262714515.589	0.370	1.448	1.422	4.145	0.652	1.919

	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
	wk5	-3.203	0.041	18.718	134591188.494	20.171	575780254.717	0.755	2.127	1.447	4.252	1.051	2.859
	wk6	1.895	6.656	0.005	1.005	20.776	1053690427.385	0.865	2.376	0.480	1.616	0.755	2.128
	wk7	15.287	4356424.447	18.833	151098399.729	20.213	600094782.153	1.009	2.743	1.307	3.695	0.482	1.620
	wk8	-0.965	0.381	1.044	2.839	-1.287	0.276	-1.293	0.275	0.602	1.826	0.285	1.330
	wk9	1.149	3.156	20.019	494239655.392	19.234	225447470.466	0.694	2.002	0.658	1.931	0.668	1.951
	wk10	-2.373	0.093	0.795	2.213	0.646	1.907	0.806	2.240	1.201	3.323	0.270	1.310
	wk11	17.148	28013710.825	18.208	80804892.729	19.196	217118205.299	-0.453	0.636	1.061	2.890	0.405	1.500
	wk12	14.599	2188300.301	17.058	25594791.523	17.550	41873570.647	0.150	1.162	0.923	2.516	0.398	1.489
	wk13	-1.260	0.284	-0.028	0.972	0.183	1.201	-0.644	0.525	0.562	1.754	-0.078	0.925
	wk14	16.459	14055614.344	18.368	94823345.534	18.800	146194016.091	0.618	1.854	0.769	2.159	0.049	1.051
	income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
Space flight participants will be required to provide their height, weight, and blood pressure in their medical	race1	16.870	21215892.280	0.441	1.555	-0.883	0.414	-0.669	0.512	-0.397	0.672	-0.117	0.889
	race2	16.556	15501779.964	1.544	4.685	0.049	1.051	0.354	1.425	0.313	1.368	-0.188	0.828
	race3	-2.289	0.101	2.066	7.890	0.124	1.132	0.058	1.060	0.341	1.406	-0.783	0.457

	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
history questionnaire.	race4	14.992	3243115.670	-0.639	0.528	-2.806	0.060	-0.792	0.453	-0.213	0.808	0.103	1.109
	race5	1.579	4.851	-16.836	0.000	-19.421	0.000	-0.650	0.522	-0.891	0.410	-0.822	0.439
	sex1	0.463	1.589	0.583	1.791	0.020	1.021	-0.084	0.920	-0.058	0.943	0.321	1.378
	edu1	18.888	159632320.485	20.713	990129896.312	23.679	19221302977.906	21.950	3409259172.425	3.381	29.395	22.559	6269694968.006
	edu2	16.449	13915829.575	18.063	69949624.611	18.137	75335839.525	21.138	1514204965.955	1.549	4.708	0.490	1.632
	edu3	16.648	16983504.693	19.079	193130415.791	19.520	300238534.005	20.003	486519103.444	1.015	2.759	1.099	3.002
	edu4	13.110	493820.885	16.571	15728023.235	17.479	38998358.650	19.281	236280857.374	0.400	1.492	0.663	1.940
	edu5	14.586	2160246.057	17.537	41326949.338	17.927	61027073.178	19.499	293966255.259	0.096	1.101	0.479	1.614
	edu6	14.063	1280239.108	15.888	7945709.698	17.844	56155611.840	19.095	196238376.247	0.173	1.189	0.797	2.219
	edu7	12.413	245924.009	16.478	14329821.234	18.461	104126692.408	19.309	243021966.126	0.288	1.333	0.450	1.568
	edu8	-19.490	0.000	-2.585	0.075	17.534	41208782.575	19.436	275944473.556	0.200	1.222	1.061	2.888
	age	0.028	1.028	-0.015	0.985	0.001	1.001	-0.002	0.998	-0.004	0.996	-0.009	0.991
	marital1	0.622	1.862	-0.958	0.384	-0.326	0.722	0.196	1.216	0.511	1.667	-0.334	0.716
	marital2	0.601	1.824	-1.778	0.169	-1.123	0.325	-0.372	0.689	-0.213	0.808	-0.422	0.656
	marital3	-30.978	0.000	-4.087	0.017	-1.956	0.141	-0.027	0.973	0.140	1.151	-0.090	0.914
	marital4	1.722	5.597	-0.432	0.650	0.519	1.680	0.972	2.642	0.999	2.717	0.385	1.470
	housesize	0.928	2.528	0.440	1.553	0.034	1.035	0.101	1.106	0.141	1.152	-0.052	0.949
	children	-1.318	0.268	-0.466	0.628	0.188	1.206	-0.082	0.922	0.013	1.013	0.165	1.180
	region1	-1.085	0.338	-0.031	0.969	0.294	1.341	0.578	1.782	0.449	1.567	0.366	1.443

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
region2	1.669	5.306	1.955	7.064	0.649	1.915	0.414	1.513	0.194	1.214	-0.037	0.963
region3	0.105	1.111	1.023	2.782	0.011	1.012	0.209	1.232	0.292	1.339	-0.122	0.885
stat1	-0.728	0.483	0.326	1.386	0.449	1.567	-0.372	0.689	-0.764	0.466	-1.308	0.270
stat2	0.119	1.126	1.306	3.693	1.806	6.088	0.748	2.114	0.137	1.147	-0.364	0.695
emp1	-0.040	0.961	1.037	2.822	1.725	5.615	1.096	2.992	-0.085	0.918	-1.073	0.342
emp2	0.330	1.391	0.751	2.118	0.693	2.000	0.280	1.324	0.218	1.244	0.012	1.012
emp3	-0.489	0.613	0.744	2.103	-0.080	0.923	-0.081	0.922	-0.131	0.877	-0.552	0.576
emp4	1.027	2.792	3.160	23.571	1.714	5.549	0.830	2.294	0.347	1.415	-0.525	0.592
wk1	14.798	2672089.170	17.122	27285399.396	-0.804	0.447	0.826	2.284	-0.108	0.898	0.015	1.016
wk2	-4.398	0.012	-2.333	0.097	2.762	15.832	2.349	10.475	1.785	5.961	2.116	8.301
wk3	37.870	27986381763558900.000	22.658	6918969950.756	4.086	59.520	4.322	75.332	22.676	7045265518.999	21.205	1619464875.868
wk4	15.763	7010368.428	18.502	108500747.129	2.035	7.651	2.216	9.171	0.874	2.397	1.073	2.923
wk5	-1.307	0.271	19.215	221258372.170	1.773	5.887	2.770	15.962	1.197	3.311	1.002	2.725
wk6	22.271	4701578331.159	21.115	1479847884.293	4.656	105.236	3.782	43.886	2.594	13.382	1.034	2.812
wk7	15.355	4663218.079	17.261	31346069.588	1.376	3.959	2.258	9.565	0.714	2.041	0.256	1.292
wk8	15.663	6344576.914	17.480	39018317.913	1.359	3.893	1.802	6.065	-0.183	0.833	0.520	1.681
wk9	0.353	1.423	0.838	2.311	1.746	5.731	2.735	15.408	0.722	2.059	1.413	4.110
wk10	-1.196	0.302	0.985	2.679	1.709	5.525	2.161	8.684	0.676	1.965	0.301	1.351

Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
	wk11	16.679	17529685.931	19.244	227820350.799	1.986	7.283	1.473	4.362	0.443	1.557	0.431	1.539
	wk12	15.542	5622269.082	17.832	55524548.462	1.207	3.344	1.999	7.382	0.618	1.854	0.322	1.381
	wk13	0.191	1.210	-0.190	0.827	-20.260	0.000	-0.238	0.788	-0.709	0.492	-0.285	0.752
	wk14	16.767	19139132.105	18.078	71016051.655	0.699	2.012	2.072	7.942	0.929	2.531	0.263	1.301
	income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
Space flight participants must undertake general medical tests which will assess overall physical health, urinalysis, hearing, and vision screening.	race1	-0.487	0.614	-1.289	0.275	-0.317	0.728	0.022	1.022	0.027	1.027	0.157	1.170
	race2	-20.203	0.000	-1.661	0.190	-0.118	0.889	0.844	2.326	0.637	1.890	0.074	1.077
	race3	-12.172	0.000	1.299	3.665	0.297	1.346	0.564	1.758	0.990	2.692	0.733	2.081
	race4	-1.701	0.183	-3.396	0.034	-1.658	0.191	-0.320	0.726	-0.085	0.918	0.359	1.433
	race5	-18.224	0.000	-19.043	0.000	-19.007	0.000	0.065	1.067	0.698	2.009	-0.612	0.542
	sex1	0.690	1.993	-0.073	0.930	0.306	1.358	0.205	1.227	0.175	1.191	0.067	1.069
	edu1	19.592	322716586.393	24.352	37680554266.753	4.867	129.921	2.577	13.157	2.858	17.422	21.022	1348186615.046
	edu2	-0.689	0.502	20.454	763942119.681	0.587	1.799	2.951	19.123	1.315	3.723	-0.533	0.587
	edu3	16.885	21520935.615	19.710	363017487.268	0.727	2.069	1.668	5.301	0.544	1.723	-0.222	0.801
	edu4	15.777	7112259.704	18.704	132759699.837	-0.467	0.627	0.784	2.191	-0.114	0.892	-0.571	0.565

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
edu5	15.830	7498763.409	18.745	138377964.623	-0.217	0.805	1.006	2.736	0.177	1.193	-0.502	0.605
edu6	12.469	260087.272	17.872	57784906.318	-0.208	0.813	0.630	1.878	-0.053	0.949	-0.375	0.687
edu7	-1.527	0.217	19.039	185489969.351	0.430	1.537	0.834	2.303	-0.017	0.983	-0.622	0.537
edu8	13.540	758843.891	18.733	136642666.172	0.328	1.389	1.404	4.071	0.131	1.140	0.121	1.129
age	0.000	1.000	-0.002	0.998	0.003	1.003	0.006	1.006	-0.006	0.994	-0.004	0.996
marital1	15.692	6531198.876	0.700	2.014	0.506	1.659	1.431	4.181	0.816	2.261	0.214	1.238
marital2	14.030	1239334.825	-0.489	0.613	-0.782	0.457	0.400	1.491	0.308	1.361	-0.271	0.763
marital3	13.758	943717.084	-0.515	0.597	-0.611	0.543	0.764	2.146	0.532	1.703	0.038	1.039
marital4	-1.651	0.192	-17.970	0.000	1.006	2.734	1.139	3.123	0.584	1.793	1.082	2.950
housesize	-0.392	0.676	-0.016	0.984	0.138	1.148	0.234	1.264	0.077	1.080	-0.040	0.961
children	0.854	2.350	0.225	1.252	0.321	1.379	-0.148	0.862	0.023	1.023	0.094	1.099
region1	17.285	32113251.328	0.304	1.355	-0.336	0.715	0.288	1.334	0.353	1.423	0.197	1.218
region2	18.275	86482949.504	0.122	1.130	-0.546	0.579	-0.211	0.810	0.210	1.234	-0.085	0.918
region3	18.360	94131884.692	0.124	1.132	-0.295	0.744	-0.031	0.969	0.068	1.070	-0.140	0.870
stat1	-1.705	0.182	-1.502	0.223	-2.119	0.120	-0.885	0.413	-0.867	0.420	-0.529	0.589
stat2	0.545	1.724	-0.200	0.818	-0.478	0.620	-0.003	0.997	-0.274	0.760	-0.085	0.918
emp1	0.529	1.698	-0.165	0.848	0.208	1.232	0.702	2.019	-0.069	0.933	-0.807	0.446
emp2	-2.314	0.099	-1.016	0.362	-0.114	0.892	0.005	1.005	-0.039	0.962	-0.377	0.686
emp3	-0.277	0.758	-0.784	0.457	-0.184	0.832	0.014	1.014	-0.046	0.955	-0.498	0.608

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
emp4	2.907	18.296	1.625	5.079	1.958	7.083	0.873	2.395	0.779	2.179	-0.044	0.957
wk1	-2.394	0.091	-3.075	0.046	-3.438	0.032	-1.703	0.182	-0.659	0.517	0.085	1.089
wk2	-17.181	0.000	1.114	3.047	0.718	2.051	0.633	1.882	1.875	6.523	2.720	15.175
wk3	-15.061	0.000	-16.540	0.000	-18.505	0.000	-19.775	0.000	1.919	6.816	21.272	1731879235.113
wk4	1.523	4.584	1.176	3.242	0.996	2.708	0.773	2.167	0.696	2.006	0.752	2.120
wk5	1.606	4.985	0.626	1.871	0.197	1.218	0.339	1.404	0.852	2.344	0.983	2.672
wk6	-18.259	0.000	0.204	1.227	0.665	1.945	0.103	1.108	1.650	5.208	0.964	2.622
wk7	-2.418	0.089	-0.788	0.455	0.095	1.100	0.128	1.137	0.511	1.667	0.359	1.432
wk8	0.253	1.288	-0.524	0.592	-1.738	0.176	-0.894	0.409	-0.348	0.706	0.702	2.018
wk9	3.242	25.590	1.685	5.395	0.092	1.097	-0.059	0.943	-0.230	0.795	1.053	2.867
wk10	-13.801	0.000	-16.896	0.000	-18.149	0.000	0.201	1.223	0.552	1.737	0.515	1.673
wk11	-16.694	0.000	0.041	1.042	-0.695	0.499	-0.113	0.893	0.081	1.084	0.450	1.568
wk12	-0.178	0.837	-0.143	0.867	-0.424	0.655	0.386	1.471	0.560	1.751	0.163	1.177
wk13	-18.981	0.000	-1.552	0.212	-0.921	0.398	0.694	2.001	0.849	2.338	0.371	1.449
wk14	0.500	1.650	0.155	1.168	-0.761	0.467	0.364	1.439	0.706	2.026	-0.009	0.991
income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

		Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Cat 6	
Dependent Variable	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
An electrocardiogram (EKG) will be required to record the participant's	race1	3.284	26.680	3.138	23.050	0.631	1.880	1.038	2.823	1.230	3.421	0.599	1.820
	race2	0.994	2.701	-1.451	0.234	0.845	2.328	1.324	3.757	1.495	4.459	0.286	1.332
	race3	-12.784	0.000	-16.943	0.000	1.109	3.030	1.943	6.978	1.633	5.121	-0.348	0.706

heart electrical activity and give an overview of cardiac health.	Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
	race4	-20.601	0.000	-15.954	0.000	1.162	3.196	0.621	1.861	1.492	4.444	1.391	4.019
	race5	-6.900	0.001	-15.893	0.000	-17.518	0.000	1.133	3.106	1.021	2.776	-0.061	0.941
	sex1	0.789	2.200	0.811	2.251	0.535	1.708	0.362	1.436	0.176	1.192	0.415	1.515
	edu1	9.378	11822.159	5.413	224.383	3.139	23.077	2.300	9.975	21.800	2935630059.717	20.947	1250507262.487
	edu2	-18.936	0.000	-20.480	0.000	-2.261	0.104	0.908	2.480	-0.146	0.864	-0.691	0.501
	edu3	-2.393	0.091	-1.444	0.236	-1.124	0.325	0.007	1.007	-0.686	0.503	-0.279	0.757
	edu4	-5.492	0.004	-4.620	0.010	-3.277	0.038	-1.216	0.296	-1.947	0.143	-0.806	0.447
	edu5	-7.515	0.001	-2.845	0.058	-1.977	0.138	-0.898	0.407	-1.420	0.242	-0.625	0.535
	edu6	-7.767	0.000	-4.829	0.008	-2.625	0.072	-0.951	0.387	-1.336	0.263	-0.472	0.624
	edu7	-7.013	0.001	-2.204	0.110	-1.796	0.166	-0.811	0.444	-0.927	0.396	-0.712	0.490
	edu8	-21.077	0.000	-1.442	0.237	-2.233	0.107	-0.281	0.755	-0.503	0.604	-0.635	0.530
	age	0.026	1.026	-0.099	0.906	-0.028	0.973	-0.012	0.989	-0.014	0.986	-0.004	0.996
	marital1	9.935	20643.485	11.754	127258.877	-2.663	0.070	-0.172	0.842	-0.302	0.739	-0.204	0.816
	marital2	14.470	1924905.691	15.136	3745298.227	-1.406	0.245	-0.104	0.901	-0.603	0.547	-0.560	0.571
	marital3	-12.156	0.000	13.235	559628.676	-1.732	0.177	0.560	1.751	0.024	1.024	-0.252	0.777
	marital4	22.229	4505916471.097	17.409	36343187.440	-1.016	0.362	0.565	1.760	0.536	1.710	0.370	1.447
	housesize	2.499	12.169	0.866	2.377	0.599	1.820	0.372	1.450	0.203	1.225	-0.038	0.962
	children	-2.417	0.089	-0.837	0.433	-0.289	0.749	-0.345	0.708	-0.232	0.793	-0.025	0.975
	region1	-0.512	0.599	0.310	1.363	0.507	1.660	0.302	1.352	0.283	1.327	0.044	1.045
	region2	4.069	58.510	1.421	4.142	0.595	1.812	0.140	1.150	0.353	1.423	0.196	1.216
	region3	2.573	13.105	1.072	2.922	0.721	2.057	0.434	1.544	0.432	1.540	0.007	1.007
	stat1	-3.981	0.019	1.074	2.926	-0.737	0.478	-0.715	0.489	-0.957	0.384	-0.712	0.491
	stat2	0.537	1.711	4.118	61.460	0.805	2.237	0.357	1.430	-0.301	0.740	-0.263	0.769

Independent Demographic Variable Category	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)	B (Parameter Estimate)	Exp(B) (Odds Ratio)
emp1	0.864	2.373	3.979	53.489	0.240	1.271	0.141	1.152	-0.880	0.415	-1.192	0.304
emp2	-6.747	0.001	-3.109	0.045	-0.999	0.368	-0.360	0.698	-0.293	0.746	-0.289	0.749
emp3	-9.416	0.000	-0.924	0.397	-0.983	0.374	-0.372	0.690	-0.330	0.719	0.021	1.021
emp4	2.307	10.047	3.675	39.463	0.973	2.646	0.807	2.241	0.488	1.630	0.221	1.248
wk1	-4.694	0.009	-2.477	0.084	-0.942	0.390	-1.041	0.353	-0.234	0.791	0.285	1.330
wk2	-17.330	0.000	-14.799	0.000	-17.659	0.000	-0.134	0.875	1.475	4.369	2.406	11.084
wk3	-8.469	0.000	-12.969	0.000	-17.497	0.000	-20.030	0.000	0.139	1.149	-1.172	0.310
wk4	7.143	1264.823	1.960	7.101	1.777	5.912	0.100	1.105	0.514	1.672	1.144	3.138
wk5	-16.205	0.000	1.491	4.441	0.760	2.138	0.642	1.900	1.033	2.808	0.543	1.721
wk6	7.746	2313.158	1.457	4.293	2.724	15.247	0.637	1.891	1.027	2.792	0.380	1.462
wk7	-2.321	0.098	1.463	4.320	1.339	3.817	0.033	1.033	0.220	1.246	0.180	1.197
wk8	-18.432	0.000	-15.273	0.000	-1.007	0.365	-0.149	0.861	0.294	1.341	0.444	1.559
wk9	-10.884	0.000	-14.574	0.000	-19.086	0.000	-1.539	0.215	-0.416	0.660	1.107	3.026
wk10	-15.561	0.000	-18.038	0.000	-0.057	0.945	0.190	1.209	0.529	1.697	0.201	1.223
wk11	-16.167	0.000	1.294	3.647	0.431	1.538	-1.020	0.361	-0.618	0.539	0.110	1.116
wk12	-1.630	0.196	-2.173	0.114	0.232	1.262	-0.546	0.580	0.236	1.266	0.231	1.260
wk13	-2.005	0.135	-0.352	0.703	-0.808	0.446	0.374	1.453	1.129	3.093	0.423	1.527
wk14	1.138	3.120	-1.105	0.331	0.506	1.659	0.236	1.266	0.516	1.675	0.111	1.117
income	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000

Appendix D

Figures

Figure D1

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must Execute a Reciprocal Waiver of Claims with the FAA/DOT

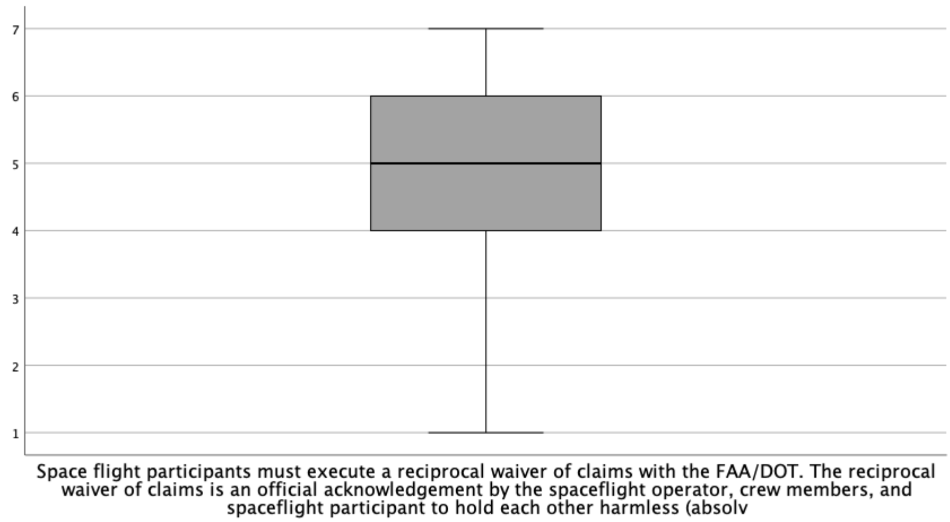


Figure D2

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must Be Made Aware of the Known Hazards and Risks that Could Result in Serious Injury, Death, Disability, or Total/Partial Loss of Physical and Mental Function

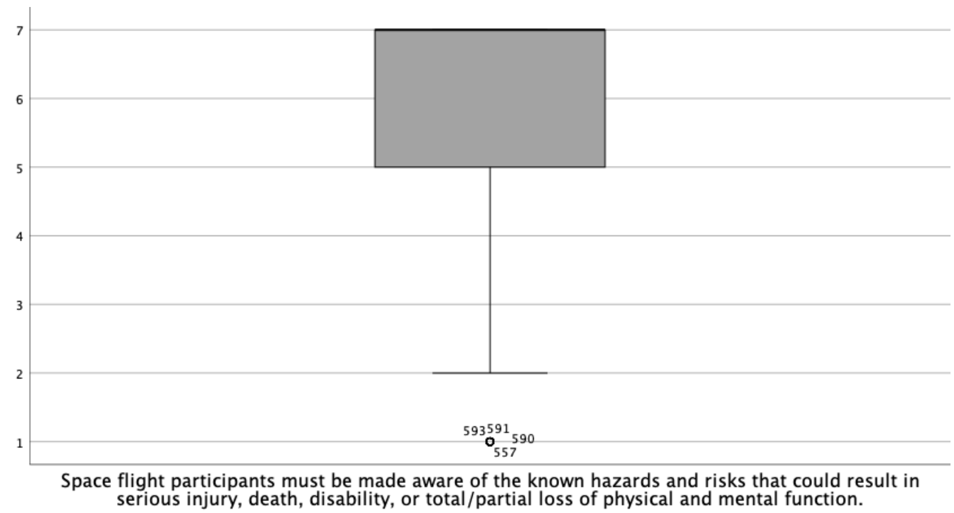


Figure D3

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must be Made Aware that There Are Unknown Hazards

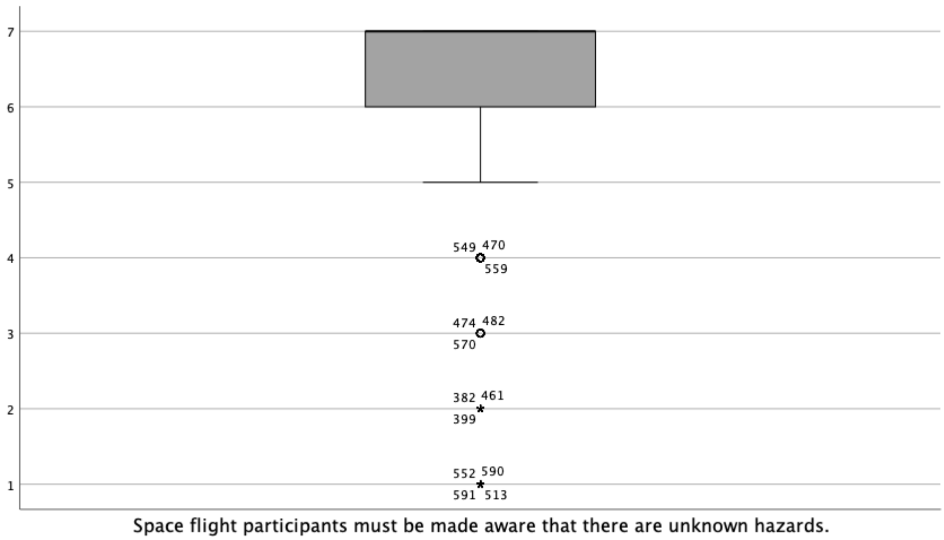


Figure D4

Boxplot of Outliers for Dependent Variable: The Operator Must Inform Space Flight Participants that the U.S. Government Does Not Certify Launch/Reentry Vehicles as Safe for Carrying Crewmembers or Space Flight Participants

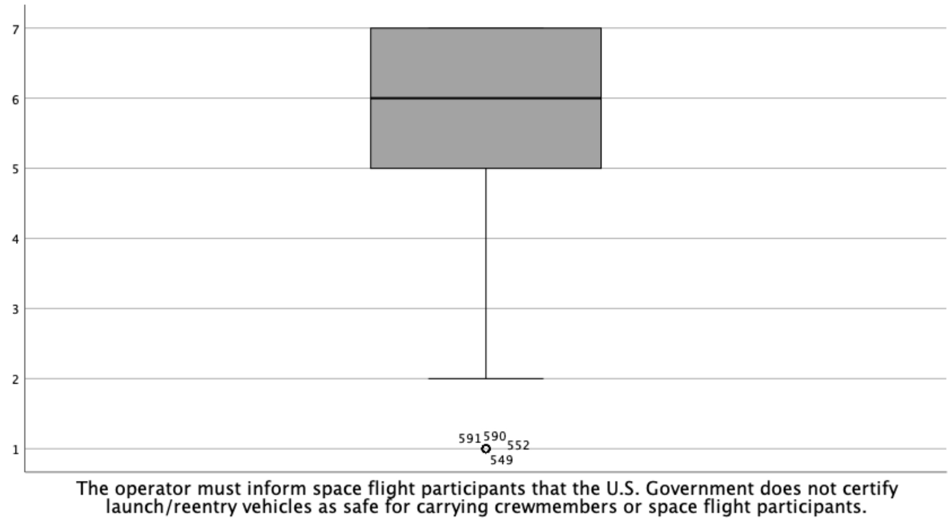


Figure D5

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must Be Informed of the Safety Records (i.e., Accidents and Incidents) of All Private and U.S. Government Launch/Reentry Vehicles

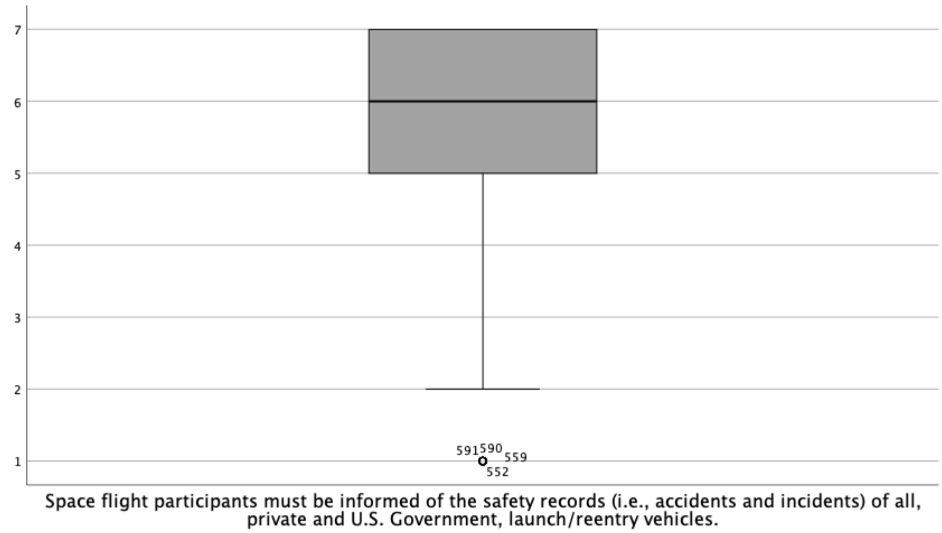


Figure D6

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must Be Given the Opportunity to Ask the Space Flight Operator Questions

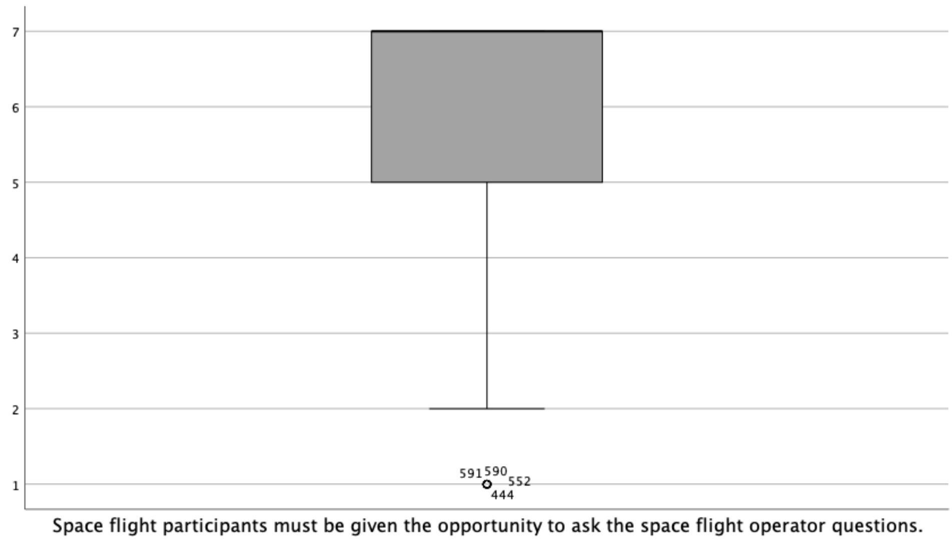


Figure D7

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must Fill Out and File a Medical History Questionnaire to Disclose Any Preexisting Medical Conditions, History of Illness or Surgeries, and Current Dedications Which May Result in Death or Injury During Space Flight or Compromise the Health and Safety of Other Participants

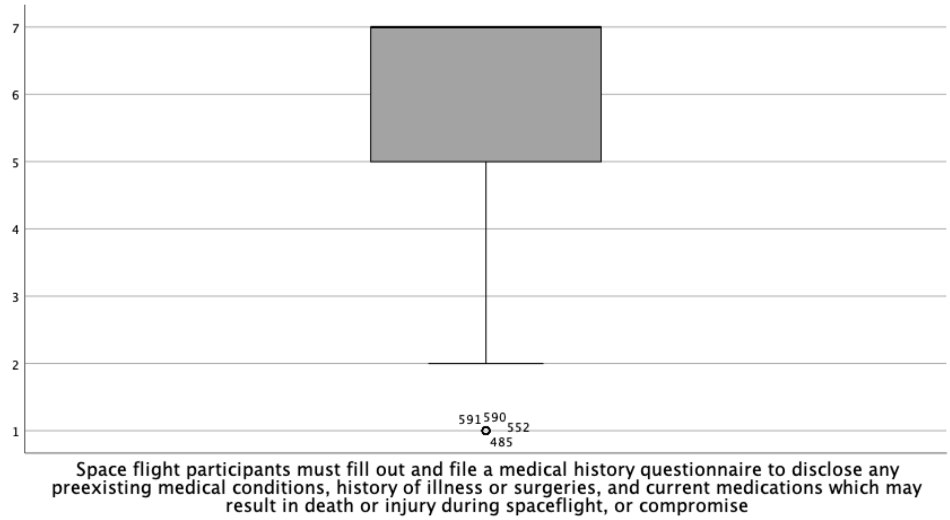


Figure D8

Boxplot of Outliers for Dependent Variable: Space Flight Participants Will Be Required to Provide Their Height, Weight, and Blood Pressure in Their Medical History Questionnaire

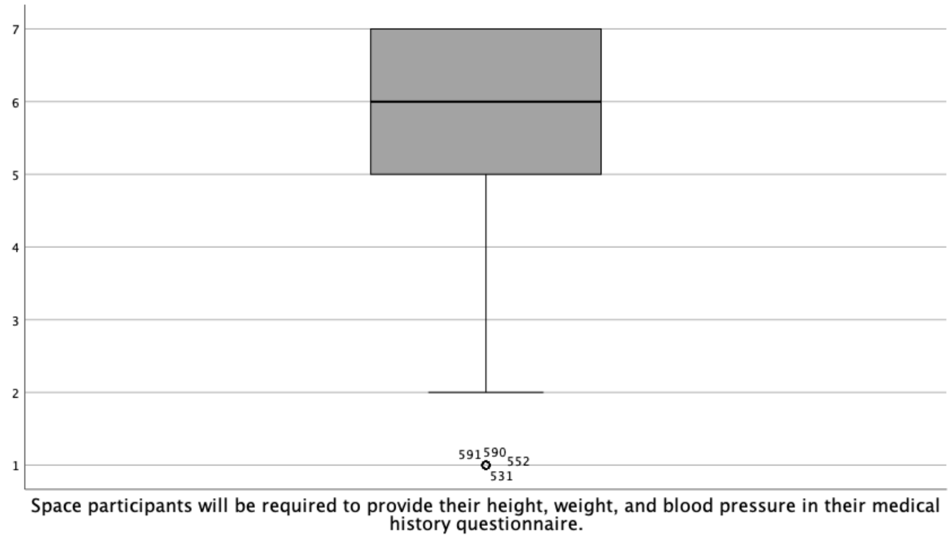


Figure D9

Boxplot of Outliers for Dependent Variable: Space Flight Participants Must Undertake General Medical Tests Which Will Assess Overall Physical Health, Urinalysis, Hearing, and Vision Screening

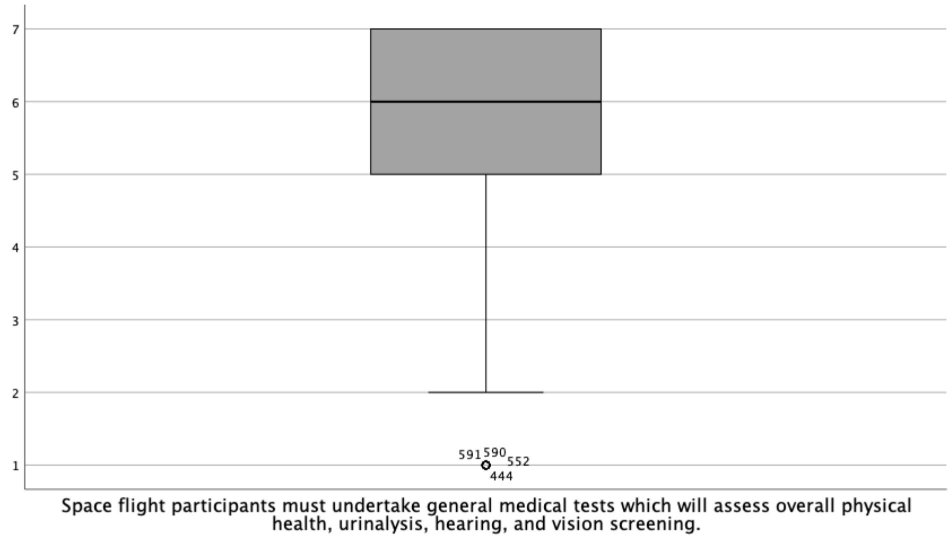


Figure D10

An Electrocardiogram (EKG) Will be Required to Record the Participant's Heart Electrical Activity and Give an Overview of Cardiac Health