



Middle East Technical University
Department of Statistics

**DESG (DEMOGRAPHIC, ECONOMIC, SOCIOLOGIC, GEOGRAPHIC) FACTORS
AND DISASTER AWARENESS IN TURKEY**

STAT 365
SURVEY AND SAMPLING TECHNIQUES

BY
LEVENT SARI 2290930
CEREN ATEŞ 2290492
İPEK AYDIN 2290526

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ABSTRACT

Disasters are what become of hazards that victimize people. To prevent disasters from occurring, every member of a society needs to be aware and prepared against them. This study aims to measure the awareness and preparedness levels for different segments of community separated by various DESG factors, and how open every segment is to be improved. The study was conducted by focusing mainly on earthquakes, floods and the recent pandemic disaster. First, an online survey was conducted with the aim of reaching every DESG group which was almost perfectly achieved, with a side-effect of possible biases. Later on, the data consisting of 639 subjects was examined using MS Excel, R and Python. After cleaning the data, measures for disaster awareness and preparedness were calculated using simple functions in R and MS Excel respectively. The DESG information was then visualized, and summary statistics were shown. Subsequently, relevant statistical methods such as Kruskal-Wallis tests for relationships between variables, Shapiro-Wilk tests to measure whether the variables were parametric, and Chi-Squared tests along with Cramer's V correlation tests to look for relationships between categorical variables were used. Satisfying evidence on relationships between disaster awareness and age, region of accommodation; and satisfying evidence on relationships between disaster preparedness and age, income levels of participants were found. It was also observed that females are more willing to get educated on disaster awareness and preparedness.

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1. INTRODUCTION

Disasters are emergency situations that have considerable negative effects on a population, limiting the population's capability of restoration.¹ It is necessary to be prepared for disasters in order to diminish the destructiveness and the catastrophe they cause to people and the environment. In case of a disaster, people should know what to do and take precautions beforehand. A previous work by Karanci et al. (2005, p. 243), elaborates on a similar research done in 2003 with a sample of 800 participants shows that many factors including experiences, disaster education, and some of the social and demographic factors had significant impacts on disaster awareness, anxiety and preparedness.²

This study aims to find relationships between disaster awareness and various DESG factors. The intent on doing this is both to measure disaster awareness and preparedness from every fraction of the population, and also to raise awareness about disasters with the published result. In the study, how prepared people with different demographic characteristics in Turkey are against a potential earthquake, flood, or pandemic disaster is measured. Also, the factors that separate people's opinions and various beliefs on disaster awareness are investigated. The rating system used was measured by disaster awareness levels calculated from various questions. Using these observations, relevant statistical tests were conducted with the hopes of results helping in enhancing disaster prevention measures both in the community and relevant government offices.

1.1 DICTIONARY AND DESCRIPTION

Natural hazards: "Natural hazards", are extraordinary occurrences of nature that might have varying negative outcomes including casualties and material/non-material damages over their victims along with the area it occurs in. Natural hazards (Extraordinary occurrences of nature) include but are not limited to geologic (Earthquakes, volcanic eruptions, landslides, avalanches) and biologic (Epidemic diseases, wildfires).³

Disaster: A disaster is what hazards evolve into when there are victims or any kind of after effect that damages how the population operates. Disasters could be both natural, and industrial.⁴

Disaster preparedness: Disaster preparedness accounts for every action that helps in preventing the negative after-effects of prospecting hazards, reducing the harmful outcomes and fixing the damage done by them.⁵

The NUTS classification system: The NUTS (Nomenclature of territorial units for statistics) classification system, taking its name from the French version "Nomenclature des Unités Territoriales Statistiques", is a statistical ordered structure that helps in splitting a country by the economic situations of the regions while aiming:

- Acquiring, enhancing and adjusting the compatibilities of territorial European statistics.
- Making inference about social and economic statuses of territories.
 - NUTS 1: Territories split with the widest range of socio-economic similarity.
 - NUTS 2: Territories further split by legislative and executive decisions
 - NUTS 3: Territories further split into small pieces by unique attributes of the pieces⁶

¹ (Lee E, Lee H. Disaster awareness and coping: Impact on stress, anxiety, and depression. *Perspect Psychiatr Care*. 2019; 55:311-318)

² (Karanci, Ayse & Aksit, Bahattin & Dirik, Gulay. Impact of a community disaster awareness training program in Turkey: Does it influence hazard-related cognitions and preparedness behaviors. *Social Behavior and Personality - SOC BEHAV PERSONAL*. 2005; 33. 243-258)

³ (Smith, K. *Environmental hazards: Assessing risk and reducing disaster*. 2013)

⁴ The International Federation of Red Cross and Red Crescent (IFRC), (*What is Disaster*, (n.d.)2021)

⁵ The International Federation of Red Cross and Red Crescent (IFRC), (*Disaster Preparedness*, (n.d.)2020)

⁶ Eurostat, Navigation. (n.d.). 2021

2. AIMS OF RESEARCH

2.1.Main Objective

The study primarily scopes on analysing the relationships between disaster awareness and various DESG factors.

2.2.Minor Objectives

1. Finding the factors that separate people's opinions and various beliefs on disaster awareness.
2. Raising awareness on disasters, their causes and outcomes.
3. Implementing disaster risk detection for prospecting disasters.
4. Urging people to increase their preparedness against disasters and use scientific data to support their preparations.
5. Increasing mental and physical preparedness for possible upcoming disasters.

2.3.Research Philosophy

This research study embraces the philosophy of ontology as it aims to study the nature of reality and a group's perception of reality. The ontological approach is also supported with the focus on sociologic, economic and demographic factors affecting the various beliefs about disasters and how close they are to reality. Since the study mainly researches people's opinions on disasters, it mainly specialises further into objectivism. In addition, keeping in mind the opportunities of raising disaster awareness and reducing future casualties, extends the approach to pragmatism.⁷

2.4.Significance of the Study

This study aims to find relationships between disaster awareness and various DESG factors. As preventing disasters requires mainly the population's aid along with the related institutions⁸, the outputs of this study shall be used as input to guide relevant organizations in their future studies in the field, especially providing sufficient data to increase overall disaster awareness in the community under study.

3. RESEARCH PREPERATION

3.1. Literature Review

A study done by Karkanci, A.N. and Aksit, B. (1998) has mentioned as a "lesson learned" that the community of Bursa was eager to enhance in disaster preparedness after the 1998 Earthquake, however the effects of the experience did not last long and the work on the subject ended quickly, implying that past experiences had no impact on people's willingness to improve.⁹ According to a similar study that focuses on the results of the famous "1999 Earthquake" which was one of the most overwhelming disasters of Turkey, it discusses that focusing on social and cultural factors of the survivors should be an aspect in a study that aims

⁷ Saunders, Lewis & Thornhill (2019). Understanding research philosophy and approaches to theory development. In *RESEARCH METHODS FOR BUSINESS STUDENTS* (8th ed., pp. 128-170).

⁸ (Newport, J.K. and Jawahar, G.G.P. "Community participation and public awareness in disaster mitigation", Disaster Prevention and Management, 2003; Vol. 12 No. 1, pp. 33-36.)

⁹ (Karanci, Ayse & Aksit, Bahattin. Strengthening community participation in disaster management by strengthening governmental and non-governmental organisations and networks: a case study from Dinar and Bursa (Turkey). 1998)

to enhance disaster preparedness and awareness.¹⁰ Not only the people who have lived through disasters are more prepared compared to the others, a study done on risk analysis and strategy making has found that people living in high-risk areas are constantly worried and thinking about the possibility of a disaster, making them involuntarily more aware of the risk.¹¹ In another study that was conducted on a sample of 461 survivors of the Erzincan earthquake; a relationship between sacredness, level of management and education levels was found.¹²

3.2. Research Questions

Mainly, the relationship between disaster awareness and various DESG factors was the subject to be researched on. Expanding on, five research questions were chosen:

- 1-) Does disaster awareness increase as education level increases? At which level of education is disaster awareness the lowest?
- 2-) Does disaster and risk awareness of communities depend primarily on age and other demographic and geographic factors (gender, the city of residence)?
- 3-) Which groups of the community are the most open to enhancement about disaster preparedness?
- 4-) Does disaster awareness have a relationship with level and steadiness of income?
- 5-) Do past experiences and existing awareness have an impact on mental and physical disaster preparedness?

4. RESEARCH METHODS

4.1. SURVEY DESIGN

4.1.1. Sample Design

As a method of non-probabilistic sampling, Convenience (Haphazard, Accidental) Sampling functions by sampling certain subjects from a population who are easier to cooperate with, which might include people that are physically adjacent to the researchers, people that are eager to join the study, or people that are easily reachable. Convenience sampling is a low-cost, low-effort method of sampling and the participants using this method are usually found easily. In a study that uses convenience sampling, the analysts are required to express that the sample might diverge from a probabilistic sample. Also, the analysts must give information about the removed subjects or subjects that are commonly chosen for the sample. In this method of sampling, gathering data from subjects that are in close proximity of reach to the analyst is aimed.¹³

A widely used and non-probabilistic sampling method effective against hidden populations is Snowball Sampling. The main principle behind it is having participants recommend the study to people with certain aspects that they might see as an asset to the study. Disadvantages of this method mostly breed from the non-probabilistic method of choosing participants as it may result in a dependence on biased decisions of the informants, uneasiness about privacy, interactions and similarities between the magnitude and selection probabilities of the sample.¹⁴

¹⁰ Ecevit, M., & Kasapoğlu, A. Demographic and psychosocial features and their effects on the survivors of the 1999 earthquake in Turkey. (2002).

¹¹ (López-Vázquez, E., & Marván, M. L. RISK PERCEPTION, STRESS AND COPING STRATEGIES IN TWO CATASTROPHIC RISK SITUATIONS. 2003)

¹² (Rüstemli, A., & Karanci, A. N. Correlates of Earthquake Cognitions and Preparedness Behavior in a Victimized Population. 1999)

¹³ (Etikan, *Comparison of Convenience Sampling and Purposive Sampling*, 2015)

¹⁴ (Johnson, T.P. Snowball Sampling: Introduction, 2014)

4.2. QUESTIONNAIRE DESIGN & CONSTRUCTION

4.2.1. Questionnaire Design

Every question in the survey was designed carefully to serve a purpose. It was endeavoured to ask questions that people would not hesitate to answer and would not be offended. Demographic questions are placed at the end to prevent participants leaving before completing the survey or giving unrealistic answers. The survey was kept as short as possible to keep people from getting bored. The options for the questions of the questionnaire were written as simple and clear as possible. The questions were aimed to be straightforward and to raise awareness of people about disasters, even while answering the questions. It was instructed in the informative paragraph at the beginning of the survey that only one person from each household to fill in in order not to collect similar data. A specific time limit was set and stated for the survey thus, no chance is given for extra data to occur after the analysis process has begun. Eventually, the survey was designed on Google Forms and a simple link was acquired to spread the survey by snowball sampling technique.

In the survey, the first nine questions were used to measure the disaster awareness score and they were adapted from the Federal Emergency Management Agency (FEMA), next four questions focus on the respondents' experiences and possible approaches on disasters, and the last thirteen questions aim to measure respondents' emergency and disaster awareness.

4.2.2. Pilot Survey

The pre-test questionnaire was applied to the participants who were chosen via convenience sampling. In the pre-test questionnaire, it was noticed that some of the questions were not clear enough. These questions have been reorganized to be simple and understandable by all. Short and clear questions were used instead of long and complicated ones.

5. DATA

5.1. Data Collection

This survey was conducted within 2 weeks (07.12.2021-21.12.2021) via online because of Covid-19 Pandemic. The odds of having physical communications and interviews were slim. Google Forms was used to collect the data. The researchers implemented a questionnaire of 32 questions and pretested before going through the data collection process. There were 639 responses, more than triple of the expected responses.

5.2. Descriptive Statistics

5.2.1. Initial Analysis on the Data Set

Before starting the analysis, the data were classified into six main groups: disaster preparedness, disaster awareness, belief and opinion, experience, demographic characteristics and openness to change.

Disaster Preparedness Score was calculated by using the if function in Microsoft Excel. The Total Preparedness Score and the Total Disaster Awareness Score were calculated by assigning a value of 1 or 0 to the answer of each question to obtain numerical variables from the responses. For loop in R was used for the Total Disaster Awareness Score.

There are 2 binary variables for belief and opinion section. The responses of the questions related to experience result in categorical variables.

The demographic data consists of both categorical and binary data. Regions are classified according to NUTS shown in *Table 1* and then the data were manipulated and processed accordingly.

The questions asked to determine the groups which are the most open to enhancement provides 2 different groups of binary data.

5.3. Data Processing

From the answers given to various questions, scores of disaster awareness and disaster preparedness were calculated. Different statistical methods were then applied to various factors and the score to search for relationships between the factors and awareness. For the statistical analysis and data visualization parts of the research study, the primary tool has been chosen as R. As a supplementary software, MS Excel was used for extra analysis and score calculation.

REGIONS OF TURKEY SEPERATED BY NUTS CLASSIFICATION SYSTEM		
NUTS 1	NUTS 2	NUTS 3
Istanbul Region (TR1)	<i>Subregion of Istanbul (TR10)</i>	Istanbul (TR100)
West Marmara Region (TR2)	<i>Subregion of Tekirdag (TR21)</i>	Tekirdag (TR211) Edirne (TR212) Kırklareli (TR213)
	<i>Subregion of Balıkesir (TR22)</i>	Balıkesir (TR221) Çanakkale (TR222)
Aegean Region (TR3)	<i>Subregion of İzmir (TR31)</i>	İzmir (TR310)
	<i>Subregion of Aydın (TR32)</i>	Aydın (TR321) Denizli (TR322) Muğla (TR323)
	<i>Subregion of Manisa (TR33)</i>	Manisa (TR331) Aydınkarahisar (TR332) Kütahya (TR333) Uşak (TR334)
East Marmara Region (TR4)	<i>Subregion of Bursa (TR41)</i>	Bursa (TR411) Eskişehir (TR412) Bilecik (TR413)
	<i>Subregion of Kocaeli (TR42)</i>	Kocaeli (TR421) Sakarya (TR422) Düzce (TR423) Bolu (TR424) Yalova (TR425)
West Anatolia Region (TR5)	<i>Subregion of Ankara (TR51)</i>	Ankara (TR511)
	<i>Subregion of Konya (TR52)</i>	Konya (TR521) Karaman (TR522)
Mediterranean Region (TR6)	<i>Subregion of Antalya (TR61)</i>	Antalya (TR611) Isparta (TR612) Burdur (TR613)
	<i>Subregion of Adana (TR62)</i>	Adana (TR621) Mersin (TR622)
	<i>Subregion of Hatay (TR63)</i>	Hatay (TR631) Kahramanmaraş (TR632) Osmaniye (TR633)

Central Anatolia Region (TR7)	<i>Subregion of Kirikkale (TR71)</i>	Kırıkkale (TR711) Aksaray (TR712) Nigde (TR713) Nevşehir (TR714) Kirsehir (TR715)
	<i>Subregion of Kayseri (TR72)</i>	Kayseri (TR721) Sivas (TR722) Yozgat (TR723)
West Black Sea Region (TR8)	<i>Subregion of Zonguldak (TR81)</i>	Zonguldak (TR811) Karabuk (TR812) Bartın (TR813)
	<i>Subregion of Kastamonu (TR82)</i>	Kastamonu (TR821) Cankiri (TR822) Sinop (TR823)
	<i>Subregion of Samsun (TR83)</i>	Samsun (TR831) Tokat (TR832) Corum (TR833) Amasya (TR834)
East Black Sea Region (TR9)	<i>Subregion of Trabzon (TR90)</i>	Trabzon (TR901) Ordu (TR902) Giresun (TR903) Rize (TR904) Artvin (TR905) Gumushane (TR906)
Northeast Anatolia Region (TRA)	<i>Subregion of Erzurum (TRA1)</i>	Erzurum (TRA11) Erzincan (TRA12) Bayburt (TRA13)
	<i>Subregion of Agri (TRA2)</i>	Agri (TRA21) Kars (TRA22) Igdir (TRA23) Ardahan (TRA24)
Central East Anatolia Region (TRB)	<i>Subregion of Malatya (TRB1)</i>	Malatya (TRB11) Elazığ (TRB12) Bingöl (TRB13) Tunceli (TRB14)
	<i>Subregion of Van (TRB2)</i>	Van (TRB21) Mus (TRB22) Bitlis (TRB23) Hakkari (TRB24)
Southeast Anatolia Region (TRC)	<i>Subregion of Gaziantep (TRC1)</i>	Gaziantep (TRC11) Adıyaman (TRC12) Kilis (TRC13)
	<i>Subregion of Sanliurfa (TRC2)</i>	Sanliurfa (TRC21) Diyarbakir (TRC22)
	<i>Subregion of Mardin (TRC3)</i>	Mardin (TRC31) Batman (TRC32) Siirt (TRC33) Siirt (TRC34)

Table 1: NUTS Classification System in Turkey ¹⁵

¹⁵ (Şengül, Eslemian, & Eren, Türkiye’de İstatistikî Bölge Birimleri Sınırlamasına Göre Düzey 2 Bölgelerinin Ekonomik Etkinliklerinin VZA Yöntemi ile Belirlenmesi ve Tobit Model Uygulaması, 2013)

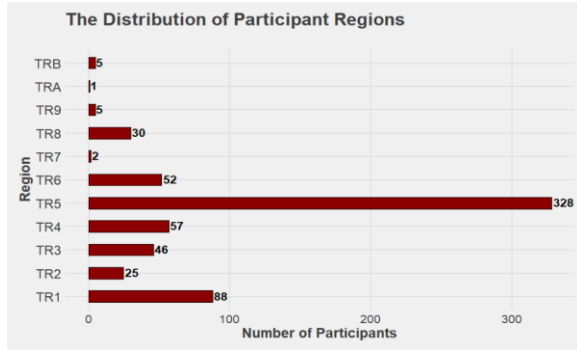


Figure 1: Bar Graph Showing the Allocation of Participants by NUTS

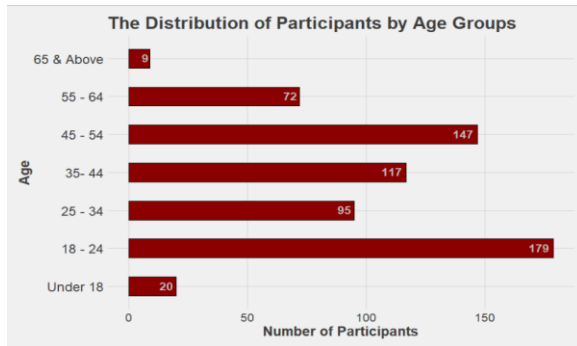


Figure 2: Bar Graph of Participants by Age Groups

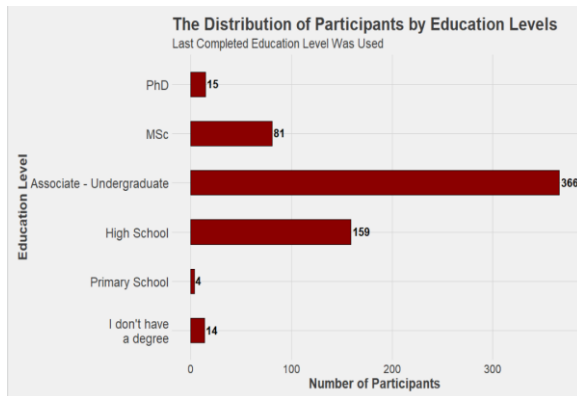


Figure 3: Bar Graph of Participants by Education Levels

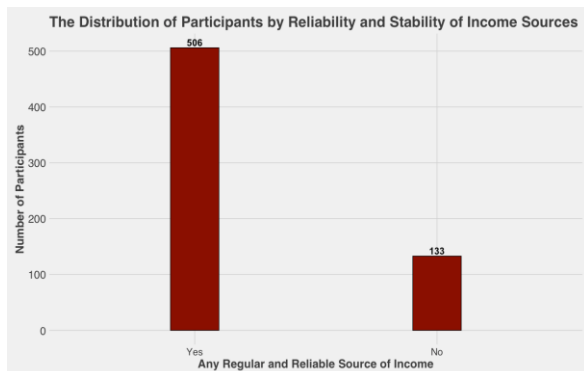


Figure 4: The Distribution of Participants by Reliability and Stability of Income Sources Bar Graph

Figure 1 shows that, 49.3% of the respondents live in Ankara, 13.8% of them live in İstanbul and 36.9% people live in other cities in Turkey.

As illustrated in Figure 2, the age intervals of the respondents are between under 18 with 3.1%, 18-24 with 28%, 25-34 with 14.9%, 35-44 with 18.3%, 45-54 with 23%, 55-64 with 11.3%, and 65+ with 1.4%.

Figure 3 shows that, the last completed degree of the respondents was associate-undergraduate with 57.3%, high school with 24.9%, MSc with 12.7%, PhD with 2.3%, do not have any degree with 2.2%, and primary school with 0.6%.

In Figure 4, it can be seen that while 79.2% of the respondents have a regular and reliable source of income, 20.8% of them do not have any regular and reliable income.

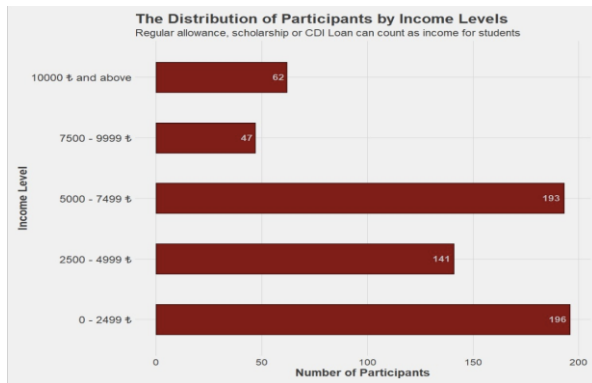


Figure 5: The Distribution of Participants by Income Levels Bar Graph

Observing the monthly income distribution given in *Figure 5*, 30.7% of the respondents have 0-2499 ₺, 30.2% have 5000-7499 ₺, 22.1% have 2500-4999 ₺, 9.7% have 10000+ ₺ and 7.4% have 7500-9999 ₺ monthly income.

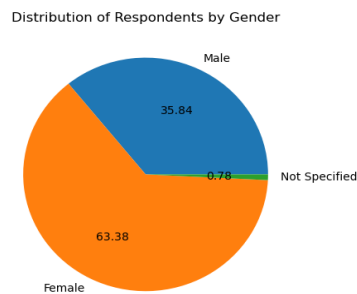


Figure 6: Pie Chart of Gender Distribution

Out of 639 respondents, 63.4% were females, 35.8% were males, and 0.8% were not specified as illustrated in *Figure 6*.

5.1.3. Statistical Tests

Statistical Methods on Research Questions:^{16 17 18}

For each research question, needed number of hypotheses were conducted with the aim of implementing statistical methods to confirm or deny them. The corresponding statistical methods were Shapiro-Wilk tests for normality, Box-Cox transformation for the trial of parametrization of the variables, Kruskal – Wallis Rank Sum Test to look for median differences of numeric variables between varying levels of a categorical variable is applied along with the corresponding boxplot of the variables. To inspect the relationship between two categorical variables, contingency tables were conducted and depending on the expectations of the responses, either Fisher's Exact test or the Chi-Squared test was applied on the table to find correlations between the two variables. The appropriate correlation measure such as Cramer's V correlation coefficient was also calculated on certain hypotheses to further explain the correlation.

¹⁶(Bluman, *Elementary statistics: a step by step approach*. 2018)

¹⁷ (Freund, J. E., & Perles, B. M. *Modern elementary statistics*. 2014)

¹⁸ (Irizarry R.A. *Introduction to Data Science: Data Analysis and Prediction Algorithms with R*. 2019)

6. ANALYSIS AND FINDINGS^{19 20}

6.1. ANALYSIS

Research Question 1:

Does disaster awareness increase as education level increases? At which level of education is disaster awareness the lowest?

H₀: Median disaster awareness status of people are the same for each group of education level.

H_A: People with a high level of education have higher disaster awareness scores.

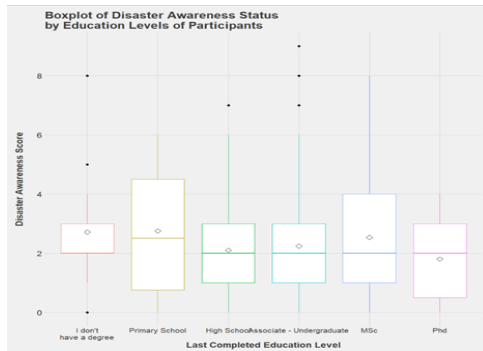


Figure 7: Box Plot of Disaster Awareness Status by Education Level of Participants

There does not seem to be a clear relationship between education status and disaster awareness score in the box plot. Appropriate tests can be conducted to test for further accuracy.

When the normality of the data is checked, according to the results of the Shapiro-Wilk Normality test ($P - \text{value} < 0.22 \times 10^{-15}$), the data does not follow a parametric distribution. Normalization of the data is tried with a Box-Cox transformation with power equal to ~ 0.1818 to no avail. (Transformed $P - \text{value} < 0.22 \times 10^{-15}$) As the non-parametric equivalent of the appropriate test, Kruskal – Wallis Rank Sum Test was applied ($K-W X^2 = 3.1032$, $P - \text{Value} = 0.6841$). Since the p-value is larger than 0.05 by high margins, no relationship between the variables can be confirmed.

Research Question 2

Does disaster and risk awareness of communities depend primarily on age and other demographic and geographic factors (gender, the city of residence)?

H₀: Median disaster awareness status of people are the same for each age group.

H_A: Younger people are more aware of disasters.

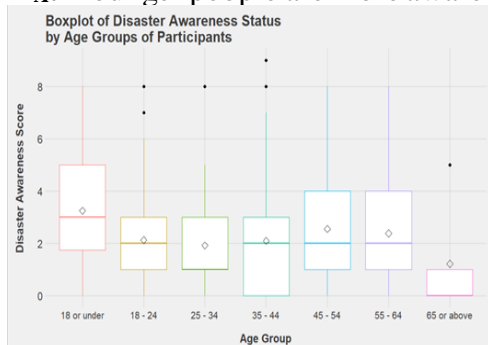


Figure 8: Box Plot of Disaster Awareness Status by Age Groups of Participants

The box plot shows varying levels of disaster awareness scores between age groups. The differences between each group can be closely examined by using statistical methods.

Kruskal – Wallis Rank Sum test is applied to look for a considerable amount of change between at least two groups. ($K-W X^2 = 16.972$, $P - \text{Value} = 0.009386$). An important change between at least two of the age groups can be seen from the rank sum test.

H₀: Median disaster preparedness status of people are the same for each age group.

H_A: Older people are more prepared for disasters.

¹⁹ (J. Maindonald and W.J. Braun, Data Analysis and Graphics Using R, 2010)

²⁰ (Montgomery, D.C., E. A. Peck and G.G. Vining. Introduction to Linear Regression Analysis, 2012)

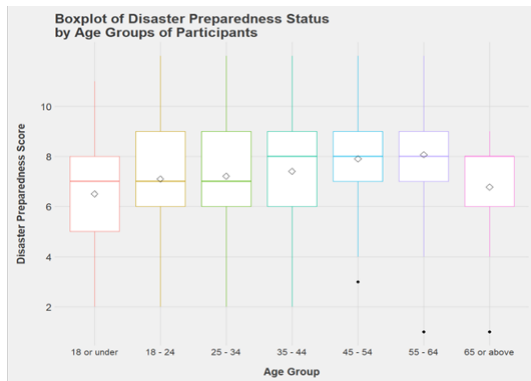


Figure 9: Box Plot of Disaster Awareness Status by Age Groups of Participants

The plot seems to show no significant differences of disaster preparedness scores between age groups. Statistical methods are then used to make sure.

Since the preparedness score fails the normality check, a Box-Cox transformation with power equal to 1.1 is applied to failure. Kruskal-Wallis test is then applied to look for evidence on rejecting the null hypothesis, which provides enough evidence to reject H_0 ($K-W X^2 = 24.338$, $P\text{-value} = 0.0004524$).

H_0 : Median disaster awareness score is the same for all NUTS regions in Turkey.

H_A : Istanbul region is more aware compared to other regions.

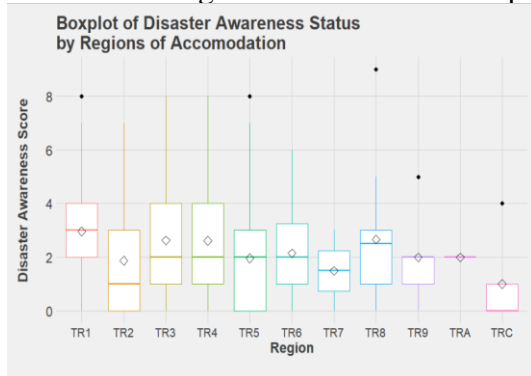


Figure 10: Box Plot of Disaster Awareness Status by Regions of Accommodation

The plot seems to show the region with the highest disaster awareness score is in the İstanbul Region.

To confirm, the Kruskal-Wallis Rank Sum Test ($K-W X^2 = 30.984$, $P\text{-Value} = 0.0005903$) is applied after an unsuccessful Box-Cox transformation (Transformed $P\text{-value} < 0.22 \cdot 10^{-15}$) to find a momentous difference between at least two groups, satisfying the need for evidence to reject null hypothesis for the alternative hypothesis.

Research Question 3

Which groups of the community are the most open to enhancement about disaster preparedness?

H_0 : Eagerness to improvement about disaster preparedness is the same for each age group.

H_A : Younger people are more eager to improve in disaster preparedness.

Openness to Improvement \ Age	No	Yes	No (Expected)	Yes (Expected)
18 or under	2	18	3.661972	16.338028
18-24	33	146	32.774648	146.225352
25-34	14	81	17.394366	77.605634

As the expected values include inputs less than 5, Fisher's Exact test ($P\text{-Value} = 0.3228$) is applied instead of a Chi-Squared test, which shows that there is a significant relationship between age groups and openness to be educated about disaster management, however with no clear pattern.

35-44	21	96	21.422535	95.577465
45-54	25	122	26.915493	120.084507
55-64	21	51	13.183099	58.816901
65 or above	1	8	1.647887	7.352113

Figure 11: Contingency and Expected Contingency Table

H₀: Eagerness to improvement about disaster preparedness is the same for each gender.

H_A: Females are more eager to improve in disaster preparedness.

Openness to Improvement \ Gender	No	Yes	No (Expected)	Yes (Expected)
Not Specified	2	3	0.915493	4.084507
Male	56	173	41.929577	187.070423
Female	59	346	74.154930	330.845070

Figure 12: Contingency and Expected Contingency Table

Since the expectations include two inharmonious values (<5), Fisher's Exact test (P-Value = 0.002589) is again applied instead of Chi-Squared test and a significant relationship is found with a very weak Cramer's V correlation score of 0.1321, which means likeliness to participate in disaster management training increases from not specified to males and from males to females.

Research Question 4

Does disaster awareness have a relationship with level and steadiness of income?

H₀: Disaster awareness status is the same for every group of income level.

H_A: The disaster awareness of at least one group differs from the others.

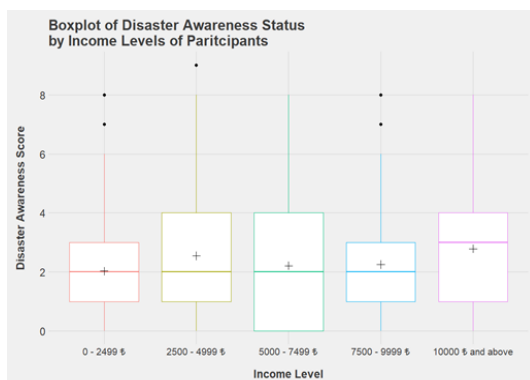


Figure 13: Box Plot of Disaster Awareness Status by Income Levels of Participants

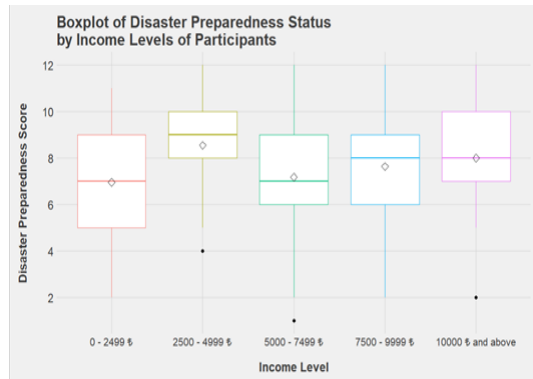
By looking at the boxplot, an increase in disaster awareness can be observed for the highest income group.

First, a failed Box-Cox transformation with power equal to 0.2222 to make the data normal is tried (Transformed P - value $< 0.22 \times 10^{-15}$). After that, the Kruskal-Wallis Rank Sum test is

applied ($K-W X^2 = 6.2136$, $P\text{-Value} = 0.1838$) and no significant change of disaster awareness between income groups is found. Providing no evidence to reject the null hypothesis.

H₀: Disaster preparedness status is the same for every group of income level.

H_A: People with higher incomes are more prepared for disasters.



The boxplot seems to indicate differences for median preparedness score between different income levels.

Figure 14: Box Plot of Disaster Preparedness Status by Income Levels of Participants

After the Box-Cox transformation with a power value equal to 1.31 (Transformed P - value $< 0.22 \times 10^{-15}$) and with failure to normalize the data, Kruskal - Wallis test is conducted to look for a significant relationship ($K-W X^2 = 31.809$, P - Value = 0.000002093), a significant change of median disaster preparedness between groups is found. A pairwise comparison test is done to look for the relationship between each group separately.

Pairwise Comparisons Using Wilcoxon Rank Sum Test with Continuity Correction				
Income Level	0 – 2499₺	2500 – 4999₺	5000 – 7499₺	7500 – 9999₺
2500₺ – 4999₺	0.00000083	-	-	-
5000₺ – 7499₺	0.40887	0.00039	-	-
7500₺ – 9999₺	0.00884	0.00219	0.11980	-
10000₺ & above	0.00884	0.16423	0.05459	0.22088

Figure 15 Wilcoxon Test on Income levels and Disaster Preparedness

In line with the boxplot, differences between most groups can be seen, with the most significant difference being between the first two income groups.

Research Question 5

Do past experiences and existing awareness have an impact on mental and physical disaster preparedness?

H₀: People's experience has no relationship with their preparedness level.

H_A: Experienced people are more prepared for disasters.

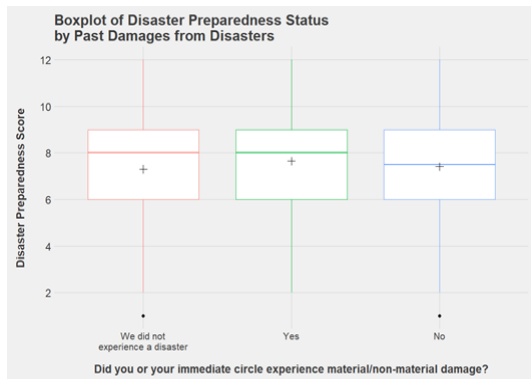


Figure 16: Box Plot of Disaster Preparedness Status by Past Damages from Disasters

No clear relationship is seen from the boxplot.

Kruskal - Wallis Rank Sum test ($K-W X^2 = 2.4891$, $P\text{-Value} = 0.2881$) to find evidence of relationship is applied and no significant result to reject H_0 is found.

H_0 : Past disaster damage has no effect on religious outlook.

H_A : People with past disaster damage take a more religious approach on identifying the causes of disasters.

Religious Approach \ Material -- Non-Material Disaster Damage	Yes	No	Yes (Expected)	No (Expected)
We were not exposed to disaster	26	163	28.39437	160.6056
Yes	31	145	26.44131	149.5587
No	39	235	41.16432	232.8357

Figure 17: Expected Frequency Table of Religious Approach/ Material—Non-Material Disaster Damage

As there are no expected values smaller than 5, a Chi-Squared test ($P\text{-Value} = 0.523$) was applied to look for significant differences of religious approach between groups. The results show no significant relationship between past disaster experience and religious approach to the cause of disasters, giving no evidence to reject the null hypothesis.

6.2.FINDINGS

After the above tests were applied on the data, a consensus on the relationships of various factors to disaster awareness was formed. Firstly, it is clear, there exists no link between education level and disaster awareness. There is convincing evidence that a relationship between age and disaster awareness exists which, by looking at the plot, seems to be the highest on people under the age of 18. Similarly, even though there seems to be no clear relationship in the plot, age also seems to have a relationship with disaster preparedness, making it an important factor in the study. By looking at the plot and the relevant Kruskal – Wallis test result, Istanbul seems to be the region with the highest disaster awareness score, making the region a valid geographical factor in disaster awareness. Looking at age and willingness to enhance disaster preparedness, it was thought that younger people would be more willing to take necessary education, however there was no sufficient evidence to support the claim after the Fisher's Exact Test was done on the relevant variables. On the contrary, genders had different

responses on willingness to enhance, with females being more open to take the necessary education around 1.13 times how much the men are, according to the relevant Cramer's V statistic. From the information that both the graph and the tests provide, there was no clear relationship between disaster awareness and income levels of the participants, looking at the relationship between income levels and disaster preparedness however, there was sufficient evidence of a relationship between the two. Still, no clear pattern was found on the data. Past experiences seem to have no correlation with disaster preparedness, neither with the people's religious looks on disasters.

7. CONCLUSION AND RECOMMENDATIONS

Hazards should be acknowledged as part of daily life. More than half of the subjects in this study have been exposed to hazards in one way or another, and a considerable amount of them had material/non-material losses. To prevent these losses and also to prevent hazards from becoming disasters, every member of the community should be aware of and prepared against them. The study done on the subjects shows that varying factors contribute to disaster awareness and preparedness levels of the participants. These factors can be examined by both governmental and non-governmental organizations to pinpoint the groups that need to be enhanced the most, along with the ones that are most open to enhancement. Participants of this project stated that the survey improved their disaster awareness even when they only filled the questionnaire. Thus, in addition to the scientific research, the goal of raising awareness has been achieved. The study also shows that an important number of participants are willing to be educated on disasters, which is a remarkable opportunity that would potentially result in increasing their awareness and preparedness scores. By looking at the past literature that is in line with the study, small-scale attempts and efforts on increasing disaster awareness or disaster preparedness can be seen. The research done on the literature also shows that the results about factors and their relationship with the awareness/preparedness scores can be varying from subject to subject. Follow-up research on the willing subjects of this study is also planned with the aim of measuring both the effects of time and the effects of the conducted survey on people's awareness.

Keeping the results in consideration, a large-scale study at measuring the disaster awareness and preparedness of Turkey as a whole can be attempted if the appropriate crew and equipment needs for the study are satisfied, results of which can be used as guidelines by governmental and non-governmental organizations to improve disaster prevention measures all around the country.

It can also be discussed that disaster prevention should be of utmost importance for the relevant organizations in Turkey, as the negative effects of even the smallest disaster can have a large-scale impact on the country. Expenditures should not be avoided to make hazards stay as they are and prevent them from becoming disasters.

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9. APPENDIX

Turkey Disaster Awareness Survey

This survey study was prepared to complete the requirement of STAT365 course as 3rd year students of the Statistics Department of Middle East Technical University. Information collected from this study to examine the statistical methods used, people of different people living in Turkey, earthquakes, floods and aimed to measure their pandemic disaster awareness and preparedness. With the results obtained, it is aimed to make it easier for the society to raise awareness and take measures against future disasters. The data collected in this study that may be personal or identifying will be kept confidential. If you are uncomfortable or abstain from marking a question, you can leave the survey.

Disaster Awareness Questions

The questions asked in this part are adapted from the disaster awareness scale prepared by FEMA and will be used to measure your disaster awareness score.

Do you know the cautions taken and preparations made against emergencies and disasters by official institutions in your country? *

Yes – No

Do you know how to track the emergency broadcasts in case of an emergency situation? *

Yes – No

Do you have a disaster kit that you can use in emergency situations which contains vital components in a designated place at your home? *

Yes – No

Do you have a disaster bag in your home, workplace or car which contains essential wares and equipment that you can easily fetch in case of an emergency? *

Yes – No

Did you prepare communication plan with your family for emergency situations? *

Yes – No

Do you have a designated meeting location supposing you fail to return home or make contact with your family in case of an emergency? *

Yes – No

Have you ever drilled/practiced what you should do in an emergency? *

Yes – No

Have you ever volunteered for an emergency organization? *

Yes – No

Have you taken a mouth-to-mouth resuscitation course or any other first aid courses in the last 5 years? *

Yes – No

Experience, Knowledge and Opinion Questions

The questions asked in this part are prepared with the aim of gathering information about the experiences and approaches you and your immediate circle might have on disasters.

Please specify the types of disaster you or your intimate circle has experienced if there is any. (This question can be left empty if there is no disaster experienced.)

Earthquake - Flood - Pandemic Illness - Other

If you or your intimate circle has experienced a disaster, did any of you experience material/non-material damage? *

Yes – No - We did not experience disasters.

Do you think that a person's manner of life or faith can be a cause of disasters? *

Yes – No

Do you think that a person's manner of life or faith has any impact on them taking precautions against disasters? *

Yes – No

Disaster Preparedness Questions

The questions asked in this part are supplementary information questions aimed to measure your emergency and disaster awareness.

Do you own TCIP Compulsory Earthquake Insurance? *

Yes – No

I have no TCIP requirement.

Do you own any optional insurances that are suitable to you (Life, home, workplace, private health, etc.)? *

Yes – No

Is your city of accommodation in a region with high earthquake risk? *

Yes – No - I Don't Know

Is your home on a fault line? *

Yes – No - I Don't Know

Has the earthquake endurance test of the building you accommodate in been done? *

Yes – No - I Don't Know

Does the place you spend most of your day on reside on a fault line? (School, home, workplace, etc.) *

Yes – No - I Don't Know

Do you know the risk of your city of accommodation being flooded? *

Yes – No

Did you take any precautions against a flood if you are in a flood zone? (If you aren't in a flood zone, please leave this question empty.)

Yes – No

Do you find the precautions you or your immediate circle take against the spread of pandemic sufficient? *

Yes – No - Somewhat

Which of these precautions did you take to protect you and your immediate circle from getting infected during the pandemic? (Choose all that apply, you may leave this question empty if none applies.)

Wearing a facemask while outside

Not entering crowded spaces unless it is mandatory (cafe, cinema, theatre etc.)

Protecting social distance

Following the rules of hygiene

Do you have emergency funds? *

Yes – No

Would you like to join any future seminars or similar courses that aim on providing disaster awareness and preparedness? *

Yes – No

Would you like to be educated non-governmental organizations or other certified instructors with the aim of acquiring new skills such as first aid, or firefighting and join the disaster community work? *

Yes – No

Demographic/Sociologic/Economic/Geographic Information

Your Gender: *

Male - Female - Not Specified - Other:

Age: *18 or under, 18 – 24, 25 – 34, 35 – 44, 45 – 54, 55 – 64, 65 or above

City of accommodation: *

What is your last completed degree? *I don't have a degree, Primary School, High School, Associate – Undergraduate, Masters, Doctorate

Do you have a regular and reliable source of income? *

Yes – No

Please choose your monthly income. (Regular allowance, scholarship or CDI Loan can count as income for students.) *

0 – 2499 ₺, 2500 – 4999 ₺, 5000 – 7499 ₺, 7500 – 9999 ₺, 10000 ₺ and above

CODES

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afet$c0130=="Bilecik" |afet$c0130=="Kocaeli" |afet$c0130=="Sakarya" |
afet$c0130=="Düzce" |afet$c0130=="Bolu" |
afet$c0130=="Yalova"),]$ibbs = "TR4 - East Marmara Region"
;afet[(afet$c0130=="Ankara" |afet$c0130=="Konya" |
afet$c0130=="Karaman"),]$ibbs = "TR5 - West
Anatolia";afet[(afet$c0130=="Antalya" |afet$c0130=="Isparta" |
afet$c0130=="Burdur" |afet$c0130=="Adana" |afet$c0130=="Mersin" |
afet$c0130=="Hatay" |afet$c0130=="Kahramanmaraş" |
afet$c0130=="Osmaniye"),]$ibbs = "TR6 - Mediterranean
Region";afet[(afet$c0130=="Kırkkale" |afet$c0130=="Aksaray" |
afet$c0130=="Niğde" |afet$c0130=="Nevşehir" |afet$c0130=="Kırşehir" |
afet$c0130=="Kayseri" |afet$c0130=="Sivas" |
afet$c0130=="Yozgat"),]$ibbs = "TR7 - Central Anatolia
Region";afet[(afet$c0130=="Zonguldak" |afet$c0130=="Karabük" |
afet$c0130=="Bartın" |afet$c0130=="Kastamonu" |afet$c0130=="Çankırı"
|afet$c0130=="Sinop" |afet$c0130=="Samsun" |afet$c0130=="Tokat" |
afet$c0130=="Çorum" |afet$c0130=="Amasya"),]$ibbs = "TR8 - West Black
Sea Region";afet[(afet$c0130=="Trabzon" |afet$c0130=="Ordu" |
afet$c0130=="Giresun" |afet$c0130=="Rize" |afet$c0130=="Artvin" |
afet$c0130=="Gümüşhane"),]$ibbs = "TR9 - East Black Sea
Region";afet[(afet$c0130=="Erzurum" |afet$c0130=="Erzincan" |
afet$c0130=="Bayburt" |afet$c0130=="Ağrı" |afet$c0130=="Kars" |
afet$c0130=="Iğdır" |afet$c0130=="Ardahan"),]$ibbs = "TRA - Northeast
Anatolia Region";afet[(afet$c0130=="Malatya" |afet$c0130=="Elazığ" |
afet$c0130=="Bingöl" |afet$c0130=="Tunceli" |afet$c0130=="Van" |
afet$c0130=="Muş" |afet$c0130=="Bitlis" |
afet$c0130=="Hakkari"),]$ibbs = "TRB - Central East Anatolia
Region";afet[(afet$c0130=="Gaziantep" |afet$c0130=="Adıyaman" |
afet$c0130=="Kilis" |afet$c0130=="Şanlıurfa" |afet$c0130=="Diyarbakır"
|afet$c0130=="Mardin" |afet$c0130=="Batman" |afet$c0130=="Şırnak" |
afet$c0130=="Siirt"),]$ibbs = "TRC - Southeast Anatolia Region";afet$c0131
=
as.factor(afet$c0131);summary(afet$c0131);levels(afet$c0131);levels(afet$c
0131) = c("Phd","I don't have\n a degree","Primary School","High
School","Associate - Undergraduate","MSc");summary(afet$c0131);afet =
FnReorder(afet,"c0131",c("I don't have\n a degree","Primary School","High
School","Associate - Undergraduate","MSc","Phd"));summary(afet$c0131);
levels(afet$c0131) = c("Eğitimimi Tamamladım","İlköğretim","Lise","Ön
```

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Lisans - Lisans", "Yüksek
Lisans", "Doktora");summary(afet$c0131`);afet$c0132` =
as.factor(afet$c0132`);levels(afet$c0132`) = c("Yes", "No");
afet$c0133`);afet$c0133` = gsub("ve üzeri", "and
above", afet$c0133`);afet$c0133` = as.factor(afet$c0133`);afet =
FnReorder(afet, "c0133", c("0 - 2499 \u20ba", "2500 - 4999 \u20ba", "5000 - 7499
\u20ba", "7500 - 9999 \u20ba", "10000 \u20ba and
above"));afet$c0133`=gsub("and above", "ve üzeri", afet$c0133`);afet$c0128 =
gsub("Erkek", "Male", afet$c0128);afet$c0128 =
gsub("Kadın", "Female", afet$c0128);afet$c0128 = gsub("Belirtmek
istemiyorum", "Not
Specified", afet$c0128);afet$c0128=gsub("Diğer", "Other", afet$c0128);afet
%>%ggplot(., aes(x=c0128)) + geom_bar(fill="darkred", c01or = "black", width =
0.5) + theme_fivethirtyeight() + theme(axis.text.x = element_text(size = 16),
axis.text.y = element_text(size = 18), axis.title.x = element_text(size = 19, face =
"bold"), axis.title.y = element_text(size = 19, face="bold"), plot.title =
element_text(size = 24, face = "bold"), plot.subtitle = element_text(size=17)) +
labs(title = "The Distribution of Participant Genders", subtitle = "", y = "Number
of Participants", x = "Gender") + geom_text(aes(label = stat(count)), stat =
"count", vjust = 0.4, hjust = -0.1, fontface = "bold", size = 5.5, c01or = "black") +
coord_flip();afet$c0128 = gsub("Male", "Erkek", afet$c0128);afet$c0128 =
gsub("Female", "Kadın", afet$c0128);afet$c0128 = gsub("Not
Specified", "Belirtmek istemiyorum", afet$c0128);afet$c0128
=gsub("Other", "Diğer", afet$c0128);library(MASS);library(rcompanion);library(
psych);library(quantreg);library(polycor);{afet$awm = 0for(i in
1:nrow(afet)){for(j in 2:10){if(afet[i,j]=="Evet"){afet$awm[i] =
afet$awm[i]+1}}}};afet$c0131` = as.factor(afet$c0131`);
shapiro.test(afet$awm);boxcox(afet$awm+1~afet$c0131`);lmbd =
boxcox(afet$awm+1~afet$c0131`)$x[which(boxcox(afet$awm+1~afet$c0131`
)$y==max(boxcox(afet$awm+1~afet$c0131`)$y))];shapiro.test(afet$awm^lmbd
);kruskal.test(afet$awm~afet$c0131`);afet =
cbind(afet, read.csv("Book1.csv"));afet %>%
ggplot(., aes(x=`c0112`, y=TOPLAM, c01or = `c0112`)) +
geom_boxplot(outlier.c01or="black", outlier.shape=16, outlier.size=2,
notch=FALSE) + theme_fivethirtyeight() + stat_summary(fun=mean,
geom="point", shape=3, size=4, c01or="black") +
scale_fill_manual(values=c("darkred", "brown", "grey", "darkblue", "darkgreen", "d
arkgrey")) + scale_x_discrete(labels = c("We did not\ nexperience a
disaster\n", "Yes", "No")) + labs(x = "Did you or your immediate circle experience
material/non-material damage?", y = "Disaster Preparedness Score\n", title =
"Boxplot of Disaster Preparedness Status\nby Past Damages from Disasters") +
theme(legend.position = "none", axis.text.x = element_text(size = 16), axis.text.y
= element_text(size = 18), axis.title.x = element_text(size = 19, face = "bold"),
axis.title.y = element_text(size = 19, face = "bold"), plot.title = element_text(size
= 24, face = "bold"), plot.subtitle = element_text(size=17))
+scale_y_continuous(breaks =
seq(0, 12, 2));shapiro.test(afet$TOPLAM);boxcox(afet$TOPLAM~afet$c0112`);l
mbd2 =
boxcox(afet$TOPLAM~afet$c0112`)$x[which(boxcox(afet$TOPLAM~afet$c0
112`)$y==max(boxcox(afet$TOPLAM~afet$c0112`)$y))];shapiro.test(afet$TO
PLAM^lmbd);kruskal.test(afet$TOPLAM~afet$c0112`);afet$c0133`);afet%>%
ggplot(., aes(x=`c0133`, y=awm, c01or =
`c0133`))+geom_boxplot(outlier.c01or="black", outlier.shape=16,
outlier.size=2,
notch=FALSE)+theme_fivethirtyeight()+stat_summary(fun=mean,
geom="point", shape=3,
size=4, c01or="black")+scale_fill_manual(values=c("darkred", "brown", "grey", "d
arkblue", "darkgreen", "darkgrey"))+scale_x_discrete(labels = c("0 - 2499
\u20ba\n", "2500 - 4999 \u20ba", "5000 - 7499 \u20ba", "7500 - 9999
\u20ba", "10000 \u20ba and above"))+labs(x = "Income Level", y = "Disaster
Awareness Score\n", title = "Boxplot of Disaster Awareness Status\nby Income
Levels of Pariticipants")+theme(legend.position = "none", axis.text.x =
element_text(size = 16), axis.text.y = element_text(size = 18), axis.title.x =
element_text(size = 19, face = "bold"), axis.title.y = element_text(size = 19, face
= "bold"), plot.title = element_text(size = 24, face = "bold"), plot.subtitle =
element_text(size=17)) +scale_y_continuous(breaks =
seq(0, 12, 2));afet$c0133`=as.factor(afet$c0133`);levels(afet$c0133`) =
levels(afet$c0133`)[c(1,3,4,5,2)];boxcox(afet$awm+1~afet$c0133`);lmbd3 =
boxcox(afet$awm+1~afet$c0133`)$x[which(boxcox(afet$awm+1~afet$c0133`
)$y==max(boxcox(afet$awm+1~afet$c0133`)$y))];lmbd3;shapiro.test(afet$awm^r
n^lmbd3);kruskal.test(afet$awm~afet$c0133boxcox(afet$TOPLAM~afet$c013

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3`)$x[which(boxcox(afet$TOPLAM~afet$c0133`)$y==max(boxcox(afet$TOPL
AM~afet$c0133`)$y))];lmbd4;shapiro.test(afet$TOPLAM^lmbd4);kruskal.test(a
fet$TOPLAM~afet$c0133`);pairwise.wilcox.test(afet$TOPLAM,
afet$c0133`, p.adjust.method =
"BH");boxcox(afet$awm+1~afet$c0129);shapiro.test(afet$awm^0.2);kruskal.test
(afet$awm~afet$c0129);
boxcox(afet$TOPLAM~afet$c0129);shapiro.test(afet$TOPLAM^1.1);kruskal.tes
t(afet$TOPLAM~afet$c0129); ggplot(afet, aes(x=afet$ibbs, y=afet$awm, c01or
=afet$ibbs))+geom_boxplot(outlier.c01or="black", outlier.shape=16, outlier.size
=2, notch=FALSE)+stat_summary(fun=mean, geom="point", shape=23,
size=4, c01or="black")+scale_x_discrete(labels =
c("TR1", "TR2", "TR3", "TR4", "TR5", "TR6", "TR7", "TR8", "TR9", "TRA", "TRC")
)+theme_fivethirtyeight()+labs(x = "Region\n", y = "Disaster Awareness
Score\n", title = "Boxplot of Disaster Awareness Status\nby Regions of
Accommodation")+theme(legend.position = "none", axis.text.x = element_text(size
= 16), axis.text.y = element_text(size = 18), axis.title.x = element_text(size = 19,
face = "bold"), axis.title.y = element_text(size = 19, face = "bold"), plot.title =
element_text(size = 24, face = "bold"), plot.subtitle =
element_text(size=17))+scale_y_continuous(breaks
=seq(0, 10, 2))boxcox(afet$awm+1~afet$ibbs);shapiro.test(afet$awm^0.1);kruska
l.test(afet$awm~afet$ibbs);afet$egitim
="No";afet$egitim[which(afet$c0126=="Evet")]="Yes";afet$egitim[which(afet
$c0127=="Evet")] =
"Yes";table(afet$c0129, afet$egitim);chisq.test(table(afet$c0129, afet$egitim), sim
ulate.p.value =
TRUE)$expected;fisher.test(table(afet$c0129, afet$egitim), simulate.p.value =
TRUE);table(afet$c0128, afet$egitim);chisq.test(table(afet$c0128, afet$egitim))$e
xpected;fisher.test(table(afet$c0128, afet$egitim));cramerV(table(as.factor(afet$c
0128), afet$egitim));table(afet$c0112`, afet$c0114`);chisq.test(table(afet$c0112
`, afet$c0114`))$expected;chisq.test(table(afet$c0112`, afet$c0114`));table(afet$
`c0112`, afet$c0113`);chisq.test(table(afet$c0112`, afet$c0113`))$expected;chis
q.test(table(afet$c0112`, afet$c0113`))

```