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**Airline Consumers' Perception of
Transport Security Administration's Prohibited Items**

by

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Bachelor of Science Aviation Management with Flight

Florida Institute of Technology

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Bachelor of Science Electrical Engineering

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in

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We the undersigned committee hereby recommend that the attached document be
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in
Applied Aviation Safety.

**“Airline Consumers’ Perception of
Transport Security Administration’s Prohibited Items”**

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ABSTRACT
Airline Consumers' Perception of
Transport Security Administration's Prohibited Items

by

Clayton Ernest D'souza

Committee Chairperson: Scott Winter, Ph.D.

There has been limited research conducted and significantly limited scholarly articles on consumer attitudes towards the current TSA prohibited items list. If the research were to be conducted a year after the September 11, 2001 attacks, the results of the research would be negatively skewed, indicating the majority of passengers would approve of the TSA prohibited list. But after almost thirteen years since the devastating act of terrorism and no major attempt to repeat a similar terrorist activity, would airline consumers continue to fly if the TSA amended the prohibited items list and allowed passengers to bring on liquids and sharp objects in their carry-on luggage? The current study analyzed a passenger's perception on the TSA's prohibited items list, specifically, liquids, gels, aerosols, and sharp objects in carry-on luggage. The study examined three different dependent variables – comfort, trust, and willingness to fly, if the TSA permitted or prohibited liquid, gels, and sharp objects in a carry-on. Overall, participants demonstrated a positive perception to scenarios prohibiting sharp objects and a neutral perception to scenarios permitting sharp objects.

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DEDICATION

I dedicate my thesis to my dad. I wish you could have been there at the finish line but you will forever be in my thoughts. I can only hope you are as proud of me as the first time I came home a graduate. I will always appreciate all you have done for me through the years and no amount of gratitude and thankfulness can suffice. I my only hope is I can give my family everything and more, as you gave for our family for the past 60 years. You were my role model, my friend and my dad. I love you.

I also dedicate this work and give special thanks to my mom Nancy M. D'souza and my wonderful wife Caitlin for being there for me throughout the entire master's program and constantly encouraging me to strive for better. Thank you for all the sacrifices you both have made to make sure I succeed. Both of you have been my best cheerleaders.

CHAPTER 1: INTRODUCTION

Aviation Security has changed significantly post September 11, 2001. The substantial change came in the form of the Transportation Security Administration, also known as the TSA. The formation of TSA on November 11, 2001 revolutionized aviation security by enforcing thorough screening techniques to avert terrorist activity. The agency introduced new regulations, such as a prohibited items list and an intensive screening method for all travelling passengers (TSA, 2014). The change helped avoid the repetition of the September 11 attacks but created distress and frustration among airline consumers due to extensive, and perhaps invasive, security procedures. It has been thirteen years since the formation of TSA, and the preventive measures to combat any acts of terrorism has only intensified.

Flying has been a preferred mode of transportation among people living in the U.S., especially with the emergence of multiple low-cost airlines. According to the Federal Aviation Administration (FAA) forecast, the total number of people flying commercially on U.S. airlines will increase by 0.2 percent to 732 million in 2012, then to 746 million in 2013, and then increase more rapidly to 1.2 billion in 2032 (Price, 2012). This would imply longer wait times at airports and further delays in order to accommodate this growth. Passengers who have flown in the past year have experienced full body scanners, use of swabs or Explosive Trace Detection machines, or been thoroughly patted down, and in some instances, experienced all three. These tests are time consuming and often cause frustration among passengers because it causes delays and ultimately contributes to longer

wait times. During the sequester (US Government shutdown) in 2013, wait times at the majority of the busier airports doubled significantly due to insufficient TSA agents. The Department of Homeland Security is responsible for trying to find the proper balance between hiring additional TSA agents while investing in new technology to screen baggage and passengers to meet the growth of passengers travelling each year despite budget constraints. Finding this balance will be essential to aviation security because it would imply amending the prohibited items list or discontinuing certain screening procedures to decrease wait times at airports. This decision, in turn, may benefit airlines in terms of on-time departures because the airline industry has adopted better security measures to avoid a possible hijacking such as: Installed Physical Secondary Barriers (IPSBs) to restrict access to the hardened cockpit door during door transitions, the Federal Air Marshal Service (FAMS), and the Federal Flight Deck Officer (FFDO) Program (Stewart & Mueller, 2013).

All items on the current TSA prohibited items list in carry-on luggage came about either due to an event or classified information that was provided by international agencies, in which items could potentially pose a threat to air travel. Prior to 2001, the FAA permitted passengers to bring on board blades that were four inches or shorter in length. The regulation was amended post 2001 because investigators believe the hijackers bought box-cutter knives whose blades were less than four inches in length (Griffith, Spiegel, & Williamson, 2002). Despite restrictions on sharp objects, passengers continue to bring sharp objects in their

carry-on luggage. This likely happens either because passengers are absent-minded or unaware the sharp objects are in the carry-on luggage, or, in some instances, employees working for the airport, airline, or government believe that the security measures do not apply to them, and when these people are caught, they justify their actions by informing TSA that they were just testing the system (Forest & Price, 2013). Regardless, TSA continues to notify and inform passengers of all the items seized on a weekly basis at airports all over the U.S. via their website. The ban on liquids and gels came about in 2006 when British police foiled an attempt by hijackers to bring down aircraft bound for Canada and USA by using liquid-based explosives. The restrictions were eventually relaxed and the current 3-1-1 regulations on liquids were adopted by the TSA in 2006.

In a recent survey of more than 3,200 U.S. air travelers by travel web site Trip Advisor ®, 39 percent cited long security lines as the most annoying part of being at an airport (Weber, 2010). There are multiple websites that publish articles on “Step by Step Guide to Get Through Airport Security in Record Time,” but the guides are not guaranteed or published by a professional/scholarly researcher who has tried and tested the method. The TSA does provide guides on their website, www.tsa.gov, on how passengers can go through the security screening process in an efficient, quick manner. If more passengers did take the time to read the TSA published articles and guides, wait times could possibly decrease significantly because then each passenger would be aware of which items should be better off being packed in a checked-in luggage rather than in a carry-on, or how wearing

limited accessories can result in walking through the full body scanner quickly. Nevertheless, this shouldn't be considered a drawback, given the large amounts spent on acquiring state of the art screening equipment, detailed security training programs for airline employees, and a detailed database of all passengers flying on board a U.S. carrier. One would expect the TSA to begin lifting the ban on certain prohibited items, but there have been no amendments to the current regulations and wait times continue to increase, especially during holidays and weekends. This is because TSA is required to monitor every carry-on luggage and passenger for possibly trying to bring a prohibited item on board, including a bottle of water.

In April 2013, TSA announced that small knives and sporting equipment would be allowed on board an aircraft (TSA Blog Team, 2013). (Refer to Appendix E for sizes of sharp objects permitted.) Airline crewmembers and law enforcement representatives heavily criticized this announcement. According to the TSA, the new guideline was intended to allow security screeners to better focus their efforts on detecting more threatening items, such as explosives (Elliott, 2013). TSA's proposed regulation change failed to gain momentum and was eventually withdrawn citing additional security research was needed before an amendment could be made to the prohibited items list. TSA's decision to amend the prohibited items list could be considered as an initial step towards reverting back to pre-9/11 airport security. The introduction of advanced technology for screening and extensive data collection on travelling passengers has benefited airport security and increased the level of safety. Consumers have accepted these changes because it is

the price that must be paid to avoid another terrorist attack. Nevertheless, the possibility of items, such as a bottle of wine or a small knife, may eventually be allowed on board an aircraft in the distant future.

The Ex-TSA Director, Kip Hawely, stated that it is not the objects but the travelers that must be given increased scrutiny (US Today, 2005). Passengers wanting to cause harm can go to any length to use items not on the TSA prohibited list to create a lethal weapon. It is the Department of Homeland Security's (DHS) responsibility to develop an effective screening technique, such as the screening methods currently used by airports in Israel. Adopting the Israeli airport screening methods can become vital to achieving safer skies, and with current successful DHS programs, such as TSA Pre Check & Global Entry, DHS and TSA has already laid the foundation for a successful level of aviation security we currently experience. Global Entry is a U.S Custom Border Control (CBP) program and TSA Pre Check is a TSA program that allows preapproved, low-risk travelers expedited clearance upon entry into the United States and passengers traveling domestically within the U.S. (Forest & Price, 2013). Passengers have to undergo a rigorous background check before being accepted into either of the programs.

Therefore, the purpose of this study will be to gather consumer perceptions on current TSA policies in regards to what items may or may not be carried on a commercial airliner, specifically items related to liquids, gels, and sharp objects, and demonstrate their willingness, trust, and comfort to continue flying if they were permitted.

Problem Statement

The study is designed to understand the perception of travelling passengers of the current TSA's prohibited items list. Airport security has seen a major upgrade in terms of equipment, screening techniques, and passenger information. Despite these advancements, TSA continues to add items to the prohibited items list, which, to a degree, has increased the level of frustration among travelling passengers. But TSA's decision in 2013 to permit certain sharp objects raised major concerns primarily among airline groups, given members of these groups have been provided with additional security training, a reinforced door, FFDO, Air Marshals, and self-defense programs. While passengers have grown accustomed to these security measures, there is insufficient data to demonstrate if passengers would be accepting of these proposed changes. It is reasonable that one might expect the TSA to lift the ban on bringing bottles of water through airport security before permitting sharp objects in carry-on luggage. Therefore, this research study will demonstrate if passengers will continue to fly if liquids, gels, and sharp objects were permitted on board.

Purpose Statement

The purpose of the study is to analyze the current perception of TSA's prohibited items, specifically, liquids, gels, and aerosols over three ounces and sharp objects in carry-on luggage by airline consumers. There has been no significant aviation security related event after the formation of the TSA, given the upgraded screening technology and multiple security programs developed and enforced since September 11, 2001. Due to the vast security improvements at all

U.S. airports, this study will investigate if passengers are willing to accept possible TSA changes to lifting the ban on the liquids, gels, and aerosols size limit and sharp objects on board commercial aircraft.

Research Questions

The pre-experimental study will focus on two items currently on the TSA's prohibited items list in carry-on luggage: liquids and sharp objects. This will serve as a base line for the quantitative thesis. The research question under investigation is: What is the airline consumers' perception of items currently prohibited by the Transportation Security Association in carry-on luggage?

The sub research questions are as follows:

1. What is the perception of participant's comfort, trust, and willingness of flying if the ban on liquid sizes that can be carried on board an aircraft in carry-on luggage is lifted?
2. What is the perception of participant's comfort, trust, and willingness of flying if the ban on sharp objects that can be carried on board an aircraft in a carry-on luggage is lifted?

The dependent variables for this study are the comfort, trust, and willingness to fly levels of consumers as measured using a Likert-type scale. The independent variables will be the amount of allowed liquids and the ban or non-ban of sharp objects.

Study Significance

The significance of the study is to highlight the perception of airline consumers toward the TSA's decision to lift the ban on two items that are currently prohibited from being brought on board an aircraft in carry-on luggage: liquids and sharp objects. More importantly, the project will try to determine if a positive or negative attitude exists towards certain items being allowed on board an aircraft that were previously used in one form or another to conduct an act of terrorism. There are very few studies that investigate consumer's attitudes towards items on the TSA prohibited item list. This study may possibly demonstrate that consumers would continue to fly with the revised list but may feel more or less safe while flying. The majority of the controversy stems from the airline community, but given the extensive measures currently enforced by the TSA, a few changes can reduce the level of frustration among travelling passengers and possibly make flying a less frustrating experience for travelers.

Delimitations and Limitations

The following are limitations to the current study:

1. Prohibited items is a sensitive subject, therefore participants may answer questions on the survey based on emotion.
2. The survey is voluntary in nature. It will be hard to tell whether every subject will dedicate his or her full attention to finish the test.
3. Participants in the study may have limited knowledge of the improved security system (layered security system), which can affect the results of the survey.

4. Participants with significant experience or knowledge of the current security system can influence the results of the study in a negative or positive manner.
5. Given the lower age limit for the study is 18 years, there may be a possibility for bias in the study.
6. Gender can affect the study because females may demonstrate a negative attitude towards sharp objects but a positive attitude towards liquid, gels, and aerosols sizes.
7. Race can affect the study because non-Caucasian individuals may demonstrate a negative attitude lifting the ban because they may be subject to extensive screening or experience profiling, while Caucasian individuals may demonstrate a positive or neutral attitude towards lifting the ban.
8. Certain individuals may not be truthful when answering the survey or not truly understand the question when answering the survey because participants are provided a monetary compensation upon completing the survey.

The following are delimitations to the current study:

1. Participants that travelled on board a Part 121 scheduled carrier within the U.S. will only be considered for the study.
2. The survey will be limited to only participant's age 18 and older.
3. Participants will only be considered if they have travelled on a commercial airline since January 1, 2007 within the U.S.

Definition of Terms

Throughout this study, the term “prohibited items” includes liquids, gels, aerosols, and sharp objects. The term “prohibit” is defined as to forbid by authority, where the authority is considered to be the Transport Security Administration (Prohibit, 2011).

“Perception” refers to the experience of obtaining sensory information about the world of people, things, and events, and to the underlying process (Perception, 2004). In this study, the term “people” implies TSA, “things” is considered prohibited items, and lifting the ban is the “event”.

A “carry-on bag” is a small or compact bag that can be carried and stowed on board an aircraft (Carry-on, 2011). As a result of the September 11 attacks, under the Aviation and Transportation Security Act, all passengers are permitted to bring one carry-on baggage and one personal item on board an aircraft. The carry-on bag must meet size restrictions and be stowed properly in a storage compartment or under a passenger seat (FAA, 2014). The TSA permits certain liquids, gels, and aerosols as long as they comply with the 3-1-1 rules. In relation to the study, a “liquid, aerosol, or gel” is defined as (a) a substance that is liquid when at room temperature (b) an aerosol (c) a gel (d) a cream or (e) a paste (Substances Covered, 2013). While a sharp object is defined any item or object that has thin edge or fine point that is capable to cutting or piercing another item or object (Sharp, 2011). The TSA prohibited list contains specific liquids, gels, and aerosols, and sharp objects, which is attached in Appendix B.

The three dependent variables of this study are comfort, trust and willingness to fly. The term “comfort” can be defined as a soothing feeling individual experience. This feeling is experienced when our mind, body, and spirit is satisfied (Comfort food, 2009). As passengers, will this soothing feeling change if TSA lifts the ban on certain prohibited items? Or will the soothing feeling remain unchanged regardless of prohibited item permitted on board? Economists define the term “willingness” to pay as the amount of money an individual is willing to pay in order to secure a specified benefit (Garrod, 2008). In terms of willingness to fly, are passengers willing to continue flying if TSA lifted the ban on liquids, gels, and aerosols, and sharp objects or will he/she rethink their decision to continue flying given the items now permitted on board? Lastly, the term “trust” is defined extensively in Chapter 2.

Summary

Chapter one outlines a brief introduction to the topic and the issues currently affecting consumer’s perception of airport screening. Chapter two will discuss the current regulations set by the Department of Homeland Security and Transport Security Administration and the current programs they have introduced over the past thirteen years to avoid a repetition of September 11, 2001. This chapter will discuss any research that has been conducted or expert opinions from conferences on how airport-screening procedures can be made a pleasant experience for all travelling passengers. Chapter three includes a breakdown of the

methodologies used to design the survey and how participants were chosen to participate in the study.

CHAPTER 2: REVIEW OF THE LITERATURE

The previous portion of this study introduced the purpose of the study, problem statement, significance of conducting the study, and the research questions that directed the study. Chapter 2 focuses on review of the literature pertaining to the variables of the study concerning passengers' attitudes and perception towards current screening procedures and improvements that can benefit consumers' perception of aviation security. The review provides a brief insight into aviation security prior to 9/11 and after 9/11. A strong emphasis is made on the term *trust* because it is a vital dependent variable and can affect the other dependent variables, influence willingness and comfort, of an individual. If passengers trust the TSA's decision to lift the ban on prohibited items then he/she can demonstrate an adequate comfort level and willingness to fly. Therefore, understanding trust, organizational trust (TSA), and trust in the processes (layered security system) is of utmost importance to this study because it can influence a participant's decision in the study.

Definitions of Prohibit, Trust, and Organizational Trust

The term "prohibit" is defined as, to order (someone) not to use or do something (Merriam-Webster, n.d.). The TSA has designed a prohibited items list, which is required to be followed by all passengers travelling by air, land, or sea on board a public transport system. The list is constantly updated by the TSA. Items that are generally permitted on board an aircraft may be subject to additional screening or not allowed through the checkpoint if it triggers an alarm during the screening process, appears to have been tampered with, or poses other security

concerns. The final decision rests with TSA on whether to allow any items on the plane (TSA, 2014). The prohibited items list is specific to items that are prohibited in a carry-on, but permitted as a checked-in luggage and vice-versa, but certain items are prohibited regardless on board a carrier due to its volatile nature e.g. gun powder, aerosol, and lighter fluid (The TSA Blog, 2008).

The authors Lee and See defined “trust” as “the attitude that an agent will help achieve an individual’s goals in a situation characterized by uncertainty and vulnerability” (2004, p. 51). In the context of this study, the uncertainty and vulnerability of commercial passengers will be studied in association with the TSA lifting the ban on liquids, gels, aerosols, and sharp objects. The goal of this study is to analyze passengers’ attitudes towards allowing liquids and sharp objects on commercial aircraft, based on trusting the layered security system designed to protect each individual.

The term *trust* can be further assessed in political terms, known as *political trust* (Blind, 2006). Political trust occurs when citizens evaluate the government and its policy, regarding political leaders has honest, fair, and efficient. This political trust can be further directed towards specific organizations, such as the TSA, known as *organizational political trust*. The organizational political trust refers to “an issue-oriented perspective whereby citizens become trustful or distrustful of government because they are satisfied or dissatisfied with policy alternatives” (Blind, 2006, p. 3). In the context of this study, there is a probability that participants may have a positive perception and be trustful of TSA’s proposed

policies in the future because there has been no significant threat to the aviation industry in recent years, considering they have been a competent and organized agency for the past decade.

In a poll conducted in March 2001 by the *Los Angeles Times*, editors stated that 29% of the American public trusted the government to do what is right just about always or most of the time. After the events of September 11, the *Washington Post* conducted a similar poll; the level of trust in the government had increased significantly to about 64% (Chanley, 2002). This rise in trust can be considered significant because a passenger may change his/her attitude when it comes to national security. They may be more willing to accept change as long as the change will not affect their sense of security. Multiple scholars have identified public concern about threats to national security as a factor that may influence the degree of cynicism about government (Chanley, 2002). In relation to this study, consumers may be accepting to the proposed changes on prohibited items given the stringent security measures that have been adopted.

A vast majority of passengers comply with security measures and do not consider it to be a hassle because they trust the system in place (Mendenhall & Schmidhofer, 2013). Therefore, before a change such as lifting the ban on prohibited items, the TSA would be required to justify the decision with a thorough analysis and results. In order to earn public trust, the TSA should approach prospective changes by being more forthright and transparent with the public. This could be done by thoroughly justifying the proposed changes, with an analysis of

each change. To date, the TSA has not reported any form of performance or results pertaining to the effectiveness of the security system. The last report published by the TSA was in 2006, which highlighted the failure rate of detecting guns and knives in carry-on luggage. The failure rate was predicted to be about 70% (Mendenhall & Schmidhofer, 2013).

In order to gain trust from consumers, the TSA needs to inform the consumers of the layered security system put in place. Even though the data is public knowledge, methods of sharing this information to consumers is inadequate. For instance, the decision to permit sharp knives in April 2013 was not justified in a manner that would promote trust from the public. Perhaps if the change were explained with a thorough analysis and conveyance of the strength of the aviation security system, such as Air Marshal program, FFDO, hardened cockpit doors, etc., passengers would feel more comfortable with the change and trust the TSA more with their safety. Therefore, the current study is designed to analyze the level in which passengers trust the aviation security system, and to assess whether they are willing to continue flying comfortably knowing certain prohibited items are permitted on board.

The TSA and airline carriers have a list of prohibited items displayed throughout the airport and on their websites, but it does not notify passengers of the possible reasons why the item is prohibited. However, the TSA recently began working towards removing certain items from the prohibited list. This could be an indication that TSA is now focusing on finding items of high priority rather than

small items, such as perfume or small pocketknives. Given the outstanding security measures enforced, advanced technology and data collection agencies used to build an effective security system, this would be considered a change in the direction of TSA policies. However, these proposed decisions by the TSA have received controversial reviews and protests from the aviation community. Therefore, utilizing the limited data available on government websites such as TSA, ICAO, and IATA, this study will gain insight into the current perception airline *consumers* have towards prohibited items. Therefore, the current study will demonstrate if liquids of any size and sharp objects on the TSA prohibited list were to be allowed, would it change the comfort, trust, and willingness levels in which passengers currently travel?

The events of September 11, 2001 were a failure of the aviation security system managed by the Federal Aviation Administration within the U.S. For over a decade, the Government Accountability Office (GAO), considered to be the investigative agency of the U.S. Congress, conducted multiple studies on the weaknesses of aviation security within the United States. The first report was issued in 1987, the next two during the 1990s, and the last in 2000 (Dillingham 2000a; Fultz 1994, 1996; Peach 1987). The major concern in all these reports was terrorism, but all proposed recommendations failed to gain consideration from Congress to update the aviation security system. Since 1996, FAA had received more than \$1 billion from the U.S. Congress to upgrade the civil aviation security program and purchase new security equipment for U.S. airports (Dillingham,

2000b). Despite receiving significant funding, FAA was to slow install the equipment and implement stringent security regulations.

The devastating act of terrorism on September 11 was a result of a major lapse in aviation security due to a chain of events, such as poor screening procedures, improper methods of conveying crucial information in regards to possible terrorist attacks, and failure of the government to address the weaknesses of aviation security and airlines focusing on making profits rather than adhering to safety and security recommendations proposed by the GAO. Authors Jeffrey Price and Jeffrey Forrest highlighted the prior weaknesses of aviation security by stating, "...careless attitudes by airport employees toward maintaining security procedures may have been the reason certain airports were selected as the launch points for the terrorists on 9/11" (Forrest & Price, 2013, p. 184). Sharp objects were able to be smuggled on board the aircraft prior to 9/11, despite the terrorist undergoing secondary screening; they were able to board the aircraft with box cutters. The authors Camerer and Kunreuther in their journal titled "Decision Processes for Low Probability Events: Policy Implications" state that as humans, we are often more willing to take a risk of incurring a large but small probability loss in the future than accepting a smaller sure loss now (1989). The TSA have the workforce, technology, and critical information necessary to avoid another terrorist event, given the aviation security upgrade, we have the capability to take a small risk on certain prohibited items, which we previously were unable to. If the FAA had taken

the GAO's multiple security recommendations into consideration, the events of September 11, 2001 could have possibly been avoided.

Aviation Security Pre-September 11th, 2001

Prior to September 11, 2001, the FAA was tasked with the responsibility of regulating airport and airline security. All airlines were required to conduct their own passenger screening and baggage screening under the FAA guidelines. The FAA hired aviation security inspectors to monitor the airline screening procedures and airport security, inspectors were required to inform the FAA of any irregularities or violations committed by the either parties. Airlines, in turn, subcontracted this task to third party vendors; coincidently vendors with the lowest bid were awarded the contract. These contractors were poorly trained and usually worked for minimal wages, given the high workloads and strict attention to detail that was required to perform the job efficiently. "Airlines and not the government paid for the screening companies in the United States, there was little incentive to hire the "best and brightest," and more expensive, screening workforce" (Forrest & Price, 2013, p. 108). The FAA had not developed a training curriculum or set standards on how baggage screeners had to be trained, and the majority of the information available was vague and open to interpretation. If the airlines were found to be at fault in regards to any security breach, the FAA would impose fines on the airline, which, in turn, would then pass the fines to the subcontractors because they were responsible for the failure. The contractors, in turn, claimed to have met the government's "specific requirements" and pass the blame back to the

FAA for not setting appropriate measures. In fact, all three of them could be right (Hawley & Means, 2012).

A lapse in security was not an uncommon phenomenon before September 11. Individuals were allowed to bring sharp objects such as box cutters and small knives on board an aircraft. Aviation security authorities were under the impression that if an individual did take control of an aircraft, they could always be successful in negotiating terms with the individual. Hijacking was prominent in the 1960s and 1970s. It is estimated over 240 hijackings or attempted hijacking in those ten years occurred on flights between Cuba and the United States. Many of the hijackings were done for political asylum, release of prisoners, or financial gain (Forrest & Price, 2013). Pilots and flight attendants were instructed on how to gain control of a possible hijacking situation but no additional resources were spent towards prohibiting them from even occurring to begin with.

By 1974, the U.S. Congress had passed the Anti-Hijacking Act, requiring airlines to screen passengers and their baggage. The act was a significant step in aviation security because it instated armed law enforcement officers in the aircraft (now known as Federal Air Marshals) and mandating the death penalty or 20 years in prison for hijacking an aircraft (Department of State, 2006). In addition to the act, the U.S. government created a profile of how a hijacker would behave. The person of interest would often trigger the metal detector alarm, but upon further screening, he or she would usually have no item in their possession that would raise an alarm. And once the hijacker had the aircraft under their control, they would

allow the aircraft to land and begin negotiations. These are how the majority of hijackings previously occurred. For instance, the terrorist of September 11 had triggered the metal detector prior to boarding the aircraft but did not raise suspicion. The events of 9/11 caught the U.S. government by surprise because the hijackers were more interested in the aircraft than the hostages.

In the United States, screening of domestically-flying passenger-checked bags and carry-on bags did not commence until 1980. Despite this fact, the International Civil Aviation Organization (ICAO) Annex 17 stated that screening of baggage was crucial to aviation security (Shanks & Bradley, 2004). Less than 5% of passenger bags were screened prior to 9/11, but that decision was based on the Computer-Assisted Passenger Prescreening (CAPPS) program. The CAPPS program was a joint airline effort to deter possible bombing of the aircraft, not hijacking, by conducting secondary screening when passengers checked in at the airport ticket counter. The CAPPS program selected passengers based on the characteristics of how the ticket was purchased. For example, the program examined how the ticket was purchased, whether it was a one-way ticket, and how the traveler responded to specific questions when asked by the ticketing agent. If the agent had a doubt or suspected an odd behavior, the passenger would be required to undergo secondary screening. The secondary screening consisted of security screeners waving a metal detector over the passenger's body after he/she had passed through a walk-through metal detector (WTMDs). These secondary screenings were not foolproof, as they were outdated, and WTMDs do not detect

plastic explosives because the possibility of a terrorist designing a plastic explosive was unheard of (Forrest & Price, 2013).

After the bombing of Air India Flight 182 in 1985 and subsequent bombing of Pan Am Flight 103 in 1988, conventional X-ray machines were installed at a majority of the airports to screen carry-on luggage. Also, measures were taken to ensure no baggage was placed in the aircraft without the passenger on board, which is known as the Passenger-Baggage Matching Program. The primary function of the X-ray machines was to detect weapons and explosives, but neither device actually “detected” weapons or explosives (Forrest & Price, 2013). A GAO study conducted at 34 airports across the United States stated that the baggage screeners detected prohibited items 48% to 99% of the time (GAO, 1987). Sharp objects, such as knives and box cutters, shorter than four inches were permitted on board an aircraft. Operatives of 9/11 would bring box cutters on board an aircraft and observe passengers and flight attendants reactions to the items (Forrest & Price, 2013). The gaps in aviation security were prominent and failure of the U.S. government to tackle the issue in a proactive, rather than reactive, manner contributed to the tragedy of September 11.

Current generation terrorists are no longer negotiating or demanding ransom as they are focused on causing significant damage that can cripple the economic stability of a country. According to Forrest and Price, we live in a “post-9/11 world where aircraft are used as weapons of mass destruction (WMD) and hostages are merely victims (or obstacles) to the end result” (Forrest & Price, 2013, p. 51).

Aviation Security Post-September 11th, 2001

The impact of September 11 was devastating. In addition to taking away 3,000 innocent lives, it damaged global security and the U.S. economy. It is estimated the aviation industry experienced losses of \$330 million per day after September 11; passengers were skeptical of flying and major delays across the U.S. contributed to this loss (Kumar et al., 2003). Immediately after the attack, in November 2001, the U.S. Congress anonymously passed the Aviation and Transportation Act. The act created the Transport Security Administration (TSA), currently under the Department of Homeland Security (DHS).

The TSA was charged with developing new regulations and policies to enhance U.S. Transportation, but its primary focus has been airport security. Many changes to the nation's transportation network have been made in the area of aviation (Wodele, 2005). In the budget for fiscal year 2004, \$4.22 billion (86%) of the TSA budget was allocated for aviation security (Bullock et al., 2006). The TSA began its new responsibility by taking over all airline-screening responsibilities at U.S. airports. All screening equipment used prior to 9/11 was replaced with state-of-the-art imaging technology. Passengers' checked-baggage were now screened using explosive detection equipment (EDS) and explosive trace detection testing (ETD) to detect if passengers or their bags have come in contact with any explosive materials. The TSA hired over 55,000 screeners (Forrest & Price, 2013) to deter any possible terrorist act. In addition to screening passengers and their baggage, the TSA oversees multiple other programs such as:

- Federal Air Marshal Program: it is estimated the program has over 5,000+ full time marshals (Forrest & Price, 2013)
- National Explosive Detection Canine Team Program: Canines are used at airports and cargo depots to detect passengers smuggling counter band and explosives. Canines are still considered to be more effective at detecting any anomalies than current X-Ray equipment.
- Training and certification of Federal Flight Deck Officers (FFDO): under this program, only a selected few pilots have the privileges of carrying an armed weapon on board an aircraft.
- Crew Member Self-Defense Training Program: the TSA provides free self-defense classes to crewmembers. Prior to 9/11, crewmembers would comply with hijackers, but currently crewmembers go on the offensive to protect the cabin. In 2003, an individual attempted to rush the cockpit, but attendants and flight crew prevented the hijack of the plane (Baum, 2011).
- Armed Security Officers Program: provides security law enforcement officers (LEO) for General Aviation aircraft arriving and departing Ronald Reagan National Airport.
- Office of Training and Development: provides insight on all possible explosives that may be used to bring down an aircraft.

All passengers that purchase airline tickets are screened via a comprehensive list that contains names of individuals on the” no-fly list” and “selectee list,” which are part of the terrorist watch list known as the National

Terrorist Screening Center (NTSC). The NTSC is tasked with the responsibility of identifying known and suspected terrorists. Prior to 9/11, the FAA's no-fly list consisted of only 12 individuals (Forrest & Price, 2013). The improved passenger screening was known as "secure flight." The TSA adopted a layered security system (Refer to Appendix A) to deter any possible terrorist activity. The layered system begins from the time passengers purchase a ticket up until they have arrived at their destination and exit the airport. The TSA brought about multiple changes at the airport and airline operators. But all these rapid changes have come at a high cost. With many items prohibited in a carry-on, passengers are forced to check-in bags. The current baggage system was designed to only handle a set amount of checked bags and modifying the baggage system and installing EDS equipment to accommodate more bags has been very costly. Renovating the baggage system is complicated because airports have to still rely on FAA Airport Improvement program (AIP) funding to make any major changes, which can be a very slow process due to stringent budget allocation by the U.S. Federal Government. In 2000, delays were reported around twelve minutes per flight, and this delay on average cost \$10 billion in fees to the airline industry (DRI-WEFA, Inc., 2002). On average the delay on October 2013 was reported to be around fifteen minutes per flight (Lee, 2013).

After 9/11, passengers were required to wait for extend periods of time to complete security check because the entire screening process was in a state of alert and all passengers were required to go through a strict screening procedure.

Passengers became accustomed to the change because a higher level of security implied safer skies, but, overtime, frustration began to rise among travelers due to long lines. The “goal” time for an individual to wait in the screening queue is ten minutes (Hawley & Means, 2012). In August 2006, wait times once again increased when the liquid bomb plot in the United Kingdom was discovered, passengers were no longer able to bring any liquids or electronics on board because of the possibility of terrorists using an electronic device to trigger a liquid based bomb in the checked luggage. This TSA decision caused a major inconvenience among passengers because all travelling passengers were required to check-in all baggage, which led to further delays across the U.S. Screening carry-on baggage became a greater challenge because the prohibited items list continues to grow, which could possibly cause further delays in the future. The TSA currently averages between 175-250 passengers per hour per screening line, but there can be a significant change in wait time in case of a security breach or an aviation related security issue internationally (Forrest & Price, 2013). The introduction of TSA Pre Check and full body scanners can decrease wait times significantly. TSA Pre Check was created to accommodate business travelers and frequent flyers. Individuals selected for the program are designated a special identification number and move rapidly through security checks because they do not have to take off any clothing or accessories when entering a full body scanner. Overall, since the formation of TSA, there have been no significant terrorist acts on the same level as September 11. (Refer to

Appendix B for the list of TSA prohibited items in a carry-on and Appendix C for the timeline on security regulations introduced after the formation of TSA.).

TSA Layers of Aviation Security System

The TSA adopted a layered security system, which can be compared to the James Reason's Swiss Cheese Model (Young, Shorrock, and Faulkner, 2005). The Swiss cheese model of accident causation theory is a series of cheese slices placed in a vertical or diagonal manner. The slices relate to the multiple layers of defenses an organization builds in order to prevent a hazard. On occasion, organizations can become complacent, which can result in all the holes in each cheese slice momentarily align, permitting a hazard to pass through the holes of all the defenses, which leads to an accident. The FAA was complacent of aviation security screening that resulted in an industry-defining event. After 9/11, the TSA took over all screening procedures. They installed multiple defenses to deter another attack. The layered system of security was designed to deter, detect, and disrupt any individual with intent to cause harm to the airline industry. The primary layers include checking of documents by Transport Security Officers (TSO's), TSO's examining baggage using EDS and ETD, and Behavior Detection Officers (BDO's) that use SPOT (Screening Passengers by Observation Techniques) to analyze passenger behavior and appearance (GAO, 2010). The SPOT program utilizes behavior and appearance to identify individuals of interest. The program is similar to the behavior detection analysis currently used by Israel's El Al airlines. The decision on TSA's part to utilize the SPOT program as a level of defense has received

criticism because it can be considered racial profiling (Forrest & Price, 2013). The other layers included reinstating the Federal Air Marshal program, FFDO, and advanced screening equipment.

As mentioned earlier, when passengers purchase a ticket, their information is scanned through an FBI list that contains individuals of interest. Upon arriving at the airport, multiple closed-circuit televisions' (CCTV) are constantly monitoring all areas of the airport, sterile and non-sterile areas. When a passenger approaches the ticket counter, he/she is required to provide a government issued ID to the ticket agent prior to receiving a boarding pass. All checked baggage then passes through an EDS system. If the machine detects a threat item, the bag is sent to secondary screening, which is known as the threat resolution room (TRR). A TSO then chooses to either physically inspect the bag or use a canine. If the bag cannot be cleared, then the TSO notifies law enforcement to either detonate the item or remove the device (Forrest & Price, 2013). As the passenger proceeds towards security check, he/she is constantly monitored by law enforcement officials, airport employees, and behavior detection officers' (BDO). After successfully clearing security check, which can consist of walking through a full body scanner, secondary screening in a private room for selected individuals, and screening of carry-on bags, passengers enter the sterile area. Passengers are constantly monitored by CCTV's, which can be coupled with biometric imaging devices for accurate facial recognition. Once on board an aircraft, passengers may not be aware of the presence of an air marshal and/or federal law enforcement officer on board. Pilots operating the aircraft may

or may not be enrolled in the FFDO program. This element of surprise helps in deterring any possible attack once airborne. Present day crewmembers are also trained to detect odd behavior and report any suspicious activity to the deck crew. In December 2001, crewmembers and passengers successfully restrained Richard Ried from blowing up American Airlines Flight 63 (Forrest & Price, 2013). Richard Ried, also known as the Shoe Bomber, attempted to blow up a plane with explosives packed into his shoes. Passengers and crewmembers restrained him as he unsuccessfully tried to detonate the bomb. As a result of this event, passengers departing from the United States are required to take off their shoes and place them in the X-ray machine before walking through a full body scanner.

Since TSA adopted the layered security system, there have been at least 35 attempts to hijack an aircraft. In all attempts hijackers were restrained by crewmembers, passengers, air marshals, or law enforcement personnel on board (Forrest & Price, 2013). The decision on part of the U.S. government to establish the TSA and encourage its evolution was regarded as, "...one of the federal government's greatest successes of the past half-century," by Paul C. Light, a Brookings Institution scholar and professor of New York University (Goo, 2005, p. 1). TSA's new regulations set the benchmark in terms of how other airports around the world manage aviation security. After 9/11, there has been a trend toward proactive policy making in the United States and around the world (Forrest & Price, 2013). (Refer to Appendix A for a chart that outlines the TSA Layered Security System.

Secure Flight

In 2009, the TSA implemented Secure Flight, an airline passenger pre-screening program. The program enhances aviation security domestically and internationally through matching passenger information against a comprehensive list of people of interest to the FBI and other law enforcement agencies. All passengers are required to submit their name, date of birth, and gender simultaneously when purchasing an airline ticket (TSA, 2014). This is a crucial layer of the TSA layered security program because it prevents individuals who are currently on the No Fly List from boarding an aircraft and identifies passengers on the selected list to undergo secondary screening (TSA, 2014).

The secure flight program is similar to the first passenger-profiling program adopted by the airlines, known as CAPPs. The TSA secure flight program is designed to deter all possible acts of terrorism, while CAPPs was designed to prevent bombings but not hijackings. Several of the 9/11 hijackers were flagged under CAPPs (Forrest & Price, 2013). Individuals selected under CAPPs were required to undergo secondary screening prior to boarding an aircraft, but TSA's secure flight requires individuals of interest to undergo a thorough secondary screening in the presence of a law enforcement officer in an enclosed room. Airlines continue to use CAPPs as a method to collect information of all individuals purchasing tickets and then submit the list to Secure Flight for matching against multiple lists. (Appendix D contains a flowchart of TSA's secure flight.)

Prohibited Item: Sharp Objects

In 2013, TSA proposed to permit passengers to carry folding pocketknives with blades up to 2.36 inches in length, as well as sporting equipment (Burns, 2013). This was considered to be a controversial proposal because a regular box cutter was used during the terrorist attacks on September 11t 2001, and it was feared by some that this decision could cause a repetition of the attacks. This proposal drew heavy criticism and was highly opposed by the airline community, significantly by pilots and flight attendants, citing it could lead to terrorist activities. Although, airline employees working in restaurants or conducting maintenance in the sterile areas have access to sharp objects such as knives, screwdrivers, and box cutters, and could pass the item to a terrorist, or the individual could steal the object from the crewmember (Forrest & Price, 2013). Nevertheless, the decision by the TSA to amend the regulations is a major step towards changing consumers' perception of current security measures by decreasing wait times and amending the prohibited item list.

Prohibited Item: Liquids, Gels, and Aerosols

Initially, on August 10, 2006, TSA banned all liquids and gels from carry-on bags as a result of a foiled transatlantic aircraft plot, where terrorists were plotting to detonate liquid explosives disguised in soda bottles on board at least ten airlines travelling from the United Kingdom to the United States and Canada. The rationale was to prevent potential bombers from carrying explosive components onto an aircraft, then assembling the devices in aircraft lavatories (Forrest & Price, 2013). After extensive testing by independent organizations under the guidance of

the TSA, the rule was eventually revised to the “3-1-1 rule”: 3.4 ounce (100ml) bottle or less (by volume); 1 quart-sized, clear, plastic, zip-top bag; 1 bag per passenger placed in screening bin (TSA, 2014). The average wait time to walk through airport security check was about 15-20 minutes prior to the formation of the TSA. The wait time has since doubled, varying between 30-45 minutes, depending on the airport and time of day. (Yaukey & Benincasa, n.d.). These wait times may have increased because passengers are now required to remove their shoes, jackets, liquids, accessories, and laptops prior to walking through a full body scanner.

The TSA prohibited list was tabulated taking into consideration all items that can be volatile in nature, in addition to their potential use by terrorists, and items that were allowed on board an aircraft were now subject to extensive screening. Consumers were unable to bring bottled water or a bottle of perfume in their carry-ons due to the possibility of a terrorist attack. Items deemed prohibited by the TSA as carry-ons had to be stored in a checked-in luggage. These extensive security measures have been successfully implemented by the TSA for over a decade but have caused frustration and distress among travelling passengers. Over the years, new regulations have been implemented and the TSA is moving towards reducing the security screening wait times at airports by introducing the TSA pre-check program, a passenger watch list, and collecting all travelling passenger information when a flight ticket is purchased. In 2004, Tokyo Narita Airport had begun testing liquid explosives detection technology to allow passengers to bring

liquids on board (Forrest & Price, 2013). The TSA has also begun testing new liquid screening systems that use light waves to screen containers with possible explosive liquids (Forrest & Price, 2013), but there is no definite timeline on when the new detection equipment will be installed. For now, the TSA prohibited items list has had no changes since it was initiated; rather, the list continues to grow.

Previous Studies

There are very limited studies conducted in relation to consumer perception of prohibited items. The primary focus of published studies has been on public attitudes to current screening methods adopted by the Transport Security Administration and their level of satisfaction with the security measures.

The study conducted by Mitchener-Nissen, Bowers, and Chetty (2011) examined why travelling passengers preferred full body scanners or pat-downs and measured the effects of presenting passengers unbiased information about scanners at the screening checkpoint. The results were straight forward, as passengers were more accepting to using a full body scanner (>90%) over a traditional pat down (>80%). However, passengers were presented with unbiased information about scanners, which resulted in a significant positive increase in their overall favorability towards this technology and its current operation (Mitchener-Nissen, Bowers, & Chetty, 2011). The authors in this study only examined one parameter (full body scanners) and did not examine consumers' perception to the current prohibited items list. The study conducted by the researches can be replicated to examine consumers' perception of current TSA ban on liquids, gels, aerosols, and

sharp objects. The study had its limitations because the questionnaire was presented to participants at an airport that had the full body scanners installed. If the questionnaire was presented to participants at an airport that did not have the scanners, results could have varied considerably. The current study will also present participants with a questionnaire and will include all passengers: TSA Pre Check, Global Entry, and everyday passengers

A second study conducted by Gkritza, Niemeier, and Mannering (2006) used data from 2002 and 2003 to estimate multinomial logit models to uncover factors that determine passenger satisfaction at security screening points. The results demonstrated that wait times do have an effect on customer satisfaction but that could have been caused by multiple factors. Moreover, airport security practitioners need to refine security procedures to have a stable satisfaction rate, rather than focus on minimizing wait times. This study has significance because it measures satisfaction based on archival data that was collected after September 2001. This is crucial to the current study because there could possibly be a correlation between wait times and passenger perception. Given the advancement in detection equipment at airports and no major hijacking/bombing event since 2001, passengers could be more willing to lift the ban on prohibited items, which, in turn, could increase customer satisfaction at airports. Also, passengers may demonstrate a positive attitude towards lifting the ban on liquids, gels, aerosols, and sharp objects because they may want to move through security screening as quickly as possible.

The last study conducted by Yoo and Chul Choi (2006) was a study on the relative importance of the means to improve passenger security checks at the airport, taking into account the effectiveness of the screening tasks. The results of the study demonstrated that the most important factor to raise effectiveness of passenger screening would be human resources (Yoo & Choi, 2006). The researchers distributed questionnaires to experts or individuals who have extensive understanding and knowledge of screening procedures. In this study, participants complained of long working hours and the inability of screening equipment to detect all possible prohibited items. This study is significant because in April 2013, the TSA proposed to lift the ban on sharp objects because screeners were spending excessive time searching through every bag for a possible prohibited item, when they should be focusing primarily on detecting explosives and more harmful items. The study only suggests increasing screeners at security checkpoints to increase performance levels, but since the formation of TSA, the U.S. government has spent billions of dollars upgrading over 460 airports. This study is significant to the current study because it may demonstrate attitudes that are more favorable to lifting the ban on prohibited items.

Current Study

There have been no studies conducted that analyzes passenger's perception to prohibited items. The current study lays the foundation to enhance further research into understanding how consumers perceive aviation security after more than a decade of stringent security measures. Are passengers willing to continue

flying if liquids, gels, aerosols, and sharp objects were once again permitted on board? Are passengers going to feel comfortable knowing that other passengers may have a box cutter in their carry-on baggage? And lastly, are passengers going to trust flying given the TSA has lifted the ban on liquids, gels, aerosols, and sharp objects?

Mitchener-Nissen, Bowers, and Chetty, (2011) conducted a study that examined passengers' attitude towards full body scanners but did not examine passenger attitudes towards prohibited items. It has been over ten years since the last major hijacking event, and, given the enormous funding that has been provided by the government to upgrade security screening, it may be a matter of time before they start permitting sharp objects and liquids on board an aircraft. The second study addressed passenger satisfaction of aviation security screening based on wait times but it does not address if passengers are willing to accept shorter wait times if the TSA permits certain prohibited items. The current study will address these issues in a non-biased manner. Lastly, Yoo and Choi (2006) conducted research on current issues faced by screeners, but it doesn't take passenger issues into consideration. The researchers suggested better equipment and working environment was a priority for screeners. The current study address this issue from a passenger's perspective, are they willing, comfortable, and trusting of the current aviation security measures to accept the TSA lifting the ban on certain prohibited items?

Summary

The term *trust* was reviewed first because it was a vital dependent variable of the study. If passengers trust the processes designed by the TSA, then they will continue to have the same level of comfort and willingness to continue flying. If an event was to occur, the trust in the system could be difficult to regain. A brief overview of aviation security prior to September 11, 2001 was stated, which highlights the failures of aviation security. This may have affected the trust of passengers because they trusted the government to provide national security. The study further highlights the changes the government has designed, adopted, and enforced to build the current security system, which may have significantly increased passengers' trust in aviation security. Lastly, previously conducted studies on passenger attitudes towards aviation security are discussed along with their corresponding results. However, previous studies do not discuss the current perception passengers have of prohibited items.

CHAPTER 3: METHODOLOGY

The study was designed to determine if airline consumers have a positive or negative perception of TSA prohibited items, specifically, restrictions on liquid, gels, and aerosol sizes and sharp objects in a carry-on luggage. The primary goal of the research was to determine out of a possible six conditions, which condition had a significant positive and negative perception when compared to the rest.

Research Design

The research was a quantitative factorial design study, and the population used for the study was a convenience sample. The participants were residents of the United States, and in order to qualify to take the questionnaire, participants must have travelled on a commercial aircraft that departed a U.S. airport after January 2007 and be at least 18 years of age. The questionnaire was distributed via Amazon's ® Mechanical Turk (MTurk) ® and was based on a seven-point Likert-type scale. The service provided a small remuneration to participants completing the questionnaire. The G Power statistical software was used to calculate the power and determine the minimum sample size of the study. The ANOVA a priori power analysis was conducted with a medium effect size of 0.25, power = 0.8, $\alpha = .05$, which indicated a minimum sample size of approximately 211 participants, with 35 in each group.

An online survey program, Fluid Surveys, was used to create six separate questionnaires, which also included demographic questions. The questionnaire was administered to six independent groups. Participants were instructed to read the

instructions and questions entirely prior to answering the questionnaire. (The questionnaires can be found in Appendix F.)

Population and Sample

The target population for this study was individuals in the United States of America that are 18 years of age and above who have travelled on board an airline that operates under Part 121 operating rules. The scheduled carrier must have departed from any U.S. airport where the Transport Security Administration conducts security screening since January 1, 2007. The G*Power allocated a sample size of 211 participants, with 35 in each groups. However, it was determined that a sample size of 360 participants, with 60 in each group, would be appropriate for this study. This decision was selected because even though participants met the required age criteria, not all participants may have travelled on board a commercial aircraft after January 2007.

Instrument

The questionnaire was presented online using Fluid Surveys and a Likert style instrument. Questions developed for the study were tested among a group of ten participants for clarity. Each questionnaire was made available online until 80 participants had taken the questionnaire. After the participant target was reached, the questionnaire was automatically closed. Participants were recruited via Amazon's Mechanical Turk (MTurk). MTurk is an online service that allows interested participants to participate in Human Intelligence Tasks (HITs) in

exchange for monetary compensation. Participation in a HIT is voluntary and anonymous.

The questionnaire first asked if the participant was over 18 years of age. Participants that selected “yes” were then allowed to proceed further; participants that selected “no” were not allowed to participate in the study. The questionnaire then goes on to ask participants if they had travelled on board an aircraft that departed a U.S. airport after January 1, 2007. Participants that chose yes were then asked to answer three scenario-based questions. The first scenario measured the participants’ comfort, the second scenario measured the participants’ trust, and the third scenario measured the participants’ willingness. After successfully answering the three questions, participants were then asked four demographic questions. Participants who did not answer all the questions on the survey were not be included in the study. (Raw data is available upon request. A copy of the questionnaire is attached in Appendix F.)

Research Procedure

As mentioned earlier, only participants that meet the criteria set by the researcher were allowed to participate in the study. All participants were required to sign an electronic consent form prior to participating in the study. A brief description of current TSA policies on liquids, gels, aerosols, and sharp objects was presented to participants prior to beginning the survey. The 7-point Likert scaled questions were presented in random order. This was done to ensure consistency when participants answered the questions, and to reduce bias. The 7-point Likert

scaled response scale ranged from Extremely Uncomfortable/Distrustful/Unwilling, denoted as -3, to Extremely Comfortable/Trusting/Willing, denoted as +3.

The two independent variables are (1) amount of Liquids, Gels, and Aerosols and (2) ban or non-ban of Sharp Objects. The first independent variable had three levels (a) Liquids, Gels, and Aerosols (b) Liquids, Gels, and Aerosols in sizes of 3-1-1 and (c) Liquids, Gels, and Aerosols in sizes greater than 3-1-1. The second independent variable consisted of two levels (a) No Sharp Objects on board and (b) Sharp Objects permitted on board. The TSA “3-1-1” regulation specifies: 3.4 ounce (100ml) bottle or less (by volume); 1 quart-sized, clear, plastic, zip-top bag; 1 bag per passenger placed in screening bin (TSA, 2014). The matrix in Table 1 identifies the various interactions between the liquids and sharp objects conditions.

Table 1: Matrix analyzing relationship between variables.

Sharp Objects	Liquids, Gels, & Aerosols		
	All Liquids, Gels, & Aerosols Prohibited	All Liquids, Gels, & Aerosols sizes of 3-1-1 only Permitted	All Liquids, Gels, & Aerosols container sizes greater than 3-1-1 Permitted
Sharp Objects Prohibited	Condition 1	Condition 3	Condition 5
Sharp Objects Permitted	Condition 2	Condition 4	Condition 6

Data Analysis

Based on the above literature review on trust, the three dependent variables of comfort, trust, and willingness will have high internal consistency, as measured

by Cronbach's Alpha, and therefore were merged into one dependent variable for the purposes of data analysis. The data from the survey was analyzed using an ANOVA using IBM SPSS. SPSS is exploratory data analysis and modeling software. It presents the results of analysis both graphically and numerically. The limitations, conclusions, and discussions are presented in Chapter 5. The Likert scaled questions are significant to the study because it demonstrated six possible outcomes to the study:

$H1_0$ = We predict no difference in comfort/trust/willingness as a function of the amount of liquids/gels/aerosols that are allowed on board.

$H1_1$ = We predict a difference in comfort/trust/willingness as a function of the amount of liquids/gels/aerosols that are allowed on board.

$H2_0$ = We predict no difference in comfort/trust/willingness as a function of whether or not sharp objects are allowed on board.

$H2_1$ = We predict a difference in comfort/trust/willingness as a function of whether or not sharp objects are allowed on board.

$H3_0$ = We predict no significant interaction between the two independent variables.

$H3_1$ = We predict a significant interaction between the two independent variables.

The analysis of the data is explained thoroughly in Chapter 4.

Protection of Participants' Rights

An Exempt Institutional Review Board (IRB) form was submitted for approval prior to data collection. The IRB agreed that the study posed minimal risk to participants.

Summary

Participation in the study was voluntary and anonymous. The sample size was 363 individuals that reside in the U.S and were a minimum of 18 years of age that have travelled onboard a Part 121 scheduled air carrier since January 1st, 2007. The survey consisted of four research questions and four demographic questions and was distributed via Amazon's ® Mechanical Turk (MTurk) ®, and responses were based on a seven-point Likert scale. Each participant took an average of three to 5 minutes to complete the survey. The survey methodology did not collect any identifying information.

The study focused on two variables: liquids, gels, and aerosol sizes and sharp objects. The survey was designed to acquire responses to questions formulated based on the above two variables. The 7-point Likert-type scaled response scale ranged from Extremely Uncomfortable/Distrustful/Unwilling, to Extremely Comfortable/Trusting/Willing. Responses from the survey will be analyzed using an ANOVA using IBM SPSS software. The results from the SPSS software will be extrapolated using descriptive statistics. Results of the study are presented next, in Chapter 4.

CHAPTER 4: RESULTS

As mentioned in Chapter 3, a two-factor (3 x 2) Analysis of Variance was conducted to evaluate passenger's perception towards TSA prohibited items, specifically sharp objects and liquid, gels, and aerosol sizes. The two independent variables in this study are TSA liquid sizes (no liquids permitted, TSA liquid size 3-1-1 permitted, and all liquid sizes permitted) and sharp objects (no sharp objects permitted and sharp objects permitted). The dependent variable is comfort, trust, and willingness score, with higher scores indicating higher levels of comfort, trust, and willingness to board an aircraft.

For the dependent variable, we conducted a reliability test in SPSS that measures internal consistency, which studies how closely related a set of items are as a group because the response to one dependent variable had an influence on the other two dependent variables. For example, if a passenger were trustful of TSA permitting sharp objects and all liquids, gels, and aerosols container sizes greater than 3-1-1 on board an aircraft, then more than likely they would be willing and comfortable in boarding an aircraft. The Cronbach's alpha coefficient for the three items was .93, suggesting that the items have relatively high internal consistency (Kline, 1993). Therefore, we justified combining this data into one measure. The means and standard deviations for the combined measure as a function of the two factors are presented in Table 2.

Table 2: Means and Standard Deviations of Consumer Perception*

Sharp Objects	Liquids, Gels, & Aerosols		
	All Liquids, Gels, & Aerosols Prohibited	All Liquids, Gels, & Aerosols sizes of 3- 1-1 only Permitted	All Liquids, Gels, & Aerosols container sizes greater than 3-1-1 Permitted
Sharp Objects Prohibited	1.65 (1.25)	1.52 (1.35)	.87 (1.46)
Sharp Objects Permitted	-.16 (1.62)	.22 (1.75)	-.17 (1.91)

*Standard Deviations shown in parentheses

Tests of Between-Subject Effects

Table 3: Two-way Analysis of Variance for Consumer Perception.

Source	SS	df	MS	F	p
Sharp Objects	173.34	1	173.34	70.89	.000
Liquids, Gels, and Aerosol Sizes	17.47	2	8.73	3.57	.029
Sharp Objects x Liquids, Gels, and Aerosol Sizes	9.15	2	4.57	1.87	.16
Within (Error)	873.00	357	2.45		
Total	1236.56	363			

The results of the two-way ANOVA indicated there was a significant main effect on liquid, gels, and aerosols sizes onboard an aircraft, on the comfort, trust, and

willingness of passengers, $F(2, 357) = 3.57, p < .03, \eta p^2 = .02$. In Figure 1, when we ignore sharp objects, the overall comfort, trust, and willingness to board an aircraft is very similar when passengers are prohibited from bringing onboard any liquids, and when they are restricted to TSA 3-1-1 regulations. The significant main effect is likely because to the drop in comfort, trust, and willingness when liquids of all sizes are permitted onboard an aircraft. This indicates that a passenger may likely demonstrate a neutral perception (of comfortable, trusting, and willing) towards boarding an aircraft when there are no liquid, gels, and aerosol size restrictions. The error bars in the graph represent the standard error of the mean.

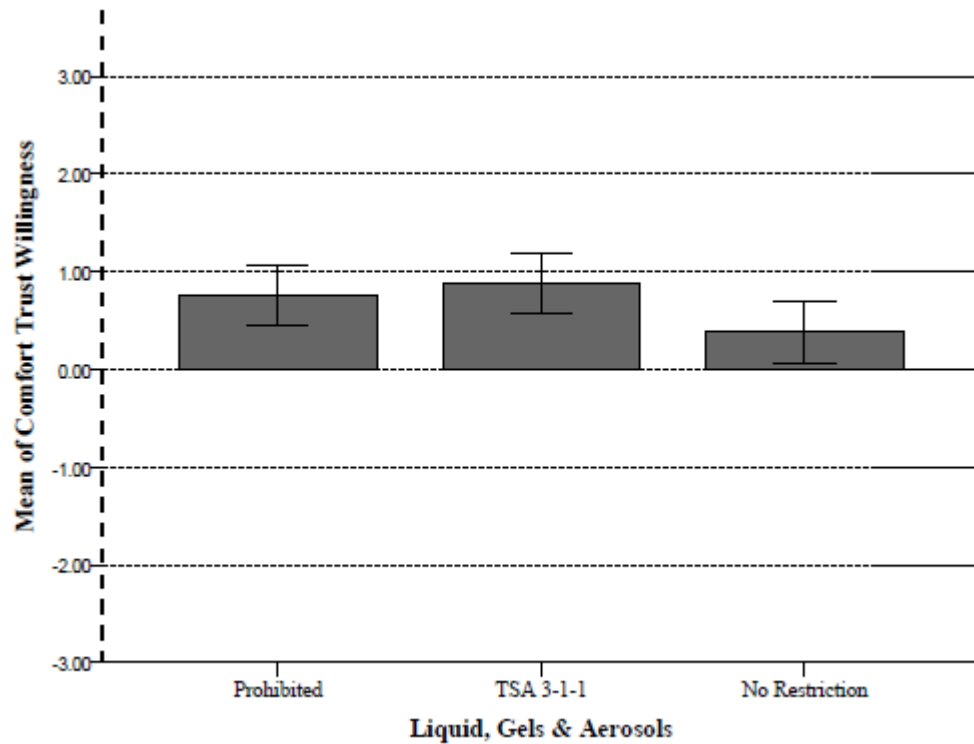


Figure 1: Graph showing the main effect of liquid, gels, & aerosols.

Additionally, the results of the two-way ANOVA indicated there was a significant main effect on sharp objects being permitted or prohibited onboard an aircraft, on the comfort, trust, and willingness of passengers, $F(1, 357) = 70.89, p < .001, \eta^2 = .17$. In Figure 2, when we ignore liquids, gels, and aerosol sizes there is a significant main effect, which is reflected by the drop in passengers comfort, trust, and willingness, when sharp objects are permitted. This indicates that a passenger is uncomfortable, untrusting, and unwilling to board an aircraft if sharp objects were prohibited. The error bars in the graph represent the standard error of the mean.

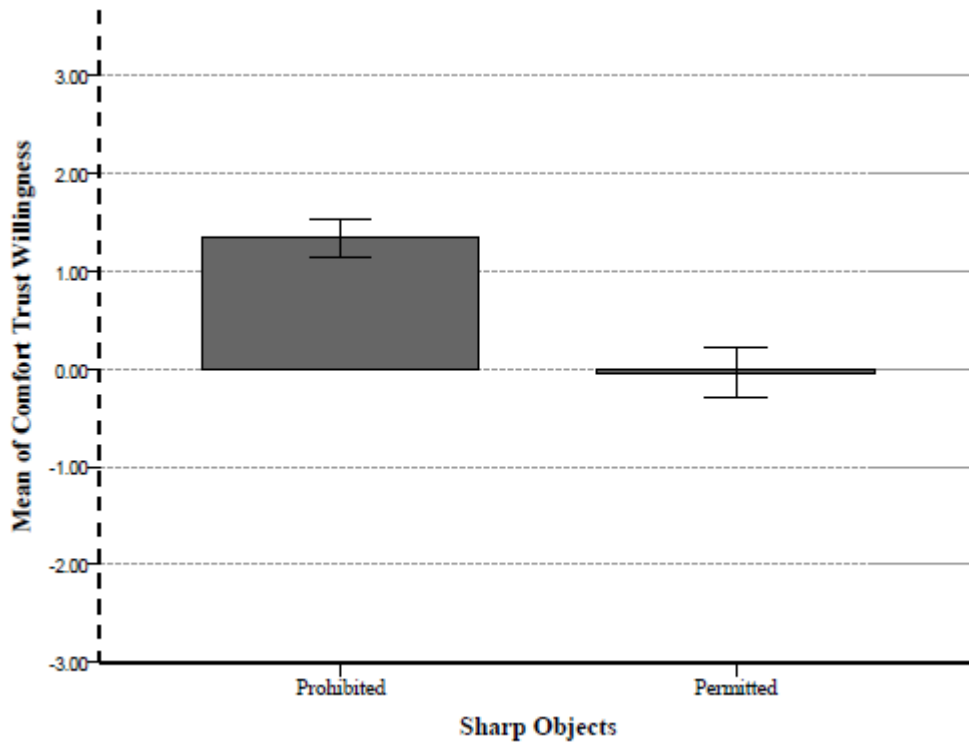


Figure 2: Graph showing the main effect of sharp objects

Lastly, The results of the two-way ANOVA indicated there was no significant interaction between sharp objects and liquids, gels, and aerosol sizes, on the passengers comfort, trust, and willingness to board an aircraft, $F(2, 357) = 1.87$, $p = .16$, $\eta p^2 = .01$. In Figure 3 and Figure 4, we observe that there is no significant interaction, which is usually shown by a parallel line in Figure 4. We can observe that when passengers are permitted to bring sharp objects onboard, the level of comfort, trust, and willingness to board an aircraft drop significantly, when sharp objects are prohibited the level increases. This gives us an indication that passengers likely have a negative perception of sharp objects in a carry-on luggage and a positive perception of liquids, gels, and aerosols of any size in a carry-on. The error bars in the graph represent the standard error of the mean.

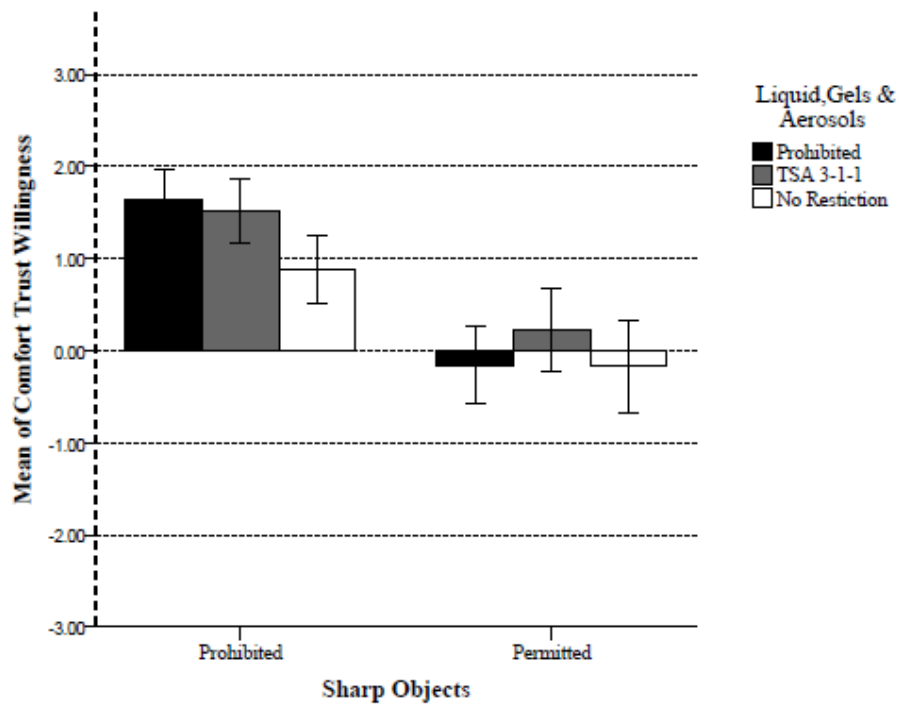


Figure 3: Graph showing no interaction effect.

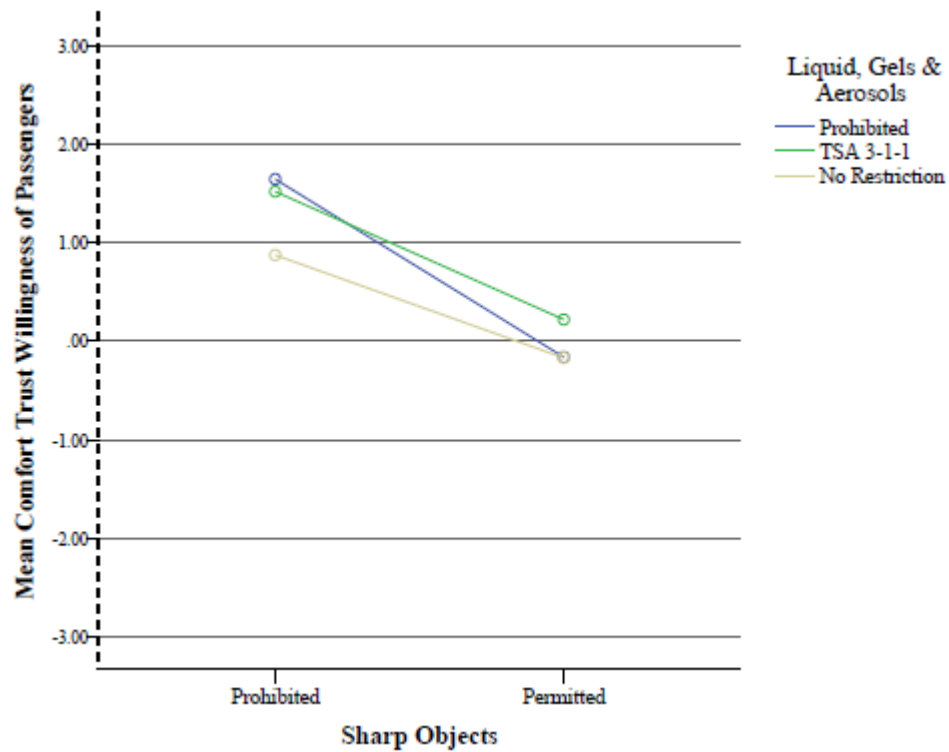


Figure 4: Graph depicting the parallel lines, indicating no interaction effect.

Post Hoc Test

There were three levels of the liquids, gels, and aerosols variables (no liquids permitted, TSA liquid size 3-1-1 permitted, and all liquid sizes permitted). Therefore, we conducted a post hoc test. The Bonferroni post hoc test showed that participants' comfort/trust/willingness was similar when prohibited from bringing any liquids, gels, and aerosols in carry-on (Level 1) and when permitted to TSA 3-1-1 liquid, gel, and aerosol sizes (Level 2), $p = 1.00$ and $M_{diff} = -.12$. Additionally, participants' comfort/trust/willingness was similar when permitted to bring any size liquids, gels, and aerosols in a carry-on (Level 3) and when prohibited from bringing any liquids, gels, and aerosols in a carry-on (Level 1), $p = .19$ and $M_{diff} = -.37$. However, participants' comfort/trust/willingness were

significantly lower when permitted to bring any size liquid, gel, and aerosol in a carry-on (Level 3), when compared to permitting the TSA's 3-1-1 liquid, gels, and aerosol sizes (Level 2), $p < .042$ and $M_{diff} = -.50$.

Research Question and Hypothesis

The responses gathered from the survey provided sufficient information to answer our research questions.

1. Based on the sample data, participants seemed comfortable, trusting, and willing to have liquids carried on-board the aircraft. However, there was a significant difference in comfort/trust/willingness scores between group of participants that were permitted to bring onboard any size liquids, gels, and aerosols and group of participants that were prohibited from bringing any liquids and group of participants that were allowed the TSA 3-1-1 size restriction.
2. Based on the sample data, participants seemed comfortable, trusting, and willing to have sharp objects prohibited in a carry-on luggage. However, there was a significant difference in comfort/trust/willingness scores between group of participants that were permitted to bring sharp objects in a carry-on and group of participants that were prohibited from bringing sharp object in a carry-on. Overall, participants that were permitted to bring sharp-objects in a carry-on seemed to have a neutral perception towards sharp-objects.

Our decision with respect to the null hypothesis is as follows:

1. We hypothesized no difference in trust/willingness/comfort as a function of the amount of liquids/gels/aerosols that are allowed on board; but based on the sample data, we had to reject the null hypothesis because there was a significant difference in trust/willingness/comfort as a function of the amount of liquids/gels/aerosols that are allowed on board. The p value equals .001, which is less than or equal to .05 (α). (Please refer to Table 3 and Figure 1.)
2. We hypothesizes no difference in trust/willingness/comfort as a function of whether or not sharp objects are allowed on board; but based on the sample data, we had to reject the null hypothesis because there was a significant difference in trust/willingness/comfort as a function of whether or not sharp objects are allowed on board. The p value equals .029, which is less than or equal to .05 (α). (Please refer to Table 3 and Figure 2.)
3. We hypothesized no significant interaction between the two independent variables. Based on the sample data, our hypothesis was correct, we failed to reject the null hypothesis because there was no significant interaction between the two independent variables. The p value equals .156, which is greater than .05 (α). (Please refer to Figure 3 and Figure 4.)

Overall, participants demonstrated a neutral perception to scenarios that allowed sharp objects to be brought on-board an aircraft in a carry-on luggage. However, participants demonstrated a positive perception in scenarios that prohibited sharp objects from being brought on-board an aircraft in a carry-on

luggage. In regards to interactions, we concluded that there was no significant interaction between the independent variables because regardless of group association, participants in all groups had a lower perception when sharp objects were permitted in a carry-on luggage and had a higher perception when sharp objects were prohibited. (Please refer to Figure 4.)

CHAPTER 5: DISCUSSION

Overview

The purpose of this study was to investigate airline consumers' perception of TSA prohibited items, with respect to their comfort, trust, and willingness towards TSA liquids, gels, and aerosols policy and sharp objects in carry-on luggage. The study was designed to gauge passengers' perceptions of whether a certain scenario would have a more positive or negative perception when compared to other scenarios. This assessment was based on grouping the study participants in six separate groups and measuring each group's perceived level of perception to the scenario. The independent variables were sharp objects (sharp objects permitted and sharp objects prohibited) and liquids, gels, and aerosol sizes (all liquids, gels, and aerosols prohibited, TSA 3-1-1 size restriction, and all sizes of liquids, gels and aerosols permitted). The dependent variable was a participant's comfort, trust, and willingness level. The sample population for the study was $n = 363$, which consisted of 197 males and 166 females.

Explanation of Findings

The first hypothesis stated that there would be no significant difference in a participant's comfort, trust, and willingness as a function of the amount of liquids, gels and aerosols that are allowed on board. However, results from the participants suggested that there was indeed a significant difference. It was interesting to note that even though there was a significant difference, participants in general had a positive perception. This indicated that participants were comfortable, trusting, and willing to board an aircraft regardless of whether

these items were prohibited, permitted, or a current TSA 3-1-1 regulation.

Participants had a much higher positive perception towards the current TSA 3-1-1 size regulation when compared to permitting all sizes to prohibiting all sizes on board. These findings suggested that participants in general were trusting of the current security measures and could be of valuable use to the TSA that were looking to make changes to the current regulations. This way, TSA officers can effectively spend their time looking for items of higher threat. If people were willing to trust that any proposed change to liquid, gels, and aerosols would not pose a serious threat to aviation security, then it would have a positive influence on passenger satisfaction. In the study conducted by Gkritza, Niemeier, and Mannering (2006), they mentioned that passenger satisfaction was not based on reducing wait times but refining security measures. The responses to this questionnaire demonstrated that if the TSA were to refine their 3-1-1 size restrictions on liquids, gels and aerosols, then passengers would continue to have a positive perception of the change.

The second hypothesis stated that there would be no significant difference in a participant's comfort, trust, and willingness as a function to whether or not sharp objects were allowed on board. The results from the participants suggested that there was a significant difference. The participants had a positive perception towards not allowing sharp objects in carry-on luggage and a negative perception towards allowing sharp objects in a carry-on luggage. What was interesting to note was that even though there was a significant difference, passengers did not have a

strong negative perception towards the proposed rule change. The authors Lee and See (2004) defined the word trust as the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability. The responses to scenarios that permitted sharp objects could possibly suggest that participants may have answered the scenario with a degree of uncertainty and vulnerability. Participants trusted the government to protect them when national security is threatened. Based on the responses, participants might not have uncomfortable, untrusting, and unwilling feelings, yet they have remained neutral to the proposed change with the hope that if there were a threat based on the rule change, the government would be able to protect them. After September 11, passengers trusted the government with the establishment of an independent security agency to protect them from any possible terrorist attacks. The conductors of this study assumed that if sharp objects were to be permitted in carry-on luggage, then passengers would have a neutral perception.

Another possible explanation to participant responses to sharp objects may be that American consumers are not inclined to totally trust anything without questioning authority (Couchen & Lieching, 2008). This probability was supported by the findings that participants were somewhat neutral to the idea of having sharp objects in carry-on luggage. One assumption could be that participants may be open to the proposed change. However, participants might demand that TSA justify itself as to how the proposed change would benefit aviation security while clarifying what steps would be taken to mitigate the threat

of potential passengers using sharp objects to cause harm to others. As mentioned above, participants trusted the government to keep them safe but permitting sharp objects in carry-ons may be considered a step back by certain participants. This can also be observed in the liquid, gels, and aerosol size restrictions, where TSA's 3-1-1 had a much higher perception to the other levels.

There is also a probability that participants may have responded to the study based on organizational political trust. As mentioned in chapter 2, citizens can become trustful and satisfied with government proposed policy alternatives (Miller, 1974). The results of the study are an indication of this trust. We can only assume that participants are trusting of the TSA because their sole purpose is to protect the transportation system of the U.S. Therefore, if in the future TSA does propose a change to the prohibited item list, participants may have a positive or neutral perception to the policy because they trust the TSA.

The last hypothesis stated that there would be no significant interaction between liquids, gels, aerosol sizes, and sharp objects. The results from the study supported this hypothesis. This was interesting because a majority of participants had a positive perception or a neutral perception towards this scenario they were presented with. The group that had the highest positive perception when compared to other groups preferred to have sharp objects permitted and liquids, gels, and aerosols of all sizes prohibited on board. This decision could possibly be based on convenience and safety. It was considered convenient because passengers would not have to worry if they were adhering to the TSA size restrictions properly and

sharp objects can be packed in checked luggage. It has influenced safety because it has reduced the chances of passengers using sharp objects to cause harm to other passengers while the concern of possible liquid explosives in a carry-on has drastically reduced. However, these results may not be a true representation of the entire population because we have limited knowledge of our participants' background. The study is limited to participants from MTurk. The raw data consisted of participants that had a strong positive perception and a negative perception towards this scenario, but the mean of the data suggested that overall participants were quite comfortable, trusting and willing to board an aircraft. Therefore, there was a probability that certain participants could have answered the questionnaire from a convenience point of view, while others could have answered from a safety point of view.

Another possible explanation for the positive perception and neutral perception may be the participants' sense of security. This observation may be related back to the study conducted by Mitchener-Nissen, Bowers, and Chetty (2011). They surveyed why travelling passengers preferred full body scanners to pat-downs. About 85.8% justified their selection, the full body scanner, based on safety and stated that the full body scanners were less intrusive. The difference between our study and the previous study was that our participants were not provided with any information prior to participating in the study, while Mitchener-Nissen, Bowers, and Chetty (2011) presented all their participants with detailed information about full body scanners and its effectiveness. Despite these

differences, the responses from our study had a positive perception. Therefore, future studies should examine if participants may be willing, trusting, and comfortable to board an aircraft with sharp objects and liquids of all sizes in their carry-ons, as long as they were convinced that effective security measures were already in place to stop another possible terrorist attack.

The study indicated that passengers either had a positive perception or neutral perception to sharp objects and liquids, gels, and aerosols size restriction. Overall, the study provided significant information that demonstrated passengers are fairly trusting, comfortable and willing to board an aircraft if the ban was lifted on sharp objects, and liquids, gels, and aerosol sizes.

Practical Implementation

There are certain real-world applications of the findings from this study. The airlines and TSA can conduct a similar study to gauge passengers' perception of certain regulations. The study suggested that passengers are willing, trusting and comfortable in each of the conditions. If the TSA and airlines were to provide the passengers with additional information on the positives of a possible rule change, passengers may be more willing to accept it (Mitchener-Nissen, Bowers, & Chetty, 2011).

The findings of this study may help guide the future actions of the TSA and airline industry regarding public opinion of current prohibited items. If either scenario were to be adopted efficiently, there could be a possibility passengers may demonstrate a higher positive perception when compared to the results of our study.

More importantly, it may make flying a more comfortable experience for all the passengers.

Limitations and Recommendations for Future Research

Eventually the restriction on liquid sizes will likely be lifted because advanced liquid screening technology has already begun testing at smaller airports in Europe (Reals, 2013). The study can be taken further by analyzing aviation employees' responses only. The aim of the study should be to gauge the level of trust passengers will continue to have with the security system, when rules begin to be amended in the future. One potential avenue to explore could be to ask passengers what changes they would like to see in the current system or what current regulation they would like to see being executed in a different manner. The TSA Pre-Check is currently one program that has received positive reviews but unfortunately not everyone qualifies for the program because the program conducts thorough background checks going back as far as ten years. However, those passengers that successfully qualify for TSA Pre-Check are allowed to move much quicker through airport security, which, in itself, is a stressful situation at major airports. If the program was to be amended, which would be more willing to accept a large population of various backgrounds, it may contribute towards increased passenger satisfaction.

The study can also be replicated to compare airline professional's perception in each scenario versus passenger's perception. This can be vital because aviation professionals may answer the scenario from a safety point of view

and a passenger may answer from a safety and convenient point of view. Another future study can also take the dependent variable of convenience and safety into consideration when designing scenario-based questionnaires. The current study can also be altered by providing passengers with unbiased aviation security measures and the programs designed to mitigate any possible threat prior to participating in the questionnaire. This method could possibly demonstrate a much higher positive perception than the current study.

The major limitation in regards to TSA policies is participants' responses being influenced by external factors. In our study, we were unable to identify detailed background of our participants; therefore, we had to make an assumption that participants may have answered the questionnaire based on safety; however, other confounding variables (e.g. convenience) may have been affecting participants' responses. Another possible limitations are that participants recruited on MTurk belonged to a wide variety of age groups ranging from 18 years to 62 years. There is a probability that if the scenarios were to be worded and presented in a different manner, we could have received completely different results.

Therefore when conducting future studies on TSA policies it should be done with a certain degree of caution. Participants lack knowledge of the current security system and even a small, seemingly insignificant security related event may alter their responses, which may sway the results of the study.

Conclusions

This study successfully displayed the perception airline consumers have towards TSA liquid restrictions and bans on sharp objects. The responses of the general public were gathered, which suggested that passengers on average were quiet willing, trusting, and comfortable to board an aircraft if sharp objects were prohibited. The data from this study suggests that passengers were neutral towards permitting sharp objects in the carry-on luggage. Overall, the results of this study are significant to understand the current perception passengers have of current TSA items, which is viable to understanding how passengers perceive the aviation security system, with the determinant being lack of sufficient knowledge of the current system.

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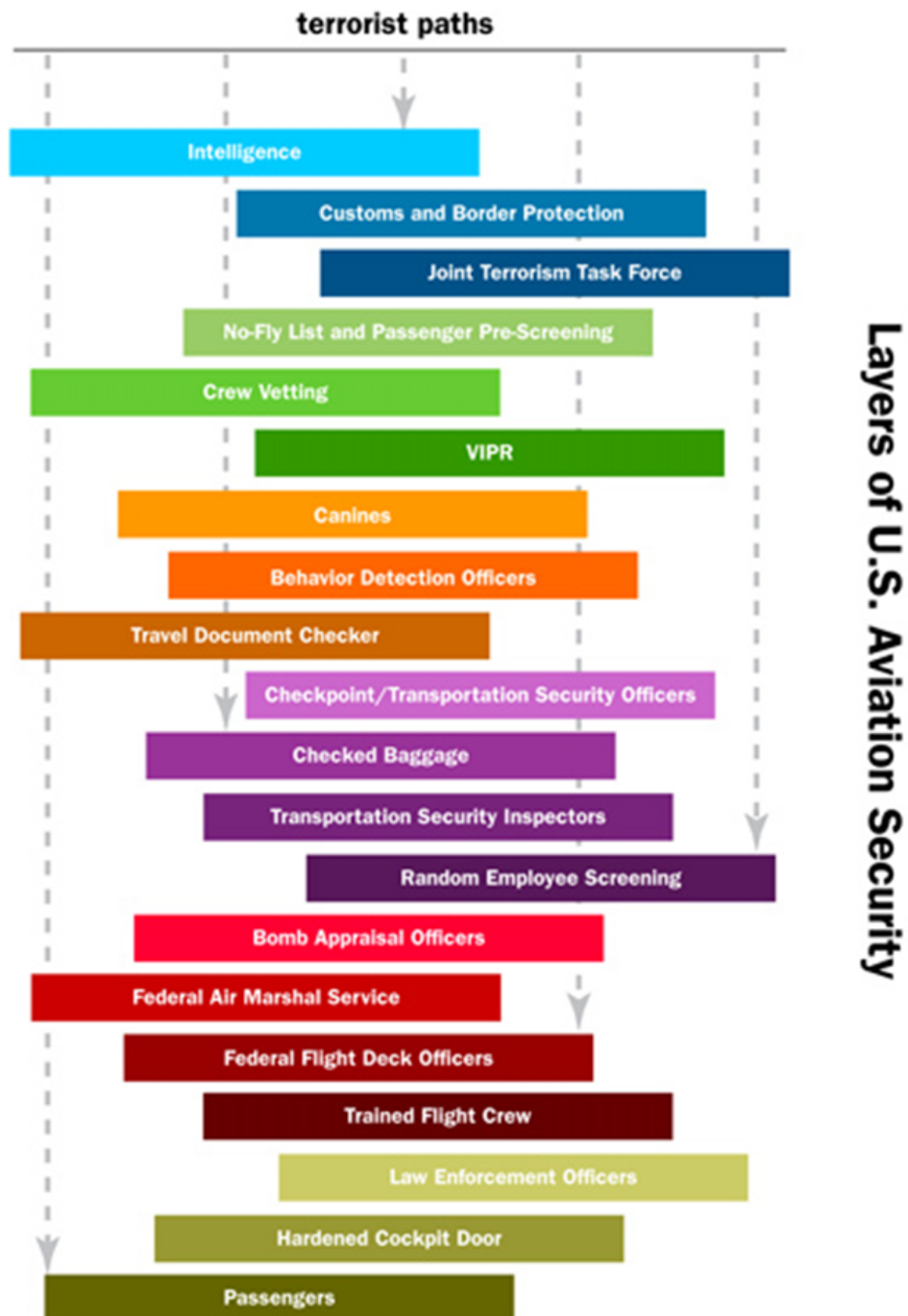
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APPENDIX A: TSA LAYERS OF AVIATION SECURITY



(Source: TSA, 2014)

APPENDIX B: TSA PROHIBITED ITEM LIST BROCHURE

Explosive Materials

Item	Carry-on	Checked
Blasting Caps	No	No
Dynamite	No	No
Fireworks	No	No
Flares (in any form)	No	No
Hand Grenades	No	No
Plastic Explosives	No	No
Realistic Replicas of Explosives	No	No

Flammable Items

Item	Carry-on	Checked
Aerosols - Are prohibited with the exception of personal care items or toiletries in limited quantities	No	No
Fuels - Cooking fuels and any flammable liquid fuel is prohibited.	No	No
Gasoline	No	No
Gas Torches	No	No
Lighters - Lighters without fuel are permitted in checked baggage. Lighters with fuel are prohibited in checked baggage, unless they adhere to the Department of Transportation (DOT) exemption, which allows up to two fueled lighters if properly enclosed in a DOT approved case. If you are uncertain your lighter is prohibited, please leave it at home.	Yes	No
Lighter Fluid	No	No
Torch Lighters - These items create a thin, needle-like flame that is hotter (reaching 2,500 degrees Fahrenheit) and more intense than those from common lighters. Torch lighters are often used for pipes and cigars, and maintain a consistent stream of air-propelled fire regardless of the angle at which it is held. Torch lighters are prohibited.	No	No
Strike-anywhere Matches	No	No
Safety Matches - Only 1 book of safety (non-strike anywhere) matches are permitted as carry-on items.	Yes	No
Flammable Paints	No	No
Turpentine and Paint Thinner	No	No
Realistic Replicas of Incendiaries	No	No

NOTE: There are other hazardous materials that are regulated by the FAA. For more information visit faa.gov.

Disabling Chemicals & Other Dangerous Items

Item	Carry-on	Checked
Chlorine for Pools and Spas	No	No
Carbon Dioxide Cylinders in a Self-Inflating Life Jacket- Up to 2 in life vests and 2 spares. The spares must accompany the life vests and be presented as one unit.	Yes	Yes
Fire Extinguishers and other Compressed Gas Cylinders	No	No
Liquid Bleach	No	No
Recreational oxygen - (non-medically required, flavored or	No	No
Spillable Batteries - Except those in wheelchairs	No	No
Spray Paint	No	No
Tear Gas - Self-defense sprays containing more than 2% by mass of Tear Gas is prohibited in both checked bag and checkpoint.	No	No

NOTE: There are other hazardous materials that are regulated by the FAA. This information is summarized at faa.gov.

Other Items

Item	Carry-on	Checked
Gel-type Candles	No	Yes
Non-Flammable Liquid, Gel, or Aerosol (3.4 oz./100.55 ml or less that fit in one, clear, plastic, quart-sized, resealable bag)	Yes	Yes
Flammable Liquid, Gel, or Aerosol	No	No
Snow Globes (unless otherwise prohibited)**	Yes	Yes

*Screening procedures are governed by federal law and designed to detect threats to aviation security. TSA officers do not search for marijuana or other drugs; however, if an item is found that may violate federal law during security screening, TSA will refer the matter to law enforcement. Whether or not marijuana is considered medical marijuana federal law provides no basis to treat medical marijuana differently than non-medical marijuana.

**Snow globes that appear to contain less than 3.4 ounces (approximately tennis ball size) will be permitted if the entire snow globe, including the base, is able to fit in the same one clear, plastic, quart-sized, re-sealable bag, as the passenger's other liquids, such as shampoo, toothpaste and cosmetics.

*** Illegal controlled substances: TSA's screening procedures, which are governed by federal law, are focused on security and are designed to detect potential threats to aviation and passengers. As has always been the case, if during the security screening procedures an officer discovers an item that may violate federal law, TSA refers the matter to law enforcement. Law enforcement officials will determine if further action is appropriate.



Prepare for Takeoff TSA's Prohibited Items List



Transportation
Security
Administration

tsa.gov

(Source: tsa.gov, 2014)

TSA Prohibited Items List

The TSA Prohibited Items List is not intended to be all-inclusive and is updated as necessary. To ensure a traveler's security, Transportation Security Officers (TSOs) may determine that an item not on the Prohibited Items List is prohibited.

The final decision rests with TSA on whether to allow any items through security checkpoints.

Travelers are encouraged to check with their airline or travel agent for policies as individual airlines may place additional restrictions on any item.

Please note that some items are illegal in certain states and will be subject to state laws. It is the traveler's responsibility to be aware of state laws in both origination and destination cities.

Please pay careful attention to the "NOTE" included at the bottom of each section - they contain important information about restrictions and exceptions.

Sharp Objects

Item	Carry-on	Checked
Box Cutters	No	Yes
Ice Axes/Ice Picks	No	Yes
Knives - Except for plastic or round bladed butter knives	No	Yes
Meat Cleavers	No	Yes
Razor-Type Blades - Box cutters, razor blades not in a cartridge (excluding safety razors) are prohibited in carry-on.	No	Yes
Sabers	No	Yes
Scissors - Metal with pointed tips and a blade length greater than four inches measured from the fulcrum	No	Yes
Swords	No	Yes

NOTE: Any sharp objects in checked baggage should be sheathed or securely wrapped to prevent injury to baggage handlers and Transportation Security Officers.

Sporting Goods

Item	Carry-on	Checked
Baseball Bats	No	Yes
Bows and Arrows	No	Yes
Cricket Bats	No	Yes
Golf Clubs	No	Yes
Hockey Sticks	No	Yes

Sporting Goods - Continued

Item	Carry-on	Checked
Lacrosse Sticks	No	Yes
Pool Cues	No	Yes
Ski Poles	No	Yes
Spear Guns	No	Yes
Tennis Rackets	Yes	Yes

Guns & Firearms

Item	Carry-on	Checked
Ammunition - Check with your airline if permitted in checked baggage. Small arms ammunitions for personal use must be securely packed in fiber, wood or metal boxes or other packaging specifically designed to carry small amounts of ammunition. Ask about limitations or fees.	No	Yes
BB Guns	No	Yes
Compressed Air Guns - Including paintball markers, may be carried in checked luggage without compressed air cylinder attached	No	Yes
Firearms - Firearms carried as checked baggage MUST be unloaded, packed in a locked hard-sided container, and declared to the airline at check-in.	No	Yes
Flare Guns - May be carried as checked baggage, but MUST be unloaded, packed in a locked hard-sided container, within hazardous material regulations, and declared to the airline at check-in.	No	Yes
Flares	No	No
Gun Lighters	No	No
Gun Powder - Including black powder and percussion caps	No	No
Parts of Guns and Firearms	No	Yes
Pellet Guns	No	Yes
Realistic Replicas of Firearms	No	Yes
Starter Pistols - Can only be carried as checked baggage and MUST be unloaded, packed in a locked hard-sided container, and declared to the airline at check-in.	No	Yes

NOTE: Check with your airline or travel agent to see if firearms are permitted in checked baggage on the airline you are flying. Ask about limitations or fees, if any, that apply.

Martial Arts & Self Defense Items

Item	Carry-on	Checked
Billy Clubs	No	Yes
Black Jacks	No	Yes
Brass Knuckles	No	Yes
Kubaton	No	Yes
Mace/Pepper Spray - One 4 fl. oz (118 ml) container of mace or pepper spray is permitted in checked baggage provided it is equipped with a safety mechanism to prevent accidental discharge. Self-defense sprays containing more than 2% by mass of Tear Gas is prohibited in both checked bag and checkpoint. For more information visit tsa.gov .	No	Yes
Martial Arts Weapons	No	Yes
Night Sticks	No	Yes
Nunchucks	No	Yes
Stun Guns/Shocking Devices	No	Yes
Throwing Stars	No	Yes

NOTE: Any sharp objects in checked baggage should be sheathed or securely wrapped to prevent injury to baggage handlers and Transportation Security Officers.

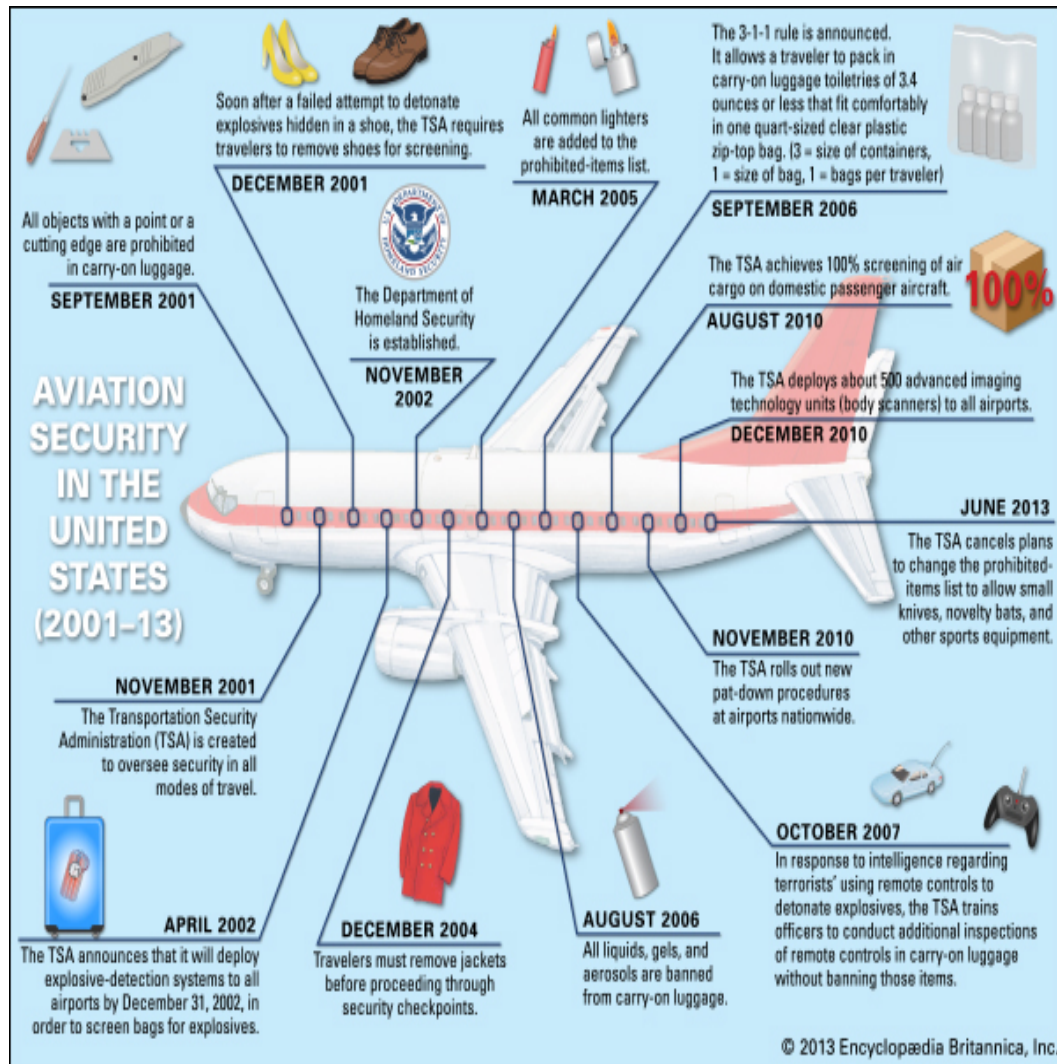
Tools

Item	Carry-on	Checked
Axes and Hatchets	No	Yes
Cattle Prods	No	Yes
Crowbars	No	Yes
Hammers	No	Yes
Drills and drill bits - Including cordless portable power drills	No	Yes
Saws - Including cordless portable power saws	No	Yes
Tools - Greater than 7 inches in length	No	Yes
Screwdrivers/Wrenches/Pliers - Greater than 7 inches in length	No	Yes

NOTE: Any sharp objects in checked baggage should be sheathed or securely wrapped to prevent injury to baggage handlers and Transportation Security Officers.

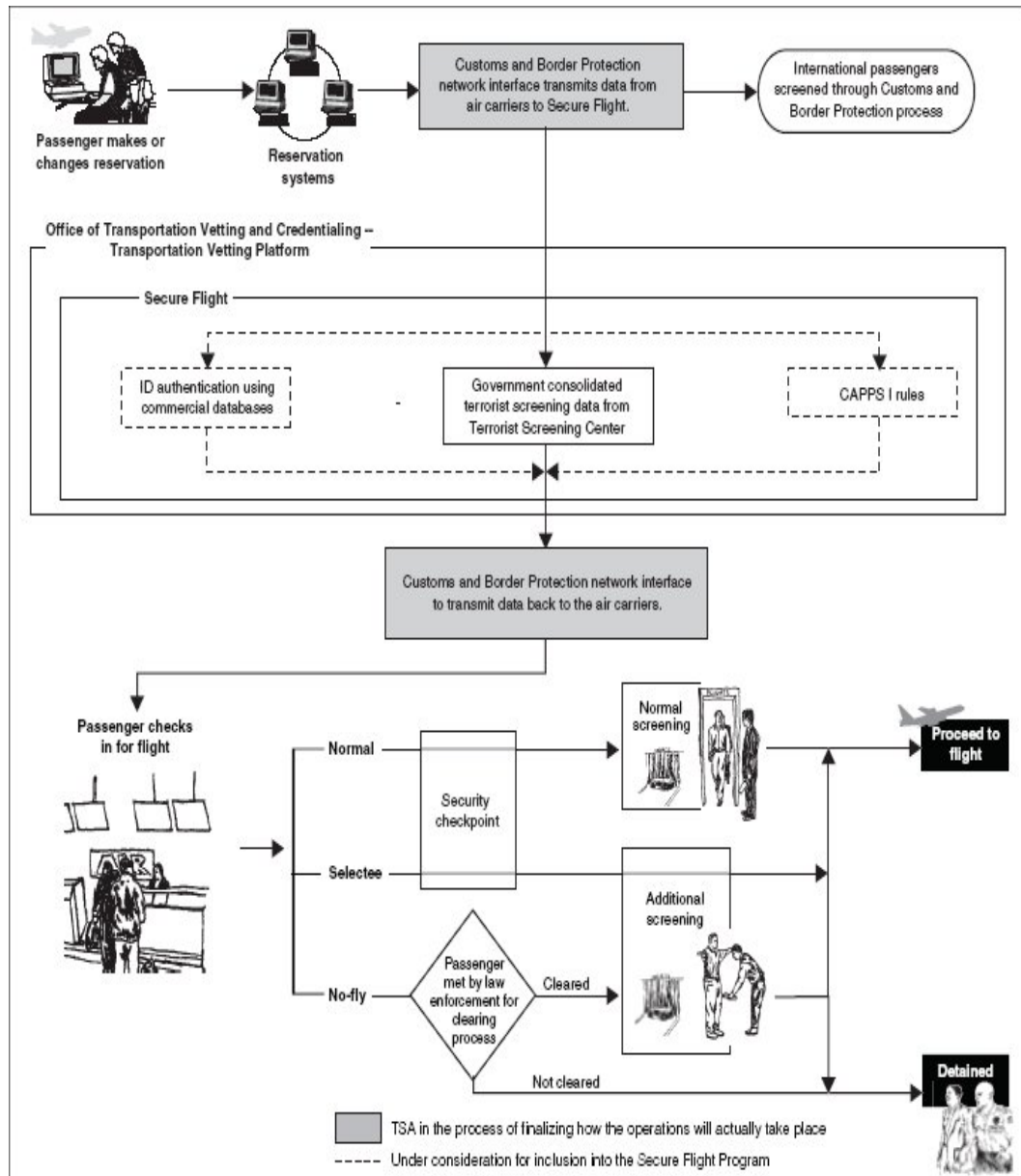
(Source: tsa.gov, 2014)

APPENDIX C: TSA SECURITY REGULATIONS TIMELINE



(Source: Encyclopedia Britannica, Inc., 2013)

APPENDIX D: SECURE FLIGHT



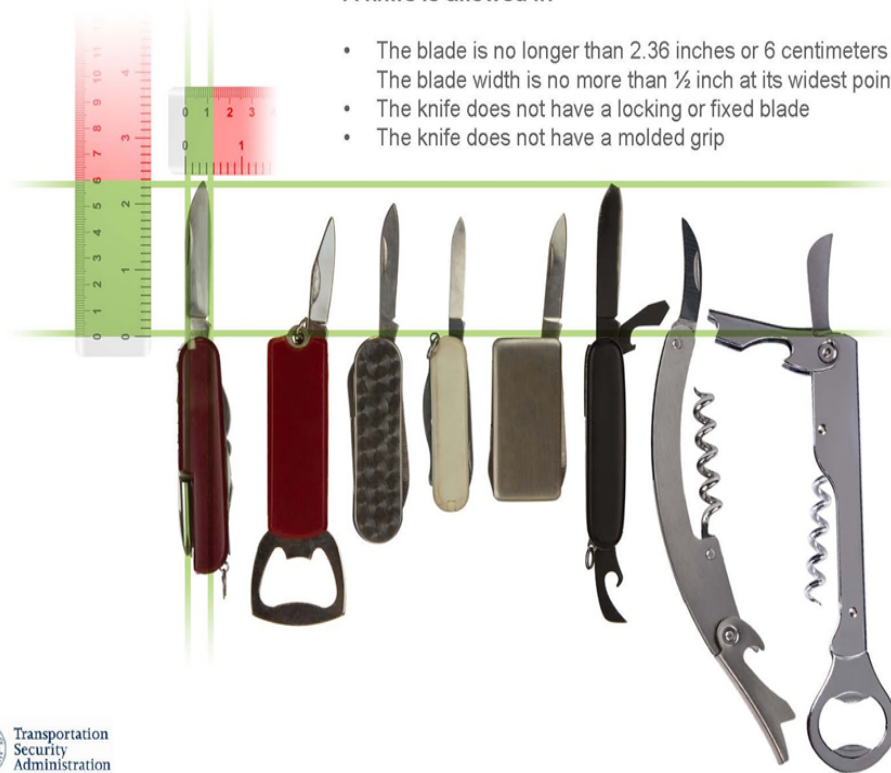
(Source: GlobalSecurity.org)

APPENDIX E: TSA PROPOSED SHARP OBJECTS SIZES

Knives Allowed

A knife is allowed if:

- The blade is no longer than 2.36 inches or 6 centimeters in length
The blade width is no more than 1/2 inch at its widest point
- The knife does not have a locking or fixed blade
- The knife does not have a molded grip



(Source: The TSA Blog Team, 2013)

APPENDIX F: EXPERIMENT QUESTIONNAIRE

Instructions: You will be presented with some information on current Transport Security Administration (TSA) procedures and you will then be asked some questions on certain scenarios. Following that, you will be asked some demographic questions. The data collection process is anonymous and your response will remain confidential. This should take you about 2-3 minutes.

Condition 1

Have you traveled on-board a commercial aircraft that departed from a U.S. airport since January 2007?

- Yes
- No

Question 1: Given the following scenario, please indicate how comfortable you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects and liquids, gels, and aerosols of any size in a carry-on bag.

- Extremely Uncomfortable
- Quite Uncomfortable
- Slightly Uncomfortable
- Neutral
- Slightly Comfortable
- Quite Comfortable
- Extremely Comfortable

Question 2: Given the following scenario, please indicate how trusting you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects and liquids, gels, and aerosols of any size in a carry-on bag.

- Extremely Untrusting
- Quite Untrusting
- Slightly Untrusting
- Neutral
- Slightly Trusting
- Quite Trusting
- Extremely Trusting

Question 3: Given the following scenario, please indicate how willing you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects and liquids, gels, and aerosols of any size in a carry-on bag.

- Extremely Unwilling
- Quite Unwilling
- Slightly Unwilling
- Neutral
- Slightly Willing
- Quite Willing
- Extremely Willing

Condition 2

Have you traveled on-board a commercial aircraft that departed from a U.S. airport since January 2007?

- Yes
- No

Question 1: Given the following scenario, please indicate how willing you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects but liquids, gels, and aerosols of any size are prohibited in a carry-on bag.

- Extremely Unwilling
- Quite Unwilling
- Slightly Unwilling
- Neutral
- Slightly Willing
- Quite Willing
- Extremely Willing

Question 2: Given the following scenario, please indicate how trusting you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects but liquids, gels, and aerosols of any size are prohibited in a carry-on bag.

- Extremely Untrusting
- Quite Untrusting
- Slightly Untrusting
- Neutral
- Slightly Trusting
- Quite Trusting
- Extremely Trusting

Question 3: Given the following scenario, please indicate how comfortable you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects but liquids, gels, and aerosols of any size are prohibited in a carry-on bag.

- Extremely Uncomfortable
- Quite Uncomfortable
- Slightly Uncomfortable
- Neutral
- Slightly Comfortable
- Quite Comfortable
- Extremely Comfortable

Condition 3

Have you traveled on-board a commercial aircraft that departed from a U.S. airport since January 2007?

- Yes
- No

Question 1: Given the following scenario, please indicate how comfortable you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects but liquids, gels, and aerosols of size 3-1-1 are permitted in a carry-on bag.

- Extremely Uncomfortable
- Quite Uncomfortable
- Slightly Uncomfortable
- Neutral
- Slightly Comfortable

- Quite Comfortable
- Extremely Comfortable

Question 2: Given the following scenario, please indicate how willing you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects but liquids, gels, and aerosols of size 3-1-1 are permitted in a carry-on bag.

- Extremely Unwilling
- Quite Unwilling
- Slightly Unwilling
- Neutral
- Slightly Willing
- Quite Willing
- Extremely Willing

Question 3: Given the following scenario, please indicate how trusting you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects but liquids, gels, and aerosols of size 3-1-1 are permitted in a carry-on bag.

- Extremely Untrusting
- Quite Untrusting
- Slightly Untrusting
- Neutral
- Slightly Trusting
- Quite Trusting
- Extremely Trusting

Condition 4

Have you traveled on-board a commercial aircraft that departed from a U.S. airport since January 2007?

- Yes
- No

Question 1: Given the following scenario, please indicate how comfortable you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects and liquids, gels, and aerosols of size 3-1-1 are permitted in a carry-on bag.

- Extremely Uncomfortable
- Quite Uncomfortable
- Slightly Uncomfortable
- Neutral
- Slightly Comfortable
- Quite Comfortable
- Extremely Comfortable

Question 2: Given the following scenario, please indicate how trusting you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects and liquids, gels, and aerosols of size 3-1-1 are permitted in a carry-on bag.

- Extremely Untrusting
- Quite Untrusting
- Slightly Untrusting
- Neutral
- Slightly Trusting
- Quite Trusting
- Extremely Trusting

Question 3: Given the following scenario, please indicate how willing you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects and liquids, gels, and aerosols of size 3-1-1 are permitted in a carry-on bag.

- Extremely Unwilling
- Quite Unwilling
- Slightly Unwilling
- Neutral
- Slightly Willing
- Quite Willing
- Extremely Willing

Condition 5

Have you traveled on-board a commercial aircraft that departed from a U.S. airport since January 2007?

- Yes
- No

Question 1: Given the following scenario, please indicate how trusting you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects but liquids, gels, and aerosols of all sizes are permitted in a carry-on bag.

- Extremely Untrusting
- Quite Untrusting
- Slightly Untrusting
- Neutral
- Slightly Trusting
- Quite Trusting
- Extremely Trusting

Question 2: Given the following scenario, please indicate how willing you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects but liquids, gels, and aerosols of all sizes are permitted in a carry-on bag.

- Extremely Unwilling
- Quite Unwilling
- Slightly Unwilling
- Neutral
- Slightly Willing
- Quite Willing
- Extremely Willing

Question 3: Given the following scenario, please indicate how comfortable you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA prohibits you from bringing sharp objects but liquids, gels, and aerosols of all sizes are permitted in a carry-on bag.

- Extremely Uncomfortable
- Quite Uncomfortable
- Slightly Uncomfortable
- Neutral
- Slightly Comfortable
- Quite Comfortable
- Extremely Comfortable

Condition 6

Have you traveled on-board a commercial aircraft that departed from a U.S. airport since January 2007?

- Yes
- No

Question 1: Given the following scenario, please indicate how willing you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects and liquids, gels, and aerosols of all sizes in a carry-on bag.

- Extremely Unwilling
- Quite Unwilling
- Slightly Unwilling
- Neutral
- Slightly Willing
- Quite Willing
- Extremely Willing

Question 2: Given the following scenario, please indicate how comfortable you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects and liquids, gels, and aerosols of all sizes in a carry-on bag.

- Extremely Uncomfortable
- Quite Uncomfortable
- Slightly Uncomfortable
- Neutral
- Slightly Comfortable

- Quite Comfortable
- Extremely Comfortable

Question 3: Given the following scenario, please indicate how trusting you would be completing a commercial flight?

You have to fly from Miami to Los Angeles on a commercial flight. The TSA permits you to bring sharp objects and liquids, gels, and aerosols of all sizes in a carry-on bag.

- Extremely Untrusting
- Quite Untrusting
- Slightly Untrusting
- Neutral
- Slightly Trusting
- Quite Trusting
- Extremely Trusting

APPENDIX G: OUTPUT OF POWER ANALYSIS

