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MARGINAL EFFECTS OF SOCIAL INDICATORS OVER GENERAL HAPPINESS

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ABSTRACT

General happiness is an indicator of livability in different locations of a city. A noncategorical social indicator may not show any evidence for general happiness and livability in a city. However, higher social indicators may capture higher happiness in some parts of the city. This article aims to find significant interaction effects of social indicators and locations of living on general happiness. Hence, based on a social survey administered in stratified locations of Adana, interaction effects of social indicators and locations over general happiness were estimated. Results indicate that social indicators and locations have significant interaction effects over general happiness. The evidences suggest that vehicle dependent neighborhoods are more livable for individuals with better health conditions. Secondary pedestrian zones are more livable for divorced-separated and widowed persons. Rural neighborhoods are happier with moderate to older age groups, thus has higher degree of livability compared to other locations of urban Adana. Rural neighborhoods are less livable for divorced or separated whereas more livable for widowed persons compared to single persons.

SOSYAL GÖSTERGELERİN GENEL MUTLULUK ÜZERİNE MARJİNAL ETKİLERİ

Makale Bilgisi

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ÖZ

Genel mutluluk, bir şehrin farklı lokasyonlarında yaşanabilirliğin bir göstergesidir. Kategorik olmayan bir sosyal gösterge, bir şehirde genel mutluluk ve yaşanabilirlik için herhangi bir kanıt göstermeyebilir. Bununla birlikte, daha yüksek sosyal göstergeler, şehrin bazı bölgelerinde daha yüksek mutluluğu yakalayabilir. Bu makale, sosyal göstergelerin ve yaşanılan yerlerin genel mutluluk üzerindeki anlamlı etkileşim etkilerini bulmayı amaçlamaktadır. Bu nedenle, Adana'nın tabakalı lokasyonlarında uygulanan bir sosyal ankete dayalı olarak, sosyal göstergelerin ve lokasyonların genel mutluluk üzerindeki etkileşim etkileri tahmin edilmiştir. Sonuçlar, sosyal göstergelerin ve konumların genel mutluluk üzerinde önemli etkileşim etkilerine sahip olduğunu göstermektedir. Kanıtlar, araç bağımlı mahallelerin daha iyi sağlık koşullarına sahip bireyler için daha yaşanabilir olduğunu göstermektedir. İkincil yaya bölgeleri boşanmış-ayrı kalmış kişiler için daha yaşanabilirdir. Kırsal mahalleler, orta ve ileri yaş grupları ile daha mutlu görünmektedir, dolayısıyla kentsel Adana'nın diğer yerlerine göre daha yüksek yaşanabilirliğe sahiptir. Kırsal mahalleler boşanmış veya ayrılmışlar için daha az yaşanabilirken, bekârlara göre daha yaşanabilirdir.

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INTRODUCTION

Human well-being has long been in the context of objective environment where people live. A historical evidence for indication of livable place comes from Hippocrates (Taşkaya, 2018). The neighbourhood and the city people live in influence well-being (Leyden et al., 2011) for which livability is described as precondition (Veenhoven, 2007). However, better social positions are also needed for being happier (Veenhoven, 2015, p. 387). Extent to which demographic and social indicators explain well-being is well known. But, do these effects depend on location of living? If they do, for example, higher income levels or better social positions at a location of living significantly explain higher overall happiness. Furthermore, interactions of demographic and social indicators of individuals with their locations of living, if exist, would better explain their general happiness. The question to be answered is how much the effect of locations differs between the levels of social indicators or that of social indicators differs between locations? In the latter case, intra-urban and urban-rural differences can be tested. Based on the assumption "happier locations with higher social indicators are more livable", locations for livability can be inferred. Thus, the interaction of social indicators and locations of living on general happiness would relatively provide some evidences about the degree of livability. This is expected to give an opportunity for individuals to make a decision where possibly to live in Adana based on their preferences.

In Econometrics, marginal means derivative, and marginal effect means the change in probability when a predictor category change conditional to a reference category. Mathematically speaking, conditional marginal effect on general happiness is the first order discrete derivative of probability of a category of general happiness with respect to a social indicator conditional to a location (Frondel and Vance, 2009, p. 15). For instance, in central pedestrian zones, the effect of being divorced vs being married on higher general happiness. Interaction effect refers to the effect of a location of living on the conditional marginal effect of a social indicator. The effect of a location here depends on a location preference and level of a social indicator. It is the second order discrete derivative of the probability of a category of general happiness with respect to a social indicator given a location of living relative to a reference location (Frondel and Vance, 2009, p.12). In other words, change in the marginal effects with respect to a change in locations. These estimations are performed for each category of general happiness relative to predictor and reference categories in the interaction, e.g. being unemployed vs employed in urban-rural difference. In order to reduce mathematical complexity and for interpretability, marginal analysis is used. First, the model is estimated using the linearized log odds model (logit model). For example, log odds of higher general happiness versus lower general happiness. Subsequently, ordered logistic regression model is run to find the odds of higher general happiness which are the coefficients of the logit models exponentiated. Finally, marginal and interaction effects are estimated after running ordered logistic regression model.

Previous literature includes micro and macro level happiness studies based on social indicators. These studies report socio-economic outcomes as expected such as unhappier unemployed than employed, the better health the happier, happier women than men, happier married than unmarried (Yinanç et al., 2020, pp. 57-58; Peiró, 2007, p. 433). However, interactions of these indicators with locations are very limited. DeMaris (1995) used logistic and polytomous regression models to discuss the effects of marital status on general happiness. In logistic regression model, the author added control variables such as age, health and income associated with marital status to check for possible contributions. Mavruk et al. (2021) also used logistic regression model to estimate the interactions of socio-economic variables and locations over time framed happiness.

This article aims to capture significant interaction effects of social indicators and locations of living on general happiness. This can be achieved best from individuals' own experience of Adana which sheds light on liveability inferred from higher levels of general happiness. The study first determines significant marginal effects of predictors (social indicators) conditional to locations of living. The conditional marginal effects pertaining to two interacting variables are more meaningful and also easier to understand (Frondel and Vance, 2009, p.17). Second, the effects of locations on these marginal effects are determined. Marital status, income, education, employment status, occupation and health condition are included as social indicators and each is interacted with location.

LITERATURE REVIEW

The literature includes a large number of studies on how demographic and socio-economic variables are related to happiness, but interaction effect relations are very few. For example, Selim (2008) showed that health, income and employment significantly affected happiness in Turkey. The findings of the author indicated negative unemployment, age and gender effects, positive marital, income and health effects. Married status had the highest degree of happiness but education was not significant.

Mavruk et al. (2021, p. 549) showed that the unemployed urban residents vs currently paid employee were more likely to feel less happy than rural residents. Being unemployed and retired vs currently paid employee in or around city center had negative effects on one-week happiness. Being unemployed residents in central pedestrian zones (p<.005), secondary pedestrian zones (p<.05) and vehicle dependent (p<.05) neighborhoods had negative and significant effects. The effect of being a retired resident in central pedestrian zones was negative and significant (p<.01) on the probability of one-week happiness. The effect of being a retired resident in an intensive public transport areas was negative and significant (p<.05) on the probability of present happiness. There was no significant interaction effects on four-week happiness. The effect of employment status on quality of life in Adana was also analyzed (Mavruk, 2020, p. 286). The author showed that the retired residents vs currently employed around transit junctions and the unemployed residents in vehicle dependent neighborhoods had higher quality of life than those in central pedestrian areas of Adana.

DeMaris (1995) tried to predict general unhappiness using health, marital status, income, education, gender, and traumatic events (deaths, unemployment, disabilities, hospitalizations). The author showed that as health condition got better the log odds of unhappiness decreased and that all nonmarried statuses were related to the log-odds of being less happy compared with married status. Being separated had stronger positive effect on the log-odds of unhappiness compared to widowed, divorced and never married.

Caner (2016) found that the unemployed are less happy than others; married individuals are happier than singles; divorced, separated or widowed individuals are less happy than singles; and males are less happy than females. Higher relative income was associated with higher happiness.

Giray Yakut, Bacaksız & Camkıran (2021) examined socio-demographic determinants of happiness in Turkey. The authors found that marital status had the highest effect on perceived happiness, and married people were happier than the unmarried ones. Age had a negative and educational background had a positive effect on happiness. For employment status, per diem employees were unhappy. Health was the most central concept in happiness for men who belong to the medium to low-income and wage workers who belong to the medium to high-income group.

Discussions on whether happiness has U-shaped relation with age have surfaced again this year as Blanchflower and Graham (2021, p.1436) found 353 articles showing a U-shaped relationship between age and happiness. The studies of Akın and Şentürk (2012), Caner (2014), Dumludağ (2013) were in line with Blanchflower and Graham (2021, p.1436). However, the finding of Brereton et al. (2008, p.392) was in contrast with these articles.

According to Asadullah et al. (2018, p.90) women were happier than men, but no gender differences (Neira et al. 2018, p.2563) were also reported. Married people were happier than other marital statuses (DeMaris, 1995, p. 959; Brereton et al., 2008, p.392; Neira et al., 2018, p.2563) due to having more sex (Blanchflower and Oswald, 2004, pp. 400-402).

Income is also a significant social indicator on happiness (Ferrer-i-Carbonell, 2005, p. 1008; Dolan et al. 2008, pp. 97-98). Individuals with higher income are happier (Asadullah et al. 2018, p. 92, Yang et al. 2019, p. 2753; Pehlivan, Özbay & Bingöl, 2022, p. 271), but this is not necessarily true according to Cheah and Tang (2013, p. 12). Adequate income was a strong predictor of higher happiness (Ala-Mantila et al., 2018, p. 8). The effect of income is stronger than education and occupation (Easterlin et al. 2011, p.2194), but in countries with lower GDP per capita (Stanca, 2010, p. 127; Veenhoven, 2015, p. 385). Income comparison level was shown to have negative effect on life satisfaction when controlled for the effect of consumption and other individual characteristics (Dumludağ, 2013)

According to the 2014 Adana Urban Problems Report by Adana Provincial Coordination Board, Adana residents were poor and deprived. Şengül and Fisunoğlu (2012, p. 20) studied determinants of poverty in urban Adana. The authors determined that depth of poverty was higher in family size four or more, and that divorced and widowed women experienced poverty more intensely than married women. In addition, they determined that women in the 65+ age group were poorer than men.

Occupation effect findings were mixed. Veenhoven (2015, p. 388) found higher correlation of happiness with occupation. On the contrary, Dolan et al. (2008, p. 100) found no sufficient evidence about the effect of occupation on well-being. Negative and significant effects of unemployment on happiness were also reported (Brereton et al., 2008, p. 392; Stanca, 2010, p.132; Asadullah et al., 2018, p. 92), but some studies reported no significant effects (Cramm et al., 2012, p. 587; Liltsia et al., 2014, p. 298). Furthermore, employed married people feel happier than other marital statue due to more social and economic support from their spouses (Cheah and Tang, 2013, p.12).

Health is another important social indicator of happiness. Poor health has negative and significant effects over happiness (Dolan et al., 2008, p.100) and good health was one of the two strongest predictors of higher happiness (Pehlivan, Özbay & Bingöl, 2022, p. 271; Ala-Mantila et al., 2018, p.8). Conversely, happier people are healthier and live longer (Diener and Chan, 2011, p.1; Lyubomirsky et al., 2005, p. 846). The health is getting poorer due to being widowed, retired and unemployed, and health support was suggested in addition to psychological support for higher quality of life of Adana residents (Mavruk and Kıral, 2020, p. 62).

The macro and the micro level happiness studies reported different effects of education. In micro level, as education level decreases, the relationship between education and happiness gets stronger in poor nations and vice versa in rich nations (Veenhoven, 2015, p. 8). Higher educated people report relatively higher happiness (Yakovlev and Leguizamon, 2012, p. 814; Ruiu and Ruiu, 2019, p. 2649), due to higher income and higher probability of being employed (Cuñado and Gracia, 2012, p.192). However, some studies show otherwise (Akın and Şentürk, 2012, p.188; Neira et al., 2018, p. 2563), perhaps due to more stress in search for jobs and social status. The increase of young people population share and an increase in educational level reduce happiness inequality (Yang et al., 2019, p. 2759).

METHOD

Why Surveyed in January-February 2019

Adana had the second highest income inequality in 2018 (Gini coefficient was 0.40) according to Turkish Statistics Institute (TSI). Unemployment rate increased to 11.20%, the number of divorced couples increased from 3803 in 2017 to 4432 in 2018 (16.50% increase) according to TSI Adana region, the ratio of registered Syrians to Adana population increased to 10%. Contribution to economy decreased after stationarity at 2.80%. Adana became province of outflow emigration with an increase by 13% in 2017-2018 (Karakuş, 2019). In the same year, there has been a regime change in Turkey and the Turkish Armed Forces has been involved in the war in Syria. All these together with existing literature might show enough reasoning for why the survey was conducted in January-February 2019 to investigate general happiness of Adana. June-July 2019 would be late for the assessment.

Data

A social survey was conducted in January-February 2019 using stratified random sampling method. The survey included demographic, socio-economic, location of living and happiness questions. Well-instructed volunteer surveyors kindly asked adults whether they would participate in the questionnaire. They received a positive return from 980 adults. 13 of whom reported location of living as Ceyhan, Kozan, Kadirli, Karataş and Imamoğlu districts which I coded as rural neighborhoods of Adana. The remaining 967 participants were from four districts, namely Seyhan, Yüreğir, Çukurova and Sarıçam. Thus, this study covers these four densely populated districts encompassing and surrounding the city center of Adana. These districts are divided into six different zones with several neighborhoods in each (Mavruk et al., 2021) because this study investigates whether happiness is conditional on intra-urban and urban-rural pairwise differences. For this purpose, the districts had to be chosen from the city center to the countryside. Adana city center is in Seyhan district and the other districts surround it. This study does not intend to analyze happiness conditional to district differences. Hence, it suffices to include four districts where 80% of the population lives in and best represents Adana population.

Since there are heavy pedestrian zones and settlements in the city center and this density decreases from the center to the rural, central and secondary pedestrian zones were created. In addition, since settlements are dense on public transport and transit routes of urban Adana, two more zones have been created, namely public transport routes and transit junctions. Since urban Adana also has new residential neighborhoods 6 to 20 km outside of the city center, not within walking distances, vehicle dependent areas have been created as another region. These five regions represent urban Adana. Regions farther from these distances constitute the sixth region as rural neighborhoods for the urban-rural difference.

Not only conditional effects of social indicators in each region but also the conditional effects of intra-urban and urban-rural pairwise differences are in the scope of this study. With six regions, the aim is to help people decide in one of the six regions based on their own preferences, and municipalities and state officials take the necessary actions based on the results of the study so that they can contribute to people's well-being.

Cochran formula $n = \frac{z^2 Npq}{e^2(N-1)+z^2pq}$ is used to find minimum required sample size (n) for the survey. At five percent significance, z table value is 1.96, N population size 1747000, population ratio p=0.50 and margin of error e=0.05. When the values are substituted into the formula, 385 is obtained. Thus, the minimum sample size requirement 385 was met with 980 respondents.

Regression Diagnostics

In order to show that the inferences to be made about the data of this study are not unfounded, the heteroscedasticity problem was tested using Stata with Breusch-Pagan/Cook-Weisberg test before running ordinal logit models. H_0: Homescedasticity (Errors have equal variances). If H_0 is not rejected, the errors are of equal variance and have normal distribution. For example, after regressing GH on health, location and minimum wage, heteroscedasticity test results for predictive values of general happiness show that $\chi^2(1)=3.19$ and $p(\chi^2)=0.074$. In interaction analysis, robust standard errors are also used against heteroscedasticity.

For collinearity diagnostics, there is no linearity issue if VIF<5 and Cond#<10. A condition number between 10 and 30 indicates the presence of multiple connections. When two or more variance decomposition proportions corresponding to a co-conditioning index greater than 10 to 30 is higher than 0.80 to 0.90, their associated explanatory variables are multicollinear (Kim, 2019, p. 564). The square root of the ratio of the maximum eigenvalue to each eigenvalue from the correlation matrix of standardized explanatory variables is called the condition index. If there is a linear relationship problem between the explanatory variables, the coefficient, odds ratio or marginal effect of a variable cannot be estimated. Hence, Stata would not show any results. These diagnostics are suggested for continuous independent variables.

For ordered independent variables, Spearman rank correlation can be used for multicollinearity check. In this study, results do not indicate any high correlations between independent variables (not shown). In case of multicollinearity between categories of an independent variable, which is quite possible, reference category can be changed, categories can be combined or/and the independent variable can be removed to remove multicollinearity at the cost of significance. However, the last should be avoided against specification error. Furthermore, correlated independent variables such as income and education together should not be included in a model.

Dependent Variable

Dependent variable is general happiness (GH) which is measured by a direct single item question. The scales are presented in Table 1. The aim is to capture general judgement of individuals' own lives in which they consider retrospective, present and prospective experiences.

Independent Variables

Independent variables are demographic and social indicators which include gender, age, marital status, family size, education level, job status, monthly income, profession and health status. Table 1 shows question types and the scales for these variables. Locations are mapped using Google Earth. In Figure 1a, white colored bordered areas show central pedestrian areas, black bordered areas show secondary pedestrian areas, gray bordered areas show vehicle dependent neighborhoods and white bordered polygons in outer parts show some rural neighborhoods of Adana. In Figure 1b, central part of Adana is zoomed for closer look of defined locations. Red rectangles in Figure 1b show intensive public transport areas.

Table 1. Variables and Scales

Dependent Variable	**Scales**	**Explanation**
How would you describe your happiness in general?	1=very unhappy, 2=unhappy, 3=neither unhappy nor happy, 4=happy, 5=very happy	Scale is reduced to three by combining the first two and the last two. Analysis is performed with two different scales, three and five.
Independent Variables		
Gender (Your	0=female, 1=male	

gender)		
Age (How old are you?)	1=18-24, 2=25-31, 3=32-38, 4=39-45, 5=46+	No age over 50 was reported. Only young and middle ages are available.
Monthly individual income level	Divided into income categories based on minimum wage and poverty line 1=0-2020, 2=2021-3999, 3=4000+	Minimum wage was 2020 TL and poverty line was 4000 TL at the time of survey.
Marital status (what is you marital status?)	1=Married, 2=Engaged, 3=Single 4=Divorced or separated, 5=Widowed	Included in the analysis because of statistical significance in generalized ordered logistic regression model where pl assumption is relaxed.
Family size (Including yourself how many people lives together in your family)		Dropped from the analysis due to violation of parallel lines assumption
Education status (What is your education status?)	1=Illiterate, 2=Primary School, 3=High School, 4=Vocational School, 5=University, 6=Master-Doctorate.	Primary and secondary school graduates are combined as primary school graduates. One illiterate person is dropped before analysis.
Employment status (What is your employment status?)	1=currently paid employee, 2=currently unemployed, 3=unpaid family worker, 4=unemployed for less than 12 months, 5=unable to work due to illness or disability, 6=retired, 7=housewife, 8=student.	No respondent falled in category 5, so it is dropped.
Occupation-profession (What is your area of work?)	1=private, 2=public, 3=semi-private, 4=unemployed, 5=self-employed (employer), 6=foundation-association.	
Health condition (How is your health condition?)	1. very poor, 2. poor, 3. moderate, 4. good, 5. very good.	
Where do you live?	1.Central Pedestrian Zones (Atatürk St., Ziyapaşa Blvd, Gazipaşa Blvd, Kenan Evren Blvd, Baraj Rd) 2. Public Transport Zones (Atilla Altıkat, Dörtyol-Inonu Park, Cemalpaşa Groseri, Bank of Provinces-Duygu Cafe, Çetinkaya Seyhan Municipality, Saydam St. City Center, Cumhuriyet-Regulator Bridge) 3.Secondary Pedestrian Zones (Old Stadium, Sular St, Tepebağ, Reşatbey, Kurtuluş neighborhoods, Meydan-Metro line, Saydam St off city center, Alidede-Big Clock Tower) 4.Transit junctions (Dörtyol, Hospitals, Turgut Ozal Bank of Provinces, Optimum, Mavi Bulvar Groseri, Kurttepe Anadolu High School Metro, Çetinkaya Seyhan Municipality Bus Metro Stations, Sular-Train station, Bus terminal junctions) 5.Vehicle Dependent Neighborhoods (Çukurova, Huzurevleri, Turgut Özal,	Locations are selected based on author's experience of Adana. If reported location was not one of the listed locations, it was coded to one of the six regions where it fitted. For example, Şambayadı and Balcalı TOKI was categorized as rural neighborhoods. Student dorms off campus were categorized as vehicle dependent neighborhood. The neighborhoods falling outside the city center such as Yüreğir/Güneşli, Kiremithane, Sinanpaşa, Karataş street, E5 east bound, Seyhan/M1, Bus Terminal, Tellidere, Yurt, Mavi Bulvar, Fatih, Dağlıoğlu, Yeşilevler, 2000 Evler were categorized as vehicle dependent neighborhoods. Ceyhan, Karataş, İmamoğlu, Karaisalı, Kozan and Kadirli are considered as rural neighborhoods.

	Yüzüncü Yıl, Kurttepe, Sarıçam, Yüreğir, Seyhan outskirts. 6. Rural neighborhoods (Kürkçüler, Yeşilköy, Alihocalı, Köklüce, Büyükdikili, Küçükdikili, Havutlu, Hadırlı, Karahan, Şambayadı, Kabasakal etc)	

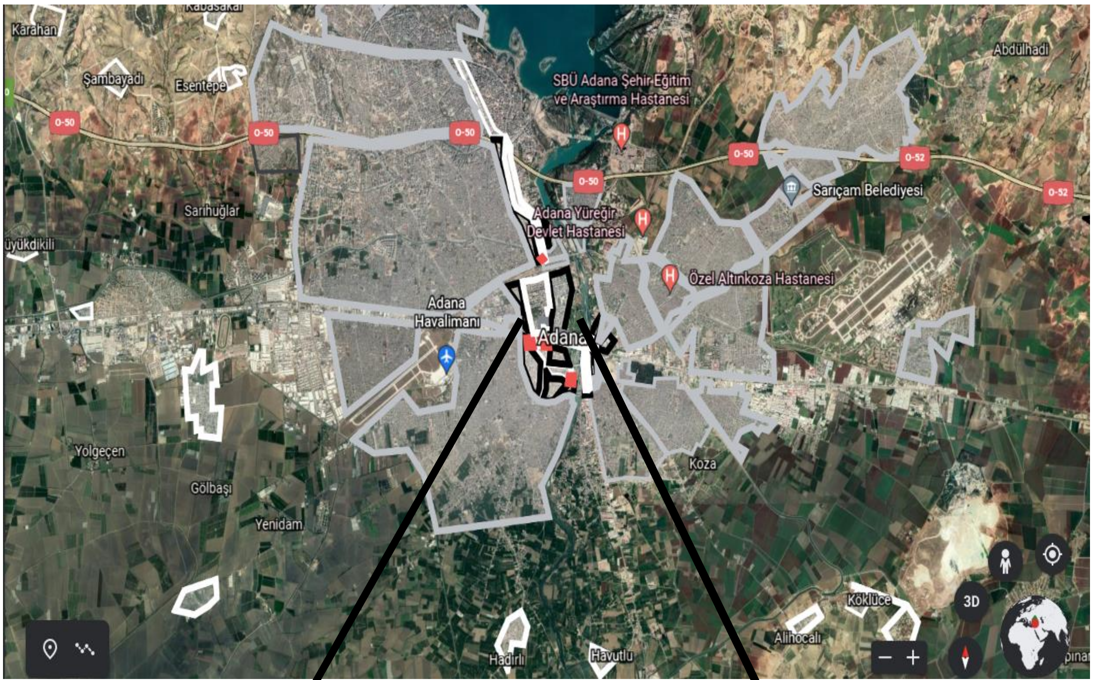

Figure 1a. Locations of Adana

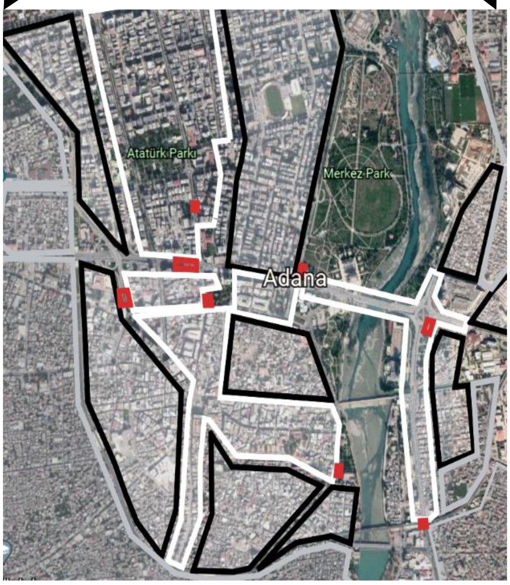

Figure 1b. Central Parts Are Zoomed

Model

The ordered logistic regression model (OLM) assumes a latent continuous dependent variable (GH*) that is linearly related to predictor variables. Probabilities of observing GH categories are given in Appendix B.

The latent model of demographic and socio-economic variables can be written as

$$GH^{*} = \gamma_j + \beta_{10}\mathrm{LOC}_j + \beta_{11}\mathrm{X} * \mathrm{LOC}_{ij} + \beta_1 AGE_i + \beta_2 GENDER_i + \beta_3 MARITAL_i + \beta_4 FAMILYSIZE + \beta_5 EDUCATION_i + \beta_6 EMPLOYMENT_i + \beta_7\, INCOME + \beta_8 OCCUPATION_i + \beta_9 HEALTH_i + \mathrm{e}_{GH^*} \quad (1)$$

$$\mathrm{e}_{GH^*} \sim \mathrm{Logistic}(0, \pi^2/3)$$

Where X is one of the social indicators as predictor variable, $\mathrm{X} * \mathrm{LOC}_{ij}$ is interaction term, γ_j is cut-off value for each j and e is the error which has a logistic distribution.

The logit model (1) can be written from (2) in order to investigate contribution of control variables to base interaction model which is given in the log odds as $log\,\frac{p}{1-p} = \gamma_j + \beta_1 X_i + \beta_2 LOC_i + \beta_3\mathrm{X} * \mathrm{LOC}_{ij}$.

$$log\,\frac{p}{1-p} = \gamma_j + \beta_1 X_i + \beta_2 LOC_i + \beta_3\mathrm{X} * \mathrm{LOC}_{ij} + \sum_{l=4}^{n} \beta_l\, O_i + \mathrm{e}_{GH^*} \quad (2)$$

In this model, p is the estimated probability of higher general happiness for the i^{th} category of an explanatory variable, 1–p is the probability of not higher GH (moderate and lower levels of general happiness) and O_i are other predictor variables in the model. A positive β_1 indicates that as the category of the predictor increases, the likelihood of being in higher general happiness category increases (Agresti, 2007). Interaction effect in this study is the effect of a predictor depending on location of living. As X is the focus variable, location can be considered as a moderator variable. The cutoff values γ_j cancel out in the estimation of marginal effects of a predictor. Thus, marginal effect results will be independent of cutoff values. The marginal probability effect for the observation of category i and independent variable is estimated by $ME_j(x_i) = \frac{\Delta P(GH=j\,|\,x_i)}{\Delta x_i}$. Marginal effect of social indicator conditional on location of living is $\frac{\Delta P(GH|SI, LOC)}{\Delta SI_i} = \beta_1 + \beta_{12} LOC_j$ or the other way around, marginal effect of location of living conditional on social indicator is $\frac{\Delta P(GH|LOC, SI)}{\Delta LOC_j} = \beta_2 + \beta_{12} SI_i$. Interaction effect is $\frac{\Delta^2 P(GH|SI, LOC)}{\Delta SI_i \Delta LOC_j} = \frac{\Delta^2 P(GH|LOC, SI)}{\Delta LOC_j \Delta SI_i} = \beta_{12}$ which is the coefficient of the interaction term.

The mean marginal probability effect includes all other observed values (held constant or at their values) in the estimation. The mean marginal probability effect of an ordered categorical variable x_i is estimated by $MME_j(x_i) = \frac{1}{n}\sum_{i=1}^{n} ME_j(x_i)$ (Hajdu and Hajdu, 2014, p. 117).

RESEARCH FINDINGS

Descriptive Findings

Summary statistics shows that the mean of five categories of happiness is 3.19 and standard deviation is 1.17. About 46 percent of respondents report that they are generally happy and eight percent very happy. The percent distribution by locations of living in the sample shows that 22 percent of the respondents are from the central pedestrian zones, 13.20 percent from the transit junctions, 6.80 percent from the secondary pedestrian zones, 10 percent from the public transport areas, 44.50 percent from the vehicle-dependent neighborhoods and 3.5 percent from rural neighborhoods.

A plot of weighted mean of general happiness across age categories between 18 and 49 shows a W-shaped distribution (not shown). Gender difference was significant only in secondary pedestrian areas but explained a decrease in general happiness of men in all locations. The W-shape of weighted mean of general happiness across age was not in line with the findings of Blanchflower and Graham (2021, p.1436) in spite of minimum levels at middle age. Table 2 shows general happiness percents relative to age categories which cover only young to middle ages.

Table 2. Percent Distribution of General Happiness With Respect to Age

General Happiness\Age	18-24	25-31	32-38	39-45	45+
Very unhappy	36	40	8	6	3
Unhappy	121	73	28	14	4

Neutral	55	43	9	6	2
Happy	201	156	60	25	9
Very happy	35	22	10	7	7

Figure 2 shows adjusted probability effects of gender on higher general happiness with respect to age categories. Although women are happier than men up to age 45, the difference is small. However, difference gets larger for the age category 46+ (46-49) in the advantage of men.

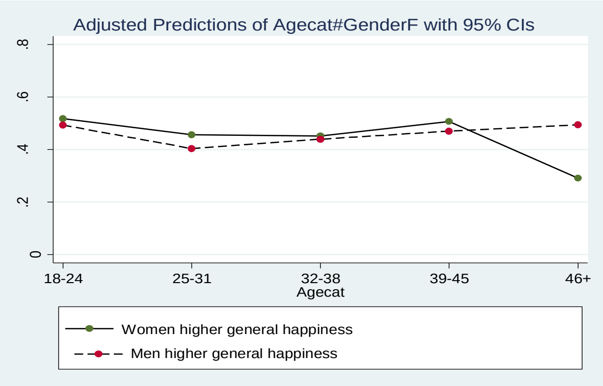

Figure 2. Gender Probability of Higher GH With Respect To Age

Table 3 shows that 57.80% reported higher happiness (happy/very happy combined) in central pedestrian zones whereas 45.90% reported lower happiness (very unhappy/unhappy) in public transport zones. The mean of lower general happiness over all locations is approximately 36.78% and that of higher general happiness is approximately 52.17%. In developed countries, social surveys report at least 70 percent of happiness (IPSOS, 2019, pp. 6-7). That high percentage would not be expected for a city of a developing country.

Table 3. Percent Distribution of General Happiness With Respect to Locations

	Very unhappy	Unhappy	Neutral	Happy	Very happy
Central Pedestrian	10.7	19.4	12.0	49.1	8.8
Public transport	15.3	30.6	13.3	36.7	4.1
Secondary Pedestrian	9.0	31.3	10.5	43.3	6.0
Intensive Transit	6.2	27.9	8.5	45.7	11.6
Vehicle Dependent	9.2	22.7	12.8	46.8	8.5
Rural	2.9	35.3	5.9	50.0	2.5

Figure 3 shows that income difference in vehicle dependent neighborhoods are higher compared to other locations.

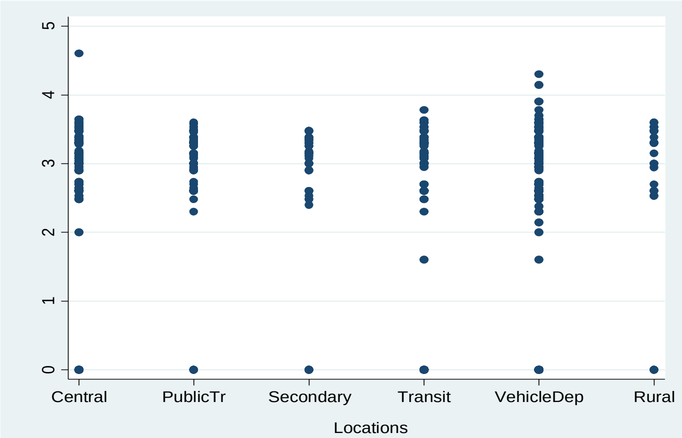

Figure 3. Income With Respect To Locations

Although age does not show a significant correlation with GH at 5 percent, correlation is significant at 7 percent and age is significantly correlated (p<.01) with all the predictors. Interaction model shows a significant coefficient for age. Thus, indicators may show significance for some categories in marginal analysis.

Table 4 indicates that GH is significantly correlated with marital status, income and health. Health shows stronger correlation with GH. Besides these significant variables, some other demographic, socio-economic variables will be included in the marginal analysis to check for significance of interactions. Because, marginal effects with respect to social indicators and interaction effects with respect to location are investigated.

Table 4. Pairwise Correlations Between GH And Explanatory Variables

GH	1										
Gender		1									
Age			1								
Marital	.08**		.31*	1							
Household#			-.13*		1						
Income	.09*	.12*	.19*		-.11*	1					
Health	.28*		-.16*	-.09*		.09*	1				
Employment		-.14*	-.27*	-.20*	.11*	-.24*		1			
Education			-.58*	-.25*		-.08**	.17*	.16*	1		
Occupation		-.14*	-.18*	-.13*	.11*	-.37*	-.07**	.52*	.10*	1	
Location			.10*								1

Empty cells in lower triangle of the table show statistical insignificance. *: p<0,01; **: p<0,05

Model Predictions of General Happiness

Model (1) did not meet the assumption of parallel lines (pl) which may be due to a large number of categories in predictor variables in the model. Family size as covariate and marital status as factor variable both violated pl assumption. In this case, generalized ordered logistic regression model (gologit) in which pl assumption is relaxed is used. The results showed age, marital status and health as significant predictors for all categories except marital status for very unhappy, whereas family size was not statistically significant. Age, marital status and health have positive coefficients in all categories of general happiness which indicates that respondents being in higher categories of age and health are more likely will be in higher categories of general happiness than current one. The results of the generalized model is given in Table 5 and Appendix C. However, marital status is not an ordered variable. It is originally sequenced as 1=Married, 2=Single, 3=Divorced or separated, 4=Widowed and 5=Engaged. Resequencing by putting "engaged" between "married" and "single" and rerunning gologit model gives marital status with a negative and significant coefficient in all categories except very unhappy which indicates that being in higher categories of marital status increases likelihood of being in current or lower category of general happiness. The outcomes are dichotomized and interpreted the same way as binary outcomes (Williams, 2006, pp. 63).

Model results vary based on the order of categories and the number of categories for each variable. Statistical significance of an explanatory variable can be lost when the order is changed. For example, a change in reference categories of marital status costs the significance of age in the gologit model.

When the categories of GH is reduced from five to three in model (1), marital (single vs married), education (higher education vs primary-secondary), employment (unemployed vs currently paid employee), occupation (self-employed vs private sector) and health (very good vs very poor) all show significant effects on the log odds of higher GH. But, no significant interaction effect at all is captured. However, when model (1) is run with five categories of GH, some significant interaction effects are captured (e.g., middle age in public transport zones, divorced or separated in central pedestrian zones). When marital status and location interaction is kept in model (1) and all other variables removed, one more significant interaction (b=-2.13, p<0.05) is captured (being engaged in central pedestrian zones).

Predictor variables are dummies except for log income and family size in model (1). The mean values of quantitative and ordered variables are calculated as age 25.78, family size 3.28, education 4.56, monthly income 1430, health 3.96. Predictions for GH=1, 2, 3, 4, 5 at the mean values of these quantitative and ordered variables with 95% confidence intervals in brackets are P(very unhappy)=0.082[0.066,0.099], P(unhappy)=0.244[0.217, 0.272], P(neither/nor)=0.126[0.104,0.148], P(happy)=0.476[0.443,0.508], P(very happy)=0.072[0.056,0.088]. The cumulative odds of unhappy is (0.244+0.082)/(0.126+0.476+0.072)=0.326/0.674=0.484 whereas that of happy is (0.476+0.126+0.244+0.082)/0.072=12.89.

Table 5 shows that some categories of marital status, employment status, education, health and location are significant predictors when categories (factors) of predictors are included in model (1). In this case, model (1) in which coefficients are in log-odds units, LR $\chi^2(9)=168.90$, Prob $\chi^2=0.0000$ (all the coefficients in the model are different from zero), Log likelihood = -1270.58 and Pseudo $R^2 = 0.0623$ is

$$GH^* = 0.221MARRIED + 0.453GRADUATE - 0.93UNEMPLOYED + 0.801SELFEMPLOYED + 1.735VERYGOODHEALTH + 0.738\text{CENTRALPED}$$

Table 5 also shows odds ratio (OR) of GH and mean marginal effects (MME) demograpfic and socioeconomic indicators not including interactions. When proportional odds ratio model is run using model (1) with factor variables but without the interaction term, the odds of higher general happiness vs the combined middle and lower levels are about 5.67 times as large for very good health as they are for very poor health. Similarly, about 2.23 times as large for self-employed as they are for private sector employed, about 3.97 times as large for higher educated as they are for lower educated. On the other hand, for probabilistic interpretation, MME results show that being married vs being single increases the probability of happiness by 10.30 pp on average as all other variables are held constant. Similarly, being in very good health condition vs being in very poor health condition increases the probability of being happy by 25.10 pp on average and that of being very happy by 12.90 pp on average. In the full model (2), health-location interaction showed no significant effects on the log-odds of higher general happiness whereas age-location interaction showed only two significant effects based on predictor and reference categories age 18-24 and vehicle dependent neighborhoods.

Table 5. Logistic Regression Models For Logodds, Odds and Mean Marginal Effects

Dependent Variable: GH	Coefficients		MME	MME
Independent Variables	b	OR	Happy	Very happy
Men vs women	-.066(.130)	.935	-.009(.019)	-.005(.009)
Age 25-31 vs 18-24	-.158(.165)	.853	-.022(.023)	-.011(.013)
Age 31-38 vs 18-24	-.488(.287)	.614	-.072(.043)	-.033(.018)
Age 39-45 vs 18-24	-.299(.386)	.742	-.043(.056)	-.043(.026)
Age 46-49 vs 18-24	.298(.581)	1.35	.035(.062)	.027(.056)
Married vs single	.818*(.254)	2.27*	.103*(.025)	.070*(.026)
Divorced or separated vs single	.391(.521)	1.48	.057(.068)	.028(.043)
Widow vs single	.239(.865)	1.27	.036(.124)	.016(.064)
Engaged vs single	.724**(.292)	2.06**	.095*(.029)	.059**(.030)
Family size	-.036(.064)	.965	-.005(.009)	-.003(.005)
Log Income	.039(.070)	1.04	.006(.010)	.003(.005)
Very good health vs very poor health	1.735*(.867)	5.67*	.251*(.155)	.129*(.037)
Unemployed vs currently paid employee	-.930*(.276)	.394*	-.142(.041)	-.061*(.020)
Unemployed in the last 12 months vs currently paid employee	-2.858*(1.012)	.057*	-.413*(.088)	-.102*(.019)
Student vs currently paid employee	-.509**(.247)	.601**	-.071**(.033)	-.039(.020)
Associates degree vs primary&secondary	.830**(.406)	2.29**	.118**(.056)	.060(.032)
MS-PhD vs primary&secondary	.453*(.310)	3.97*	.159*(.050)	.123**(.054)
Self-employed vs private	.801**(.335)	2.23**	.098*(.033)	.069(.035)
Central ped zones vs public transport zones	.738*(.233)	2.09*	.116*(.038)	.045*(.014)
Transit junction vs public transport zones	.793*(.257)	2.20*	.124*(.040)	.049*(.017)
Vehicle dependent neigh vs public transport zones	.644*(.375)	1.90*	.103*(.036)	.038*(.011)

*: p<0,01, **: p<0,05. Standard errors are in paranthesis.

Three out of eight categories of employment status and two out of five categories of education have significant coefficients. Predictions for GH at these significant categories and other particular categories show higher probabilities of higher GH. For example, predictions of GH for employed married women in very good health condition having higher income with undergraduate degree living in vehicle dependent neighborhoods are P(GH=very unhappy|x)=0.023, P(GH=unhappy|x)=0.095, P(GH=neither/nor|x)=0.065, P(GH=happy|x)=0.5895, P(GH=very happy|x)=0.2316. A change of location does not significantly change these probabilities. On the other hand, young unemployed low income associate degree single women students in rural neighborhoods with moderate health have P(very unhappy)=0.205, P(unhappy)=0.376, P(neither/nor)=0.121, P(happy)=0.271 and P(very happy)=0.027. If they live in central pedestrian zones, the probability of being very unhappy increases to 0.248. A substantial difference is observed in the probabilities of lower and higher happiness in the last two examples.

For easier interpretations, it might be better to generate an interaction model for each predictor variable with locations and then control for the contributions of the other related explanatory variables to predictor variable. For example, age, income and health are related to marital status and these variables can be controlled for contribution to marital status*location interaction model. Hierarchical regression model results indicated no significant contribution of age, income and health to the interaction model and the same is true for the other way around. However, at least one of these three variables significantly contributed to health*location interaction model (R-Square Diff. Model 2–Model 1=0.015, F(3,973)=5.197, p=0.001), whereas health*location interaction effect was not significant. Contribution of the age*location interaction model (Model 2) to $log\frac{p}{1-p} = \gamma_j + \sum_{l=4}^{n} \beta_l O_i$ is checked. Pseudo-R^2 difference 0.075–0.062=0.013 indicated a significant contribution of age*location interaction. Conversely, at least one of education, health, marital status, employment and income significantly contribute to age*location interaction model (R-Square Diff.=0.098–0.003=0.095, F(5,971)=20.541, p=0.000). Finally, income*location interaction shows no statistically significant effects on the log-odds of higher happiness. On the other hand, at least one of age, education, occupation, marital status and employment contribute to income*location interaction model (R-Square Diff.=0.019–0.006=0.013, F(5,971)=2.612, p=0.023).

Age-Location Effects

To estimate the objective spatial effects of age on the probability of general happiness, age-location interaction model (3) is used.

$$GH^* = \beta_1 AGE_i + \beta_2 LOCATION_j + \beta_{12} AGE^*LOCATION_{ij} + e \quad (3)$$

Table 6 shows predictions of marginal effects of age categories relative to reference age category 18-24 at indicated locations, i.e. the effect of age difference within the same location. In rural Adana, the effect of age on the probability of higher happiness increases as age increases relative to 18-24 category. The effect of 46-49 category relative to 18-24 increases the probability of higher happiness by 0.43-0.52 pp in central pedestrian, transit junctions and rural.

Table 6. Conditional Effects of Age Over Higher GH At Different Locations

Reference: 18-24	**Conditional effects**	**95% CI**
Age 25-31* secondary pedestrian	.246**(.126)	[.00, .49]
Age 39-45* public transport	-.437*(.069)	[-.57, -.30]
Age 39-45* transit junctions	-.369*(.139)	[-.64, -.10]
Age 46+*rural	.520*(.140)	[.24, .79]
Age 46+*central pedestrian	.434*(.044)	[.35, .52]
Age 46+* public transpot	-.437*(.069)	[-.57, -.30]
Age 46+*transit junctions	.448*(.066)	[.32, .58]

*: p<0,01; **: p<0,05. Standard errors are in parantheses

Table 7 shows these results in the log-odds and odds. The results of interaction OR model with no control variables included indicate that higher age categories vs ages 18-24 living in central pedestrian zones, secondary pedestrian zones and vehicle dependent neighborhoods are less likely to have higher GH than those living in rural neighborhoods. The results indicate that health and education did not improve present significance of the effects of higher age-location interactions.

Table 7. Interaction Effects of Age and Location on GH

Reference:Rural	**Interaction coefficients b_{12}**		**Interaction Effects On the Log-Odds**		**Interaction Effects On the Odds**	
	No control variables		Control Variables			
Age categories vs 18-24	Log-odds model	OR model	+Health	+Education	+Health	+Education
Age 39-45* secondary	-2.66*(.894)	.070*(.063)	-4.30*(2.08)	-2.78*(.906)	.075*(.074)	.062*(.056)
Age 39-45*vehicle dep	-2.12**(.851)	.121**(.103)	.865(.956)	-2.17**(.846)	.241(.245)	.114**(.097)
Age46+*secondary ped	-17.40*(1.12)	.000*(.000)	1.43(.979)	-17.31*(1.12)	.000*(.000)	.000*(.000)
Age 46+*vehicle-dep	-15.32*(1.12)	.000*(.000)	-3.83(1.98)	-15.35*(1.12)	.000*(.000)	.000*(.000)
Age 46+*central-ped	-15.86*(1.24)	.000*(.000)	-2.71**(1.38)	-15.83*(1.24)	.000*(.000)	.000*(.000)

	LR $\chi^2(11)$=54.76, Prob>χ^2= 0.0018 LL= -1327.65, Pseudo R^2= .0202	LR$\chi^2(11)$=148.7 Prob>χ^2= 0.000 LL = -1280.66 PseudoR^2=.055	LR$\chi^2(11)$=56.9 Prob>χ^2= 0.001 LL = -1326.70 PseudoR^2=.021		

*: p<0,01; **: p<0,05. Robust standard errors are in parantheses. LL: Loglikelihood

Previous research have established that age varies systematically with education level, wages, social trust etc. (Bezimeni, 2011). Thus, in this study age-location interaction effects are controlled with health and education. Since education is used as control variable for income, their contribution would be about the same, which is confirmed in this study. Social trust was not related to age. So, only education and health are added one at time in model (4).

Marital Status-Location Effects

Marital status-location interaction effects on the odds of general happiness are estimated using logit model

$$GH^* = \beta_1 MARITALSTATUS_i + \beta_2 LOCATION_j + \beta_{12} MARITALSTATUS*LOCATION_{ij} + e \quad (4)$$

Table 8 shows the predictions of conditional effects of marital statue (single, divorced or separated, widowed and engaged) over higher GH at different locations of living relative to being married. General happiness of divorced or separated persons was more likely lower than that of the married ones in the central pedestrian zones but higher than that of the marrieds in secondary pedestrian zones. General happiness of the widowed persons was more likely lower than that of the married ones in public transport zones but higher than that of the married ones in central and secondary pedestrian zones. General happiness of single persons was more likely lower than that of the marrieds in vehicle dependent neighborhoods and that of engaged persons was more likely higher than that of the marrieds in rural neighborhoods.

The effect of being single (MS_2) vs being married (MS_1) on higher general happiness (GH=3) conditional to (depends on) vehicle dependent neighborhood (LOC=5) is

$$\frac{\Delta P(GH=3|LOC=5)}{\Delta MS_2} = P(GH=3|MS=2, LOC=5) - P(GH=3|MS=1, LOC=5) = 0.501 - 0.701 = -0.200.$$

The effect of being single vs married people on higher general happiness was highly significant (p<.01) only in vehicle-dependent neighborhoods. This effect was negative, hence living in vehicle-dependent neighborhoods reduces the probability of higher general happiness for single people by approximately 20 pp. compared to married people.

Table 8. Conditional Effects of Marital Status Over Higher GH at Different Locations

Reference: Married	**Conditional effects**	**95% CI**
Single*vehicle dependent	-.200*(.055)	[-.31, - .09]
Divorced or separated*central pedestrian	-.515*(.177)	[-.90, -.13]
Divorced or separated*secondary pedestrian	.462*(.070)	[.22, .70]
Widowed*central pedestrian	.302*(.090)	[.12, .48]
Widowed*public transport	-.399*(.125)	[-.64, -.15]
Widowed*secondary pedestrian	.462*(.123)	[.22, .70]
Engaged*rural	.314**(.129)	[.06, .57]

*: p<0,01; **: p<0,05. Standard error are in parantheses

In central pedestrian areas, the probability of higher general happiness for those who are divorced or separated decreases by approximately 51.50 pp compared to the married. In secondary pedestrian areas, it increases by approximately 46.20 pp.

In central pedestrian areas, the probability of higher general happiness for widowed persons increases by approximately 30.30 pp compared to married persons. The increase is approximately 46.23 pp in the secondary pedestrian zones. In public transport areas, the probability of higher general happiness among widowed persons decreases by approximately 39.90 pp compared to married ones.

In rural neighborhoods, the effect of engaged people on the probability of higher general happiness compared to married people was positive (0.314) and significant (p<0.05). The effect of being engaged on probability of higher general happiness relative to the married increases by 31.40 pp.

Table 9 shows the log-odds coefficients of marital status and locations. In central pedestrian and secondary pedestrian zones, widowed persons have higher odds of higher GH (exp(1.08)=2.94 and exp(1.58)=4.85) compared to single persons, whereas in public transport zones they have lower odds of higher GH (exp(-16.99)=0) compared to single persons. In secondary pedestrian zones, divorced or separated persons have odds of higher GH about 4.85 times those of single persons.

Odds ratio of higher general happiness is $\frac{\frac{p_1}{1-p_1}}{\frac{p_0}{1-p_0}}$ where p_1 is the estimated probability of higher general happiness for divorced or separated, p_0 is the estimated probability of higher general happiness for single persons (DeMaris, 1995). Marital status is not an ordered variable. Thus, it can be treated as binary for each pair of comparisons based on a reference category, e.g., being single. For instance, MARITALSTATUS=0 for single and MARITALSTATUS=1 for married can be substituted in (4) to find logit and odds ratio. This can be repeated for other marital statue with a reference category. For further analysis, age, income and health can be used as control variables in (4) to check for their contribution to higher general happiness.

Table 9. Effects of Marital Status and Location On the Log-odds of Higher GH

Reference:Single	**Central Pedestrian**	**Public Transport**	**Secondary Pedestrian**	**Transit Junctions**	**Vehicle Dependent**	**Rural**
Married	.570(.420)	-.127(.508)	.528(.576)	.006(.486)	.965(.243)	.922(.584)
Divorced-separated	-2.05(1.46)	-.276(.740)	1.58*(.240)	-.446(.641)	2.34(1.323)	2.34(1.32)
Widowed	1.08*(.140)	-16.99*(1.03)	1.58*(.240)	-.580(.719)	-.580(.719)	-.58(.719)
Engaged	-1.07(1.73)	-.115(1.43)	1.23(2.58)	.524(.534)	.883(.305)	3.09(1.25)
Central Pedestrian		.585**(.245)	.500(.271)	-.050(.256)	.282(.168)	.555(.338)
Public transport	-.585(.245)		-.085(.310)	-.635**(.298)	-.303(.228)	-.03(.370)
Secondary pedestrian	-.500(.270)	.085(.310)		-.550(.320)	-.218(.255)	.055(.387)
Transit junctions	.049(.256)	.635**(.298)	.550(.320)		.332(.240)	.605(.378)
Vehicle neighbor	-.282(.168)	.303(.228)	.218(.255)	-.332(.240)		.273(.326)
Rural	-.555(.338)	.030(.370)	-.055(.388)	-.605(.378)	-.273(.326)	

Table 10 shows location effects over the marginal effects of marital status. Only the effects of divorced-separated and widowed vs single persons are significant for all locations. The log-odds coefficient of being widowed in rural neighborhoods is -0.58, whereas the log-odds coefficient of interaction WIDOWED*PUBLICTRANSPORT is 1.66. Multiplicative effect on the odds of being widowed is exp(-0.58+1.66*PUBLICTRANSPORT). For persons living in rural neighborhoods, the effect of being widowed is exp(-0.58)=0.56. This suggests that among those living in rural neighborhoods, widowed persons are 44% less likely to have higher GH compared to single persons. Among those living in public transport zones the odds of higher GH is exp(-0.58+1.66)=1.08 times as great for widowed as they are for single persons. This suggests that widowed persons living in public transport zones have odds of higher happiness about 1.1 times those of single persons. Similarly, widowed persons living in transit junctions have odds of higher happiness exp(-0.58+2.16)=4.85 times those of single persons. On the other hand, widowed persons living in secondary pedestrian zones are 100% less likely to have higher GH compared to single persons.

Divorced or separated persons vs singles living in public transport zones are less likely to have higher GH in comparison to those living in rural neighborhoods. The log-odds coefficient of being divorced or separated in rural neighborhoods is 2.34, whereas the log-odds coefficient of interaction DIVORCED-SEPARATED*PUBLICTRANSPORT is -4.40. Multiplicative effect on the odds of divorced-separated is exp(2.34-4.40*PUBLICTRANSPORT). For persons living in rural neighborhoods, the effect of being divorced or separated is exp(2.34)=10.38. This suggests that among persons living in rural neighborhoods, widowed individuals have odds of higher GH about 10 times those of single persons. Among those living in public transport zones the odds of higher GH is exp(2.34-4.40)=0.127 times as great for divorced or separated as they are for single persons. This suggests that among those living in rural neighborhoods, divorced or separated persons are 87.3% less likely to have higher GH compared to single persons.

Table 10. Effects of Location Over the Conditional Marginal Effects of Marital Status

Reference:Single	**Central Pedestrian**	**Public Transport**	**Secondary Pedestrian**	**Transit Junctions**	**Vehicle Dependent**	**Rural**
Married*central-pedestrian		.697(.659)	.043(.713)	.564(.641)	-.395(.484)	.043(.630)
Divorced-separated*central		-1.78(1.63)	-3.63**(1.48)	-1.61(1.59)	-4.40**(1.97)	Omitted
Widowed*central-ped		18.07*(1.03)	-.500(.271)	1.66**(.733)	1.66**(.733)	Omitted
Engaged*central-pedestrian		-.955(2.25)	-2.30(3.11)	-1.59(1.81)	-1.95(1.76)	-2.21(1.28)
Married*public-transport	-.697(.659)		-.655(.768)	-.133(.733)	-1.09(.562)	-.352(.718)
Divorced-separated*public-transport	1.78(1.63)		-1.85(.778)	.170(.978)	-2.62(1.52)	-4.4**(1.97)
Widowed*public-transport	-18.07*(1.03)		-18.57*(1.05)	-16.41*(1.25)	-16.41*(1.25)	1.66**(.733)
Engaged*public-transport	.954(2.25)		-1.34(2.95)	-.639(1.52)	-.998(1.46)	-4.16(2.14)
Married*secondary-ped	-.043(.713)	.655(.768)		.522(.753)	-.437(.626)	-1.05(.774)
Divorced-separated*secondary-ped	3.63*(1.48)	1.85*(.778)		2.02*(.682)	-.764(1.34)	-2.62(1.52)
Widowed*secondary-ped	.500(.270)	18.57*(1.06)		2.16*(.759)	2.16*(.759)	-16.4*(1.25)
Engaged*secondary-ped	2.30(3.11)	1.34(2.95)		.705(2.63)	.346(2.60)	-3.21(1.89)
Married*transit-junctions	-.564(.641)	.133(.703)	-.522(.753)		-.959(.540)	-.395(.820)
Divorced-separated*transit junctions	1.61(1.59)	-.170(.978)	-2.02*(.682)		-2.79(1.47)	-.764(1.34)
Widowed*transit-junctions	empty	empty	empty		empty	2.16*(.759)
Engaged*transit-junctions	1.59(1.81)	.639(1.52)	-.705(2.63)		-.359(.611)	-1.86(2.86)
Married*vehicle-dependent	.395(.484)	1.09(.563)	.437(.626)	.959(.540)		-.916(.757)
Divorced-separated*vehicle-dependent	4.40**(1.97)	2.62(1.52)	.764(1.34)	2.79(1.47)		-2.79(1.47)
Widowed*vehicle-dep	-1.66**(.733)	16.41*(1.25)	-2.16*(.759)	omitted		empty
Engaged*vehicle-dependent	1.95(1.76)	.998(1.46)	-.346(2.60)	.359(.611)		-2.57(1.35)
Married*Rural	.352(.718)	1.05(.774)	.395(.819)	.916(.757)	-.043(.630)	
Divorced-separated*rural	empty	empty	empty	empty	empty	
Widowed*rural	empty	empty	empty	empty	empty	
Engaged*rural	4.16(2.14)	3.21(1.89)	1.86(2.86)	2.57(1.35)	2.21(1.28)	
LR $\chi^2(11) = 58.17$ Prob > χ^2= 0.0003 Loglikelihood = -1325.94 Pseudo R^2= .0215						

*:p<0,01; **:p<0,05. Robust standard errors are in parantheses. Omitted: Because of collinearity. Empty: no observation

Table 11 shows the interaction effects of marital status and location in the log odds and odds of higher GH. When three control variables are added to base interaction model (4) one at a time, income and health each significantly contributed to interaction model (4). When all three control variables are added at the same time, widowed vs single in public transport zones and transit junctions, and engaged in central pedestrian zones vs single lost their significance (not shown) in comparison to Table 10 results. Contribution of health to model (4) is more significant where difference in chi-square is 148.74-58.17=90.57.

Income and health of engaged persons relative to single persons in vehicle dependent neighborhoods improves the significance of interaction effects from no significance to $p<0.05$. Significant contribution here means a control variable improves the significance of the effect in the model it is included (e.g. p<.05 to p<.01 or from no significance to p<.05). If a significance level remain the same (e.g. p<.05 to p<.05) after a control variable is added, there is no significant contribution. In the interaction odds ratio model with no control variables included, the effect of being widowed in public transport zones on the odds of higher GH is zero but highly significant (b=0; p<.01). So, the odds of being in higher happiness are 0 times as large for widowed persons vs single persons living in public transport zones as they are for those in rural neighborhoods. This suggests that widowed persons living in public transport zones are 100% less likely to have higher GH compared to single persons.

Table 11. Contribution of Control Variables to Interaction Effects of Marital Status and Location on GH

Reference: Rural	**Interaction coefficients b_{12}**		**Interaction Effects On the Log-Odds**			**Interaction Effects On the Odds**		
	No control variables		Control Variables			Control variables		
Predictor: Marital vs single	Interaction log-odds model	Interaction OR model	+Income	+Age	+Health	+Income	+Age	+Health
Divorced-separated *Public transport	-4.40** (1.97)	.012** (.024)	-4.18* (2.08)	-4.44* (1.93)	-4.30* (2.08)	.016* (.032)	.012** (.023)	.014* (.028)
Widowed*public transport	1.66** (.730)	5.25** (3.85)	1.73** (.733)	1.66** (.750)	.865 (.956)	5.63** (4.13)	5.26** (3.94)	2.38 (2.27)
Widowed*secondary pedestrian	-16.41* (1.24)	.000* (.000)	-14.34* (1.25)	-16.39* (1.26)	-16.52* (1.39)	.000* (.000)	.000* (.000)	.000* (.000)
Widowed*transit junction	2.16* (.759)	8.65* (6.57)	2.20* (.759)	2.02* (.784)	1.43 (.979)	9.00* (6.83)	7.57* (5.93)	4.16 (4.07)
Engaged*public transport	-4.16 (2.14)	.016 (.033)	-4.32** (2.08)	-4.15 (2.17)	-3.83 (1.98)	.013** (.033)	.016 (.034)	.022 (.043)
Engaged*vehicle dependent	-2.57 (1.35)	.077 (.104)	-2.74** (1.22)	-2.59 (1.37)	-2.71** (1.38)	.064** (.078)	.075 (.103)	.067** (.092)
Engaged*central pedestrian	-2.21 (1.28)	.110 (.141)	-2.36** (1.14)	-2.20 (1.30)	-2.24 (1.30)	.095** (.108)	.110 (.143)	.106 (.139)
	LR $\chi^2(26)$ = 58.17 Probχ^2=0.0003 LL=-1325.94 Pseudo R^2= .0215		LR$\chi^2(27)$=62.37 Probχ^2=0.0001 LL= -1323.84 PseudoR^2=.023	LR$\chi^2(27)$=59.76 Probχ^2=0.0003 LL= -1323.84 PseudoR^2=.022	$\chi^2(27)$=148.74 Probχ^2=0.0000 LL=-1280.66 PseudoR^2=.055			

*p<0,01; **p<0,05. Robust standard errors are in parantheses

Health Status-Location Effects

To estimate health status-location interaction effects on the probability of general happiness, model (5) is

$$GH^* = \beta_1 HEALTH_i + \beta_2 LOCATION_j + \beta_{12} HEALTH*LOCATION_{ij} + e \qquad (5)$$

The effect of a person with good or very good health on high general happiness relative to poor or very poor health status was found to be locational significant. 1. Health = very poor or poor health, 2. Health = moderate health, 3. Health = good or very good health.

Table 12. Conditional Effects of Health Over Higher GH at Different Locations

Reference: Poor Health	**Conditional Effects**	**95% CI**
Good health* Vehicle dependent	.614*(.243)	[.138, 1.09]
Good health* Transit junctions	1.37(.890)	[-.38, 3.13]
Good health* Public transport	1.09(.638)	[-.16, 2.34]
Good health* Secondary pedestrian	1.19(.900)	[-.57, 2.95]
Good Health* Rural	-.800(.905)	[-2.58, .977]

*: p<0,05. Standard errors are in parantheses.

Table 12 shows conditional effects of good health on the probability of higher GH (i.e., GH=3) for all locations. However, the effect of good health on higher GH is significant only in vehicle dependent neighborhoods. This result is based on linear prediction. The interaction effect is the difference between the impact of health difference among people living in vehicle dependent neighborhoods and the impact of health difference among people living in rural neighborhoods, which can be calculated using

$$\frac{\Delta^2 P(GH|HEALTH, LOC)}{\Delta HEALTH_i \Delta LOC_j} = \frac{\Delta}{\Delta LOC_j}\left(\frac{\Delta P}{\Delta HEALTH_i}\right) = \frac{\Delta}{\Delta LOC_j}[P(GH = 3|HEALTH = 3, LOC) - P(GH = 3|HEALTH = 1, LOC)] = [P(GH = 3|HEALTH = 3,\ LOC = 5\,) - P(GH = 3|HEALTH = 1, LOC = 5\,)] - [P(GH = 3|HEALTH = 3,\ LOC = 1\,) - P(GH = 3|HEALTH = 1, LOC = 1)]$$

Table 13. Effects of Health Status and Location On the Log-odds of Higher GH

Reference:very poor	**Central Pedestrian**	**Public Transport**	**Secondary Pedestrian**	**Transit Junctions**	**Vehicle Dependent**	**Rural**
Poor	.598(1.54)	-.22.26*(2.62)	-2.95*(.880)	-4.18*(.745)	.598(1.54)	.598(1.54)
Moderate	-3.33*(.780)	-2.40*(.905)	-2.45**(1.05)	-3.60*(.823)	1.02(1.46)	-2.0*(.738)
Good	-2.17*(.704)	-.916(.824)	-1.49(.918)	-2.54*(.765)	1.81(1.44)	-1.19*(.386)
Very good	-1.00(.616)	-1.00(.616)	-1.00(.616)	-1.00(.616)	2.45(1.46)	-1.0(.616)
Central pedestrian		1.59*(.589)	.885(.700)	.342(.496)	.502(.388)	1.07(.684)
Public transport	-1.59*(.589)		-.706(.805)	-1.93*(.647)	-1.09(.562)	-.519(.797)
Secondary ped.	-..885(.700)	.706(.805)		-1.23(.749)	-.383(.676)	.186(.880)
Transit junctions	.342(.496)	1.93*(.647)	1.23(.749)		.843(.470)	1.41(.734)
Vehicle dependent	-3.96*(1.60)	-2.37(1.65)	-3.07(1.69)	-4.30*(1.62)		- 2.89**(1.44)
Rural	-1.07(.684)	.519(.797)	-.186(.880)	-1.41(.734)	2.89**(1.44)	

Table 13 shows the log-odds β_1 and β_2 coefficients of health and locations. In all locations except vehicle dependent neighborhoods, individuals who report moderate health have lower odds of higher GH (exp(-3.33)=0.036, exp(-2.40)=0.09, exp(-2.45)=0.086 and exp(-3.60)=0.027) compared to very poor health. In central pedestrian zones, transit junctions and rural neighborhoods individuals who report good health have lower odds of higher GH those who report very poor health.

With three categories of GH, no significant interaction effects of health and location were found. Hence, subsequent analysis is based on GH with five categories. Table 14 shows β_{12} coefficients, i.e. interaction effects on the log odds of higher GH. These results indicate pairwise location difference in health difference. Rows are interactions of health categories vs very poor health with indicated locations and columns are reference locations. Persons living in vehicle dependent neighborhoods with all health conditions have higher odds of GH than those living in all other locations. The log-odds coefficient of good health in rural neighborhoods is -1.19, whereas the log-odds coefficient of interaction GOODHEALTH*CENTRALPEDESTRIAN vs rural is 3.01. Multiplicative effect on the odds of good health is exp(-1.19+3.01*CENTRALPEDESTRIAN). For persons living in rural neighborhoods, the effect of good health is exp(-1.19)=0.304. This suggests that individuals living in rural neighborhoods with good health are 70% less likely to have higher GH compared to very poor health. Among those living in central pedestrian zones, the odds of higher GH is exp(-1.19+3.01)=1.82 times as great for good health vs very poor health. This suggests that among persons living in central pedestrian zones, those with good health have odds of higher GH about 1.82 times those of very poor health.

Table 14. Pairwise Location Differences of Interaction Effects of Health

	Central Pedestrian	**Public Transport**	**Secondary Pedestrian**	**Transit Junctions**	**Vehicle Dependent**	**Rural**
Moderatehealth*Central ped		-.928(.813)	-.878(.975)	.272(.702)	-.893(.560)	3.02(1.63)
Goodhealth*Central ped.		-1.25(.645)	-.679(.764)	.366(.557)	-.528(.432)	3.01**(1.50)
Verygoodhealth*Centralped.		Omitted	Omitted	Omitted	Omitted	3.46**(1.59)
Poor health*Public-trans.	-22.85*(1.88)		-19.30*(1.07)	-18.08*(.96)	-19.40*(1.06)	empty

Good health*Public-trans.	1.25**(.634)		.575(.876)	1.62**(.71)	.727(.61)	-1.34(.850)
Poor health*Secondary ped.	-3.55**(1.78)	19.31*(2.62)		1.23(.749)	-.093(.87)	-22.9*(1.88)
Poor health*Transit junct.	-4.78*(1.71)	18.08*(2.58)	-1.23(.749)		-1.32(.73)	-3.6**(1.78)
Good health*Transit junct.	-.366(.557)	-1.62**(.710)	-1.05(.821)		-.894(.52)	-.297(.997)
Poorhealth*Vehicle dep.	Omitted	22.86*(3.04)	3.55**(1.78)	4.78*(1.71)		-4.78*(1.71)
ModerateHealth*Vehicle d	4.35*(1.65)	3.42**(1.72)	3.47(1.80)	4.62*(1.67)		-1.60(1.09)
Good health*Vehicle dep.	3.98**(1.61)	2.73(1.66)	3.30(1.71)	4.35*(1.64)		-1.34(.850)
Verygoodhealth*Vehicle d.	3.46**(1.59)	3.46**(1.59)	3.46**(1.59)	3.46**(1.59)		Omitted
Good health*Rural	.977(.798)	-.278(.910)	.297(.997)	1.34(0.85)	-3.01**(1.50)	
Very good health*Rural	Omitted	Omitted	Omitted	Omitted	-3.46**(1.59)	
LR $\chi^2(11)$ = 111.74 Prob > χ^2= 0.0000 Loglikelihood = -1299.155 Pseudo R^2= .0412						

*:p<0,01; **:p<0,05. Robust standard errors are in parantheses. Omitted: because of collinearity

Table 15 shows the results of model (5) in the log odds and odds with possible contribution of the control variables to the prediction of happiness. Significant interaction effects are captured. Age was significant in generalized ordered logit model and income was a significant correlate of GH and they are known to be important determinants of health. Thus, each is controlled for possible contribution to health-location interaction effects. Age made significant contribution to the model, but income did not. When age is added to the model as covariate, interaction coefficient of moderate health*central pedestrian zones became significant (p<0.05). However, OR standard deviation was large. The same is observed for good and very good health in central pedestrian zones. This perhaps was due to low number of observations in the reference category. To remove multicollinearity, the reference category is changed from very poor health to very good health and interaction model was run again. Moderate health and central pedestrian interaction OR was not significant (OR=2.22, p>.30) anymore, but good health and central pedestrian kept its significance (OR=3.60 and p<.05). When income is added to the model, only good health and central pedestrian interaction OR was significant (OR=3.61, p<.05). The other results do not improve statistical significance of the base interaction models.

Table 15. Contribution of Control Variables to Interaction Effects of Health and Location on GH

Reference:Rural	**Interaction coefficients b_{12}**		**Interaction Effects On the Log-Odds of GH**		**Interaction Effects On the Odds of GH**	
	No control variables		Control variables		Control variables	
Predictor: Health vs very poor health	Log-odds model	OR model	+Income	+Age	+Income	+Age
Poorhealth*secondaryped	-22.86*(1.88)	.000*(.000)	-22.97*(1.87)	-23.11*(1.97)	.000*(.000)	.000*(.000)
Poorhealth*transit-junction	-3.55**(1.78)	.029**(.051)	-3.42(1.76)	-3.79(1.86)	.033(.057)	.023**(.042)
Poorhealth*vehicle-dep.	-4.78*(1.71)	.008*(.014)	-4.89*(1.70)	-5.55**(1.83)	.008*(.013)	.004*(.007)
Moderatehealth *vehicle dep	-1.60(1.09)	.203(.222)	-1.49(1.07)	-1.57(.990)	.225(.242)	.208(.205)
Moderatehealth *central ped.	3.02(1.63)	20.59(33.64)	3.12(1.64)	3.45**(1.68)	22.63(37.03)	31.42**(52.65)
Goodhealth*vehicle-dep.	-1.34(.850)	.261(.222)	-1.32(.826)	-1.23(.860)	.266(.220)	.292(.251)
Goodhealth*central-ped.	3.01**(1.50)	20.22**(30.24)	3.02**(1.50)	3.47**(1.62)	20.59**(30.84)	32.19**(52.13)
Verygoodhealth *central ped	3.46**(1.59)	31.68**(50.21)	3.50**(1.58)	3.85**(1.71)	33.12**(52.19)	46.89**(79.96)
	LR $\chi^2(23)$ = 111.74 Log Likelihood(LL)=-1299.16 PseudoR^2= .041		LL=-1298.1 PseudoR^2= .042	LL=-1292.7 PseudoR^2= .046	LL=-1298.11 PseudoR^2=.042	LL= -1292.73 PseudoR^2=.046

*:p<0,01; **:p<0,05. Robust standard errors are in parantheses

CONCLUSION

In this study, conditional marginal effects and interaction effects of social indicators and locations on the log odds and odds of higher general happiness were investigated. With three categories of GH, conditional marginal effects were significant but interaction effects were not. This result was in line with the findings of DeMaris (1995). Even though predictive margins were mostly significant, conditional marginal effects of predictor variables were less significant in numbers leaving not much for significance of interaction effects. Thus, it can be inferred that location of living did not moderate the effects of social indicators on general happiness with three categories. Subsequently, the analyses were repeated using the five category general happiness and significant interaction effects were captured. Health, age and marital status as significant predictor variables included in interaction effect analyses. The contributions of predictor variables to these interaction effects were controlled. Health made significant contribution to interaction of marital status with location. However, health and education did not improve present significance of the effects of higher age-location interactions. Age made significant contribution to health-location interaction model, but income did not. When health, age, income control variables are added to maritalstatus*location interaction model one at a time, contributions of income and health were significant. Contribution of health was more significant.

The effects of social indicators over time-framed happiness in Adana were estimated (Mavruk et al., 2021, pp. 541-543). Gender effect was not significant, which is in line with this study. The effect of being divorced or seperated vs being married decreased the probability of global happiness when all spatial variables were included in the model, this result was in line with DeMaris (1995) except for spatial effect. In this study, the results were mixed. The effects of the divorced or separated compared to the married ones on general happiness were significant in the central and secondary pedestrian areas. These effects were negative in the central pedestrian zones and positive in the secondary pedestrian zones. The effects of being widowed on the probability of general happiness compared to the married were significant in the central pedestrian, public transport and secondary pedestrian areas. These effects were positive in the central pedestrian and secondary pedestrian zones and negative in the public transport zones.

Among individuals living in public transport zones and transit junctions, widowed persons had higher odds of GH than single persons. Divorced-separated and widowed persons vs single persons living in secondary pedestrian zones are more likely to have higher general happiness than those living in all other urban locations. On the other hand, widowed persons vs single persons living in public transport and transit junctions are more likely to have higher general happiness than those living in rural neighborhoods. Divorced-separated and widowed persons vs single persons living in public transport and secondary pedestrian zones are less likely to have higher GH than those living in rural neighborhoods.

The odds of higher general happiness were about four times as large for good health in central pedestrian-rural difference as they are for very poor health when age or income is added to base interaction model. On the other hand, individuals who reported poor, moderate and good health in vehicle dependent neighborhoods had the odds of higher happiness about two to five times those in very poor health, whereas they were less likely to have higher general happiness compared to rural neighborhoods. All pairwise location differences of interaction effects indicate that persons living in vehicle dependent neighborhoods in all health conditions vs very poor health have higher odds of general happiness than those living in the other urban locations. In a similar study, Mavruk et al. (2021) found that individuals having poor and moderate health conditions in central pedestrian areas, and having moderate health in transit junctions were less likely to have higher happiness at present than those living in the other locations.

Trust in human was not significant in explaining age which contradicts Bezimeni (2011) who reported the trust as a significant cause of age. Location effects of age difference were mixed but higher age was less likely to be happier than young participants in half of the locations. This result was in line with the study of Mavruk et al. (2021, pp.541-543) in which the effect of older age category vs young was negative and spatially significant over global happiness. Higher age individuals from rural, central pedestrian areas and transit junctions had the odds of higher general happiness greater than those of young individuals. In general, higher age individuals vs younger living in urban zones were less likely to have higher general happiness than those living in rural neighborhoods. In a similar study, Mavruk et al. (2021) found that middle age vs younger individuals living in transit junctions were more likely to have higher happiness (at present) than those living in rural Adana.

All the evidences suggest that vehicle dependent neighborhoods are more livable for individuals with better health conditions. Secondary pedestrian zones are more livable for divorced-separated and widowed persons. Rural neighborhoods are happier with moderate to older age groups, thus has higher degree of livability compared to other locations of urban Adana. Rural neighborhoods are less livable for divorced or separated whereas more livable for widowed persons compared to single persons.

This study provides an opportunity to individuals who can afford to change location but have no preference to decide for a new livable location in Adana.

APPENDIX A.

Short Background

Adana has been economically neglected since the end of cotton era in Çukurova. It was the beginning of impoverishment and would inevitably reflect on well-being of Adana. After industry left Adana for İzmit/İstanbul regions, no large scale production sector left in the province. Before 1980 military coup, the city started receiving migrants from the southeastern cities in large numbers with low socio-economic statue, large family size and different cultures. Instead of cottons, slums popped up in the cotton fields overnights. New rural and urban neighborhoods continued to emerge together since then. Today's urban Adana is mostly formed of native people who escape rural neighborhoods and smaller towns for better life. On the other hand, rural Adana was taken over partially by Southeatern migrants and immigrants where rural residents left for urban Adana. The latest wave of immigrants came from Syria including different religion sects and the ISIS militants who infiltrated into neighborhoods and disrupted the social and environmental order. Most have large family size and are below poverty line, working for a low salary or unemployed. They would find a place to themselves around Arabic speaking neighborhoods where mostly Urfa migrants are located. Not surprisingly, increasing number of poor people continue raising unemployment rates and income inequality in Adana. All these negatively reflected on the existing native residents some of whom lost their jobs and had to move to new locations within the city, within the country or abroad. Worsening economic conditions contributed to outflow of everyday two full airplanes of Turkish people only to Mexico. Of whom considerable proportion is from Adana. Those who cannot afford or not able to move abroad stayed in Adana and moved to their preferred neighborhoods.

In addition to high income inequality and high unemployment, the city has been in the highlights with the use of illicit drugs and marijuana. Adana was reported as number three in the world in illicit drugs, marijuana and alcohol, based on a 2017 sample (Daglioglu et al., 2019). Furthermore, there are some allegations about the international drug trafficing for Europe being headed towards Mersin ports and perhaps towards Adana shores.

APPENDIX B

The probabilities of GH categories are included in this part. GH* in model (1) cannot be observed. Instead, since there are happiness data in the ordered category GH=1,2,…,j, the respondents answer the question about their own happiness on a j-scale. They choose the answer category that best describes their happiness (GH*). If happiness level that the participants answered correctly is below the first cut-off point, they choose the lowest category. If the level of happiness they answered correctly falls between the first and second cut-off points, they mark the second category. Assuming there are j=1,…,k categories, observed categories of GH are

$$GH = j \leftrightarrow \gamma_{j-1} < GH^* \leq \gamma_j$$

where γ_{j-1} and γ_j are the corresponding thresholds such that $\gamma_j < \gamma_{j+1}$; $\gamma_0 = -\infty$, $\gamma_j = \infty$ (Hajdu and Hajdu, 2014, p.115). Given the i^{th} category observation x_i of the independent variables, the probability of observing GH=j:

$$P(GH = j \mid x_i) = P(\gamma_{j-1} < GH^* \leq \gamma_j \mid x_i) = P(GH^* \leq \gamma_j \mid x_i) - P(GH^* \leq \gamma_{j-1} \mid x_i)$$

In our case k=5:

GH=1 (very unhappy) if $-\infty$<GH*<γ_1

GH=2 (unhappy) if γ_1<GH*<γ_2

GH=3 (neither nor) if γ_2<GH*<γ_3

GH=4 (happy) if γ_3<GH*<γ_4

GH=5 (very happy) if γ_4<GH*<∞

APPENDIX C

The results in this part follows from Williams (2006). Table C1 shows the estimated coefficients for four (j-1) binary regressions with t values in parantheses for GH>j where j is the number of categories of GH from 1 to 5.

Table C1. Estimated coefficients for four binary regressions of GH

Variables	**GH>1**	**GH>2**	**GH>3**	**GH>4**
Age	0.103(0.68)	0.100(1.04)	0.194 (2.13)	0.354 (2.53)
Gender	0.197(0.83)	-0.024(-0.16)	-0.131(-0.95)	-0.281(-1.12)
Marital status	-0.064(-0.57)	0.196(2.32)	0.298(3.67)	0.210(1.85)
Family size	-0.04(-0.36)	-0.151(-2.12)	-0.051(-0.73)	0.119(1.04)
Education	0.085(0.62)	0.046(0.52)	0.119(1.40)	-0.036(-0.26)
Employment	0.089(2.02)	0.022(0.80)	0.028(1.05)	0.040(0.86)
Monthly income	0.381(1.36)	0.093(0.57)	0.023(0.15)	0.077(0.30)
Occupation	-0.120(-1.23)	-0.012(-0.20)	0.012(0.22)	0.071(0.71)
Health	0.919(5.75)	0.828(7.15)	0.861(7.52)	1.080(5.14)
Location	0.073(1.14)	0.038(0.94)	0.012(0.32)	0.025(0.36)
Constant	-2.429(-1.98)	-3.056(-3.71)	-4.581(-5.65)	-8.584(-5.99)

Table C2 shows the results of test of parallel regression which indicates that pl assumption is violated because global significance $p=0.015<0.05$. The problem seems to be due to marital status and family size both with $p<0.05$.

Table C2. Parallel Regression Lines Assumption Test Results

Variables	**chi^2**	**p>chi^2**	**df**
All	49.26	**0.015**	30
Age	3.94	0.268	3
Gender	2.96	0.398	3
Marital status	16.24	**0.001**	3
Family size	12.62	**0.006**	3
Education	2.47	0.481	3
Employment	2.76	0.430	3
Monthly income	1.74	0.627	3
Occupation	2.42	0.490	3
Health	1.51	0.680	3
Location	1.37	0.712	3

Table C3 shows generalized ordered logistic regresion model (gologit) of GH with respect to age, gender, marital status, family size, education, employment, monthly income, occupation, health, location with constrained variables (age gender education employment monthly income occupation health location).

Table C3. Generalized ordered logistic regresion model

1 GH	**Coefficient**	**95% CI**	**3 GH**	**Coefficient**	**95% CI**
Age	0.187** (.082)	[.025, .348]	Age	0.187** (.082)	[.025, .348]
Gender	-.075 (.122)	[-.315, .165]	Gender	-.075 (.122)	[-.315, .165]
Marital	-.085 (.105)	[-.291, .121]	Marital	.278* (.077)	[.128, .428]
Family size	-.048 (.105)	[.253, .158]	Family size	-.037 (.069)	[-.173, .099]
Education	.071 (.076)	[-.078, .220]	Education	.071 (.076)	[-.078, .220]
Employment	.035(.023)	[-.014, .077]	Employment	.035 (.023)	[-.014, .077]
Monthly income	.078 (.135)	[-.187, .343]	Monthly income	.078 (.135)	[-.187, .343]
Occupation	-.001 (.050)	[-.099, .097]	Occupation	-.001 (.050)	[-.099, .097]
Health	.902* (.099)	[.708, 1.095]	Health	.902* (.099)	[.708, 1.095]
Location	.022 (.034)	[-.046, .089]	Location	.022 (.034)	[-.046, .089]
Constant	-1.848 (.766)	[-3.349, -.348]	Constant	-4.624* (.723)	[-6.042, -3.207]
2 GH			**4 GH**		
Age	0.187** (.082)	[.025, .348]	Age	0.187** (.082)	[.025, .348]
Gender	-.075 (.122)	[-.315, .165]	Gender	-.075 (.122)	[-.315, .165]
Marital	.206* (.079)	[.050, .362]	Marital	.236* (.103)	[.034, .438]
Family size	-.128 (.069)	[-.264, .008]	Family size	.118 (.120)	[-.117, .353]
Education	.071 (.076)	[-.078, .220]	Education	.071 (.076)	[-.078, .220]
Employment	.035(.023)	[-.014, .077]	Employment	.035 (.023)	[-.014, .077]
Monthly	.078 (.135)	[-.187, .343]	Monthly income	.078 (.135)	[-.187, .343]

income					
Occupation	-.001 (.050)	[-.099, .097]	Occupation	-.001 (.050)	[-.099, .097]
Health	.902* (.099)	[.708, 1.095]	Health	.902* (.099)	[.708, 1.095]
Location	.022 (.034)	[-.046, .089]	Location	.022 (.034)	[-.046, .089]
Constant	-3.688* (.718)	[-5.096, -2.279]	Constant	-7.820* (.830)	[-9.447, -6.193]

*: p<0,01, **: p<0,05

APPENDIX D

Gender-Location Effects

To estimate the location effects of men on the probability of general happiness relative to women, gender-location interaction model (D1) is used.

$$GH^* = \beta_1 GENDER_i + \beta_2 LOC_j + \beta_{12} GENDER*LOC_{ij} + e \qquad (D1)$$

For men (GENDER=1), the log odds is $log\frac{p_1}{1-p_1} = logit[(P(GH = j|GENDER = 1)] = \beta_1 + \beta_2 LOC_j + \beta_{12} LOC_j$

For women (GENDER=0), the log odds is $log\frac{p_0}{1-p_0} = logit[(P(GH = j|GENDER = 0)] = \beta_2 LOC_j$

Where p_1 is the probability of higher general happiness for men, p_0 is the probability of higher general happiness for women, $1-p_1$ is the probability of lower general happiness for men and $1-p_0$ is the probability of lower general happiness for women.

For gender difference, subtracting the log odds gives $log\frac{\frac{p_1}{1-p_1}}{\frac{p_0}{1-p_0}} = logit[(P(GH = j|GENDER = 1)] - logit[(P(GH = j|GENDER = 0)] = \beta_1 + \beta_{12} LOC_j$, that is partial derivative of the log odds with respect to GENDER. So, conditional marginal effect, i.e. the effect of gender, depends on location of living. Thus, the odds ratio can be written as $e^{\beta_1 + \beta_{12} LOC_j}$, that is multiplicative effect of gender on the odds. Taking discrete partial derivative with respect to location (LOC) gives the interaction effect: $\frac{\Delta^2 P(GH|GEN, LOC)}{\Delta GEN_i \Delta LOC_j} = \beta_{12}$. This is equivalent to say gender (female-male) difference for urban zones is $\beta_1 + \beta_{12}$ and gender difference for nonurban (rural) zones is β_1 . Thus, the urban-rural difference of marginal effects of gender differences is β_{12}. In this case, urban and rural is treated as dichotomus which can be applied to any pair of locations.

For example, when five categories of GH is dropped to three, conditional marginal effect of gender on higher general happiness (GH=3) in secondary pedestrian zone is

$\frac{\Delta P(GH = 3|LOC = 4)}{\Delta GEN_i} = P(GH = 3|Gender = 1, LOC = 4) - P(GH = 3|Gender = 0, LOC = 4) = 0.373 - 0.643 = -0.27$, which is statistically significant (p<.05). The interaction effect is $\frac{\Delta^2 P(GH|GEN, LOC)}{\Delta GEN_i \Delta LOC_j} = \frac{\Delta}{\Delta LOC_j}\left(\frac{\Delta P}{\Delta GEN_i}\right) = \frac{\Delta}{\Delta LOC_j}[P(GH = 3|Gender = 1, LOC) - P(GH = 3|Gender = 0, LOC)] = [P(GH = 3|LOC = 4, Gender = 1) - P(GH = 3|LOC = 4, Gender = 0)] - [P(GH = 3|LOC = 1, Gender = 1) - P(GH = 3|LOC = 1, Gender = 0)] = -0.27 - [0.631 - 0.438] = -0.27 - 0.193 = -0.463$

Table D1. Conditional Effects Of Gender At Locations

Reference: Women	**Conditional marginal effects**
Men*central pedestrian	.072 (.066)
Men*public transport	.040 (.094)
Men*secondary pedestrian	-.270* (.114)
Men*transit junctions	.052 (.086)
Men*vehicle dependent	-.045 (.047)
Men*rural	.193 (.166)

*: p<0,05. Standart errors are in parantheses

Table D1 shows conditional marginal effects of men at different locations.

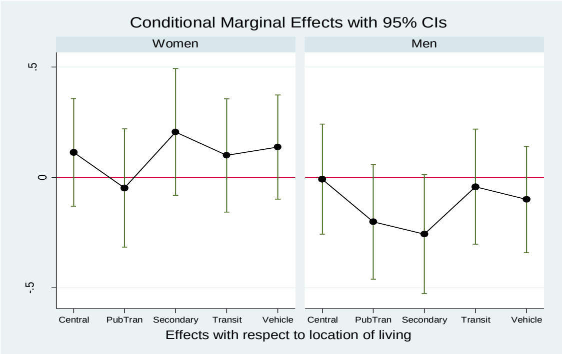

Figure D1. Conditional Effects of Gender On Higher GH

Figure D1 shows the graph of the conditional effects of men and women on the probability of higher general happiness with respect to locations of living. The y=0 line shows no effect in the gender difference. The conditional effect of men on the probability of higher general happiness P(GH=3) compared to women is negative and significant ($\hat{\beta}$=-0.27; p<.05) only in secondary pedestrian areas. The conditional effect of gender difference on the probability of higher general happiness at secondary pedestrian zone was -0.27. In other words, men living in secondary pedestrian areas are 27 percentage points (pp) less likely than women to have higher general happiness.

Education-Location Effects

Education-location interaction model (D2) is used in order to estimate the objective spatial effects of educational status on the probability of general happiness.

$$GH^* = \beta_1 EDUCATION_i + \beta_2\ LOCATION_j + \beta_{12} EDUCATION*LOCATION_{ij} + e \qquad (D2)$$

The conditional marginal effects of educational status on general happiness were highly significant (p<.0001). Compared to the illiterate, other levels of education have negative effects on the probability of higher overall happiness. The effects of other educational levels on the probability of higher overall happiness decrease between 35.60 pp and 49.80 pp relative to the illiterates.

However, since the location effects on general happiness are not significant, the interaction of education and location was not statistically significant. Only one person out of 980 who participated in the survey was illiterate. For this reason, this data was deleted and the marginal effects of education-location interaction were recalculated over 979 people. The reference category was primary school graduates (primary).

Relative to primary and secondary school graduates, the conditional effects of other education levels on higher general happiness were significant. The effect of high school graduates vs primary& secondary school graduates in secondary pedestrian zones is -0.370 (p<.05). The effect of associate degree graduates are 0.413 and 0.457 in central pedestrian zones and transit junctions (p<.05 for both) and -0.63 (p<.001) in secondary pedestrian zones. In other words, a person with a high school degree is 37 pp less likely to have a high general happiness relative to primary school graduates living in secondary pedestrian areas. Compared to primary school graduates living in central pedestrian areas and transit junctions, associate degrees' probability of higher general happiness increases by 41.3pp and 45.7pp, respectively. In secondary pedestrian areas, a person with an associate degree is 63 pp less likely to have a higher general happiness relative to primary school graduates. In public transport zones, the probability of a person with a master's or doctorate degree to have higher general happiness increases by 54.40 pp compared to primary education graduates.

Marginal analysis on education did not follow "the higher educated are happier" expectation. In secondary pedestrian zones, high school graduates and associates degree holders had negative effects over higher general happiness relative to primary school graduates. However, in public transport zones higher educated people showed positive effects relative to primary school.

Employment Status-Location Effects

To estimate the objective spatial effects of job status on the probability of general happiness, ordered logistic model (D3) with employment status-location interaction is used.

$$GH^* = \beta_1 EMPLOYMENT_i + \beta_2 LOCATION_j + \beta_3 EMPLOYMENT{*}LOCATION_{ij} + e \quad (D3)$$

The reference category is “currently employed”. Conditional effects on the probability of higher general happiness are given in Table D3.

Table D3. Conditional Effects of Employment Status Over Higher GH at Different Locations

Reference: Currently Employed	Conditional effects	Standard errors	95% CI
Unemployed*Central Pedestrian	-.446**	.196	[-.83, -.06]
Unemployed*Transit junctions	-.319*	.111	[-.54, -.10]
Unemployed*Vehicle Dependent	-.188**	.075	[-.34, -.04]
Unemployed last 12 months*Public Transport	.648*	.074	[.50, .79]
Unemployed last 12 months*Transit Junctions	.371*	.070	[.23, .51]
Unpaid family worker*Transit Junctions	-.629*	.070	[-.77, -.49]
Retired*Public Transport	-.352*	.074	[-.50, -.21]
Retired*Secondary Pedestrian	-.569*	.100	[-.76, -.37]
Retired*Transit Junctions	.371*	.071	[-.73, .32]
Housewife*Rural	.340**	.136	[.07, .61]
Student* Central Pedestrian	-.152**	.076	[-.30, -.00]
Student* Vehicle Dependent	-.108**	.055	[-.22, -.00]

*: p<0,01; **: p<0,05

The effects of the currently unemployeds vs wage earners were negative and significant in transit intersection zones, vehicle-dependent and rural neighborhoods. The effect of an unpaid family worker on the probability of higher general happiness compared to wage workers was negative (-0.629) and significant (p<.0001) at transit junctions. Those who are unemployed for less than 12 months compared to wage-earners had positive (0.648 and 0.371, respectively) and significant (both p<0.001) effects on the probability of higher general happiness in public transport and vehicle transit locations. The effects of the retirees on the probability of higher general happiness relative to wage earners were negative (-0.352 and -0.569) and significant (both p<0.001) in public transport and secondary pedestrian areas. It was positive (0.371) and significant (p<.0001) at transit junctions. Compared to paid employee, the effects of housewives on the probability of higher general happiness were positive (0.340) and significant (p<0.05) in rural neighborhoods.

The effects of students on the probability of higher general happiness relative to paid employee were negative (-0.152 and -0.108, respectively) and significant (both p<.05) in central pedestrian areas and vehicle-dependent neighborhoods.

Occupation-Location Effects

In order to estimate the effects of the profession on the probability of higher general happiness, ordered logistic model (D4) including interaction between occupation and location is used.

$$GH^* = \beta_1 OCCUPATION_i + \beta_2 LOCATION_j + \beta_{12} OCCUPATION{*}LOCATION_{ij} + e \quad (D4)$$

The reference category is “state employee”. Conditional effects on the probability of higher general happiness of those who are private, semi-private, unemployed and employer, respectively, according to state employees are given in Table D4. Compared to state employees, the effects of semi-private on probability of higher general happiness were positive (0.388, 0.519 and 0.385) and significant (all p<.01) in central pedestrian, secondary pedestrian zones, transit junctions. The effects of self-employeds on high probability of overall happiness relative to state employees were positive (0.272) and significant (both p<.05) in central pedestrian zones. It was negative (-0.474) and significant (p<.01) at transit junctions.

Table D4. Conditional Effects of Occupation Over Higher GH at Different Locations

Reference: State Employee	Conditional effects	Standard errors	95% CI
Semi-private*Central Pedestrian	.388*	.066	[.26, .52]
Semi-private*Secondary Pedestrian	.519*	.099	[.33, .71]
Semi-private*Transit Junction	.385*	.070	[.25, .52]
Self-employed*Central Pedestrian	.272**	.126	[.03, .52]
Self-employed*Transit Junctions	-.474*	.153	[-.77, .18]

*: p<0,01; **: p<0,05

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