Perception of Passengers on Long Haul Flights Toward Deep Vein Thrombosis

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Abstract

Air travel is the most primary option for people who prefer comfortable, efficient, and quick transport services. The objectives of this research were 1) to explore the perception of passengers on long-haul flights toward deep vein thrombosis and 2) to propose the prevention of DVT for passengers on long-haul flights. This research was a mixed methodology that quantitative data were collected through the questionnaire of 385 international flight passengers. An in-depth interview was used for ten international flight passengers which included two elderly, two obesities, two pregnant ladies, two smokers, and two alcoholics to gather qualitative data and the multiple investigator triangulation was also used in this research. Data were analyzed and described with frequency, mean and standard deviation. The result showed that the perception of long-haul flight passengers toward DVT is low. Most of the sample know that different behaviors of passengers affect the occurrence of DVT ($\bar{x}$= 2.76). On the other hand, passengers get enough information from the airlines about DVT ($\bar{x}$ = 1.95). The suggestions and comments toward the deep vein thrombosis of passengers on long haul flights were grouped as follows: 1) airlines should provide information about DVT for passengers (48%), 2) passengers did not know about DVT and they would like to know how to prevent DVT (35%), and 3) behaviors could be the main point of being healthy (10%) and others (7%).

Keywords: *Deep vein thrombosis, DVT, Long haul flights, Perception*

1. Introduction

According to the International Civil Aviation Organization (ICAO) report about the world of air transport in 2019, the total number of passengers carried on scheduled services rose to 4.5 billion, which is 3.6 percent higher than the previous year (ICAO, 2019). This high demand for air travel passengers could lead the competition for the airlines. Making airlines more interesting and be the first choice for the passengers, the airlines need to enhance the service quality and also safety standards such as improving in-flight entertainment, ergonomic design of passenger seats, food and beverage choice variety, and nonstop flight service for long-haul flights. These services could make the passengers remain seated for a long period. Being immobile increases the chances that blood will pool deep inside the veins in passengers' legs and potentially clot and it is called deep vein thrombosis (DVT) (Ryan, 2016).

Deep vein thrombosis (DVT) is the formation of a blood clot within a deep vein (Bevis & Smith, 2016). The consequences may be immediate and life-threatening if emboli enter the pulmonary circulation causing pulmonary embolus (PE) (Cooray & Lake, 2018). Mayo Clinic (2019) presented DVT signs and symptoms which included swelling and feeling pain on the affected leg. The pain often starts in the patients' calf and can feel like cramping or soreness. Red or discolored skin and feeling hot to touch on the affected area. Deep vein thrombosis can also occur without noticeable symptoms. Long-haul flights or multiple flights in a short period can be associated with deep vein thrombosis. When the leg is bent at the knee for a long period without moving may affect blood flow and cause blood clots. Other factors can raise this risk, such as recent surgery, taking contraceptive pills, pregnancy, cancer, heart problems, and older age. Moreover, inherited genetic factors may also play a role (Sugerman et al., 2012).

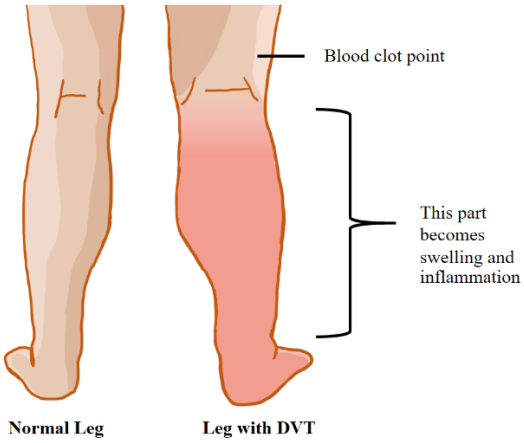

Figure 1 The difference between normal leg and DVT leg

Figure 1 shows the difference between normal leg and DVT leg and also the sign and symptoms of DVT. The purpose of this research was to explore the perception of passengers on long-haul flights toward deep vein thrombosis and to propose the prevention of DVT for passengers on long-haul flights. Professor Karlheinz Peter said that the longer the flight, the greater the risk. Any flight longer than four hours poses a risk (Ryan, 2016). The airlines should provide some information on how to prevent and reduce the occurrence of DVT in the in-flight magazines and remind passengers to move around the cabin if possible. It is a reasonable idea to keep passengers updated as prevention is better than cure.

2. Objectives

2.1 Objectives of this research was

1) To explore the perception of passengers on long haul flights toward deep vein thrombosis (DVT)
2) To propose the prevention of deep vein thrombosis (DVT) for passengers on long haul flights

2.2 Research questions

1) How much perception of passengers on long-haul flights toward deep vein thrombosis (DVT)?
2) Do the passengers on long-haul flights know how to prevent themselves from deep vein thrombosis (DVT)?

3. Materials and Methods

This research used mixed methodology, which included both quantitative and qualitative research. Rogers' revised Protection Motivation Theory (PMT) is a major health psychology theory aimed at explaining the cognitive mediation process of behavioral change in terms of threat and coping appraisal (Plotnikoff & Trinh, 2010). Each questionnaire was created based on PMT and journal study.

3.1 The population

The passengers traveling more than 5 hours (long-haul flight) on international flights were the population of this research.

3.2 The sample

The amount of 385 passengers on long-haul international flights was the sample for the quantitative research. The sample size was calculated by the Cochran formula (Statistics How To, 2019). Besides, an in-depth interview was used for the qualitative research with ten passengers on long-haul international flights. The interviews ranged from 20-30 minutes. Those ten passengers included two elderly, two obesities, two pregnant ladies, two smokers, and two alcoholics.

3.3 Data collection

Secondary sources of data were journal articles, websites, and research gathered by other researchers.

Primary sources of data consisted of the questionnaire and in-depth interviews with open-ended questions.

3.4 Research instrument

The questionnaire was divided into 4 parts as follows:

Part 1: the general information.

Part 2: medical history.

Part 3: the perception of long haul flight passengers toward DVT. Likert scale (Bhandari, 2020) was used in part 3 to scale the perception of the sample. Likert scale consisted of highest perception = 5, high perception = 4, neutral = 3, low perception = 2, and lowest perception = 1. Class interval (Wyzant, 2019) in part 3 was 0.8 and it could be defined in each class as follows; 1.00-1.80 = lowest perception, 1.81-2.60 = low perception, 2.61-3.40 = neutral, 3.41-4.20 = high perception, and 4.21-5.00 = highest perception.

Part 4: suggestions and comments toward the deep vein thrombosis of passengers on long-haul flights.

The in-depth interview consisted of 3 open-ended questions as follows: 1) what do you think about DVT? 2) what do you normally do during the long flight? and 3) what do you expect to know from the airline about DVT?

3.5 Data analysis

The quantitative data in parts 1, 2, and 3 of the questionnaire have been analyzed by frequency, percentage, mean and standard deviation. The analytical description was used in part 4 of the questionnaire and in-depth interview.

4. Results and Discussion

The results of quantitative data were divided into 4 parts which included part 1 :general information, part2: medical history, part 3: The perception of long haul flight passengers toward DVT, and part 4: suggestions and comments toward the deep vein thrombosis of passengers on long haul flights.

Part 1: General information consisted of 4 questions and the results of each question were displayed in Table 1.

Table 1 General information

General information	The number of passengers	Percentage (%)
Gender		
Male	181	47.02
Female	204	52.98
Age (years)		
20-30	154	40
31-40	116	30.13
41-50	82	21.30
51-60	22	5.71
More than 60	11	2.86
Occupations		
Civil service career	99	25.71
Private company employee	154	40
Business owner	82	21.30
Househusband/ housewife	11	2.86
Students	39	10.13

General information	The number of passengers	Percentage (%)
Frequency of air travel		
1-2 times/ week	5	1.30
3-5 times/ week	6	1.56
More than 5 times/ week	-	-
1-2 times/ month	50	12.99
1-2 times/ year	302	78.44
3 times/ year	22	5.71

Table 1 showed that most of the samples were female (52.98%), aged 20-30 years old (40%), being a private company employee (40%), and flying 1-2 times a year (78.44%).

Part 2: Medical History. Anyone can get deep vein thrombosis (DVT) but the risk increases as you get older (Ryan, 2016). This part contained 5 questions as detailed below.

Table 2 Medical history

Medical history	Yes	No
History of surgery	165 (42.86%)	220 (57.14%)
Having family history of clots	33 (8.57%)	352 (91.43%)
Smoking	72 (18.70%)	313 (81.30%)
Drinking alcohol	242 (62.86%)	143 (37.14%)
Taking certain contraceptive pills	27 (7.27%)	357 (92.73%)

The results of part 2: medical history revealed that most of the samples did not have a history of surgery (220 samples or 57.14%), nor a family history of clots (352 samples or 91.43%). Of them, 313 (81.30%) and 143 (37.14%) did not smoke or drink alcohol, respectively. Lastly, 357 (92.73%) of the samples did not take contraceptive pills .

Part 3: the perception of long-haul flight passengers toward DVT. This part consisted of 15 questions. Likert scale was used to measure the perception of the samples.

Table 3 The perception of long haul flight passengers toward DVT

The perception of long haul flight passengers toward DVT	$\bar{x}$	S.D.	Interpretation
- Description of DVT	2.15	1.14	Low perception
- Causes of DVT	2.02	1.11	Low perception
- Symptoms of DVT	2.06	1.12	Low perception
- Treatments for DVT	1.99	1.14	Low perception
- Preventions of DVT	2.06	1.12	Low perception
- DVT can occur to anyone	2.59	1.32	Low perception
- Smoking can cause DVT	2.50	1.42	Low perception
- Taking certain contraceptive pills can cause DVT	2.04	1.25	Low perception
- The airline gives passengers information about what to do for good health during the flight?	2.44	1.13	Low perception
- The passengers get enough information from the airlines about DVT	1.95	1.14	Low perception
- Drinking alcohol during a long flight can cause DVT	2.35	1.32	Low perception
- Sitting for a long period without moving legs can cause DVT	2.68	1.27	neutral
- Drinking enough water during a long flight can reduce the cause of DVT	2.61	1.38	neutral
- The limitation of seat space can cause DVT	2.53	1.24	Low perception
- Different behaviors of passengers affect the occurrence of DVT	2.76	1.27	neutral

According to the results presented in table 3, most passengers had a low perception toward DVT. The average of each perception was as follows: description of DVT ($\bar{x}$ = 2.15), causes of DVT ($\bar{x}$ = 2.02), symptoms of DVT ($\bar{x}$ = 2.06), treatments for DVT ($\bar{x}$ = 1.99), DVT can occur to anyone ($\bar{x}$ = 2.59), smoking can cause DVT ($\bar{x}$ = 2.50), taking certain contraceptive pills ($\bar{x}$ = 2.04), the airline gives passengers information about what to do for good health during the flight ($\bar{x}$ = 2.44), passengers get enough information from the airlines about DVT ($\bar{x}$ = 1.95), drinking alcohol during a long flight can cause DVT ($\bar{x}$ = 2.35), Sitting for a long period without moving legs can cause DVT ($\bar{x}$ = 2.68), drinking enough water during a long flight can reduce the cause of DVT ($\bar{x}$= 2.61), the limitation of seat space can cause DVT ($\bar{x}$ = 2.53), and different behaviors of passengers affect the occurrence of DVT.

Part 4: suggestions and comments toward the deep vein thrombosis of passengers on long-haul flights. The suggestion and comments were grouped as follows: 1) airlines should provide information about DVT for passengers (48%), 2) passengers did not know about DVT and they would like to know how to prevent DVT (35%), 3) behaviors could be the main point of being healthy (10%) and others (7%). Whilst Alqahtani et al. (2012) presented that increasing people's awareness about dealing with risk perceptions should be done by the official sources with the proper information.

The in-depth interview was used to gain qualitative data. The samples were divided into 5 groups and the results were as follows:

Group 1: Elderly

The 1st elderly: Flying in business class was much more comfortable for him because of the seat space and other services from the airline. He did not want to move around to stretch his muscle because he felt unsafe. The severe turbulence experienced still reminded him so remain seated with the seat belt on was his option. He did not know much about DVT. He suggested that the airlines should promote more information since he was at risk of DVT.

The 2nd elderly: Traveling with a walking stick was annoying and inconvenient. It was getting worse if flying on a long-haul flight. She preferred to stay seated and sleep during the flight. Moving around was not a good choice for her unless she would like to go to the bathroom. She had no idea about DVT and she would like to know more about DVT for her safe air travel next time. It could be available in a seat pocket together with a safety card.

Group 2: Obesity

Regarding Table 4: Adult Body Mass Index (BMI), if BMI is 30.0 or higher, it falls within the obese range (Centers for Disease Control and Prevention, 2020).

Table 4 Adult Body Mass Index (BMI)

Weight Range	BMI	Considered
124 lbs or less	Below 18.5	Underweight
125 lbs to 168 lbs	18.5 to 24.9	Healthy weight
169 lbs to 202 lbs	25.0 to 29.9	Overweight
203 lbs or more	30 or higher	Obese
271 lbs or more	40 or higher	Class 3 Obese

The 1st Obese: The limitation of seat space was his concern. He really enjoyed in-flight services, but he still managed to walk around. When he booked the flight, he always asked for an aisle or bulkhead seat. He had no clue about DVT, but he had hyperlipidemia. He would like to get more information about DVT because he did not want it to happen to him during his journey.

The 2nd Obese: He normally did not want to travel on a long-haul flight because it made him sick. Sleeping was the best way for him to do during the flight. He did not know about DVT. His suggestion for the airlines was to encourage passengers to avoid sitting in the same position for a long period. The airlines should inform passengers about DVT during the safety demonstration VDO.

Group 3: Pregnancy

The 1st pregnant lady: When traveling she tried to get the aisle seat because of a high frequency of going to the bathroom. She could not sleep well, so she kept watching movies, reading magazines, and ordering some drinks to keep herself hydrated. She had a bit of information about DVT. Sometimes she could see the short VDO about how to be safe during the flight. It was about what to do to keep passengers safe and healthy. She said that passengers should be aware of what could happen to them during the flight and the airline should be more concerned about the risk of DVT.

The 2nd pregnant lady: She flew on a long-haul flight only twice during pregnancy. She knew that it was not easy to travel with the condition. If she entered week 28 of pregnancy, she must have the fit to fly confirmation letter from the doctor to fly. She often went to the bathroom during the flight. Luckily she got the aisle seat and her seat was close to the bathroom. She did not know anything about DVT. She wanted the airlines to inform all passengers before the flight. At least passengers know what to do to prevent themselves from DVT.

Group 4: Smokers

The 1st smoker: He knew that it was not allowed to smoke during the flight, so he managed to smoke just before the flight and brought some chewing gum onboard. He usually smoked up to two packs of cigarettes. He just took a nap during the flight and watched movies. Walking around in the cabin was also his option. He would rather get some drink in the galley than pressing the call bell. He did not know about DVT. The following was his suggestion to the airline; the airline should ask questions that concerned the passengers' life and health during the booking process.

2nd smoker: He loved traveling and also smoking. It was challenging for him not to smoke during the flight. He chose to drink a lot of water instead of thinking about smoke. He sometimes walked around and stretched his legs. He did not know about DVT, but he was interested to get more information. The suggestion for the airline was to add more information about DVT on the inflight entertainment.

Group 5: Alcoholics

The 1st alcoholic: The longest flight that he had done was 16 hours. It was long enough to sleep and enjoy food & beverage service. He tried not to drink much alcohol even it was free of charge. He preferred to drink after the flight. He did not know about DVT, but he mentioned that it might be serious if it happened during the flight. It would be great if airlines provide information about DVT and obviously inform the passengers.

The 2nd alcoholic: Drinking during the flight was his favorite. He preferred to try all alcoholic drinks and he was not drunk easily. He often needed a bathroom because he drank a lot. Exploring inside the aircraft was also a must for him. He did not have any clue about DVT. He suggested that the airlines should prepare the booklet about what to do during the flight, especially the information about DVT, and put them in the seat pocket or magazine rack.

Since the results revealed that most of the samples had a low perception of deep vein thrombosis (DVT). Below are suggestions to reduce the risk of DVT (Evans, 2018).

- Walk around during the flight as often as possible when it is safe to do
- Refrain from crossing your legs
- Refrain from wearing tight clothes that can affect blood flow
- Refrain from drinking alcohol before and during the flight
- Keep hydrated by drinking water
- Stretch legs and move feet while sitting

There are also some exercises to keep blood flowing and reduce the risk of clots. The passengers may easily do it during the flight.

- Stretch out your legs in front of you and flex your ankles. Pull up and spread toes, then push down and curl toes. Repeat all these steps 10 times. Remove shoes if necessary.
- If you do not have enough room to extend your legs, you can just put your feet flat on the floor. Push down and curl toes while lifting heels from the floor. Then, with heels back on the floor, lift and spread toes. Repeat all these steps 10 times.

- Exercise thigh muscles by sitting with feet flat on the floor. Start with sliding feet forward a few inches, then sliding them back. Repeat all these steps 10 times.

Figure 2 Leg exercises for air travel

Figure 2 shows how to exercise for your legs and feet while sitting in your seat during the flight. Alternately pulling the heels up and then lifting the toes help increase blood flow in the calf veins and also decreases the risk of forming blood clots (Sugerman et al., 2012).

5. Conclusion

The perception of passengers toward deep vein thrombosis is important for air travel, especially for long-haul flights. This research found that most passengers had a low perception toward DVT. The most significant aspect was about the different behaviors of passengers that affect the occurrence of DVT ($\bar{x}$ = 2.76).

Suggestions and comments from the passengers toward the deep vein thrombosis of the passengers on long haul flights were grouped as follows: the airlines should provide information about DVT for passengers (48%), the passengers did not know about DVT and they would like to know how to prevent DVT (35%), the behaviors could be the main point of being healthy (10%), and others (7%).

According to an in-depth interview, there was only one sample who knew about DVT while the rest of them had no idea what DVT was, even they were in the risk group of getting DVT. The passengers would like to know more about the information and how to prevent themselves from DVT by all means of communication from the airlines.

Being healthy during a long-haul flight is what passengers prefer. There is some advice to stay away from DVT such as keep hydrated by drinking water, avoid drinking alcoholic drinks, avoid crossing legs for a long period, try to stretch out legs and move feet while seated, or walk around the cabin if possible.

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7. References

Alqahtani, M. M., Arnout, B. A., Fadhel, F. H., & Sufyan, N. S. S. (2021). Risk perceptions of COVID-19 and its impact on precautionary behavior: A Qualitative Study. *Patient Education and Counseling*, doi: 10.1016/j.pec.2021.02.025

Bevis, P. M., & Smith, F. C. (2016). Deep vein thrombosis. *Surgery (Oxford)*, *34*(4), 159-164. doi: 10.1016/j.mpsur.2016.02.001

Bhandari, P. (2020). Designing and analyzing Likert scales. Retrieved November 10, 2020, from https://www.scribbr.com/methodology/likert-scale/

Centers for Disease Control and Prevention. (2020). *Defining Adult Overweight and Obesity*. Retrieved November 13, 2020, from https://www.cdc.gov/obesity/adult/defining.html

Cooray, R., & Lake, C. (2018). Prevention of deep vein thrombosis and pulmonary embolism. *Anaesthesia & Intensive Care Medicine*, *19*(9), 480-485. doi: 10.1016/j.mpaic.2018.06.007

Evan, J. (2018). Everything You Need to Know About Deep Vein Thrombosis (DVT) and Flying. Retrieved December 1, 2020, from https://www.healthline.com/health/dvt-and-flying

Health24. (2011). *Prevent blood clots while flying*. Retrieved December 1, 2019, from https://www.news24.com/health24/Medical/Leg/Deep-vein-thrombosis/Prevent-blood-clots-while-flying-20120721

ICAO, (2019). *The World of Air Transport in 2019*. Retrieved February 1, 2021, from https://www.icao.int/annual-report-2019/Pages/the-world-of-air-transport-in-2019.aspx

Mayo Clinic. (2019). *Deep vein thrombosis (DVT)*. Retrieved November 5, 2019, from https://www.mayoclinic.org/diseases-conditions/deep-vein-thrombosis/symptoms-causes/syc-20352557

Plotnikoff, R. C., & Trinh, L. (2010). Protection motivation theory: is this a worthwhile theory for physical activity promotion? *Exercise and Sport Sciences Reviews*, *38*(2), 91-98. doi: 10.1097/JES.0b013e3181d49612

Ryan, C. (2016). Deep vein thrombosis: How long-haul flights can ruin more than your holiday. Retrieved November 5, 2019, from https://www.abc.net.au/news/health/2016-12-17/long-haul-flights-to-london-and-dvt/8128080

Statistics How To. (2019). *Cochran's Sample Size Formula*. Retrieved November 29, 2019, from https://www.statisticshowto.com/probability-and-statistics/find-sample-size/

Sugerman, H. J., Eklöf, B. G., Toff, W. D., Burke, A. E., & Livingston, E. H. (2012). Air Travel–Related Deep Vein Thrombosis and Pulmonary Embolism. *JAMA*, *308*(23), 2531-2531. doi: 10.1001/jama.2012.4098

Wyzant. (2019). *Data.* Retrieved November 10, 2020, from https://www.wyzant.com/resources/lessons/math/statistics_and_Probability/introduction/data