# Modeling the Leisure Time Physical Activity in Islamabad

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## 1. Abstract

*Leisure time Physical Activity (LTPA) has not been formally analyzed for Pakistani data. This paper is an effort to start thinking of modeling the LTPA using a nationally representative sample. This paper uses only a locally representative sample that is expected to portray the results about LTPA for Islamabad region only. The main objective of this study has been to analyze the potential correlates of LTPA. We have used various socio-demographic and cognitive correlates of LTPA.*
*Methods: Data was selected personally by direct personal interviews. Three hundred residents from six different sectors of Islamabad were chosen on stratified random sampling. Bivariate Logistic Regression Model (BLRM) has been used to analyze associations of LTPA with different demographic, self efficacy, environmental and behavioral variables.*

**Keywords:** LTPA, Logistic Regression, Omnibus Test, Association of Attributes

## *2. Introduction*

LTPA is a useful way of keeping oneself healthy and active. If we talk about western countries, plenty of research has been done on LTPA and yet more is in progress. However in South East Asian region (SEAr) this is still a new topic and only a few studies have been done in this direction. Focusing on SEAr some research has been done to analyze LTPA. Hasse et al. (2004) analyzed LTPA by using a cross-sectional survey data, of university students, from twenty three countries. They did not apply any modeling technique to see the functional relationship of LTPA with the considered correlates; however their study suggested that LTPA is below the recommended levels in a substantial population of students and the major exogenous variables are health beliefs and behavior. Bengoechea et al. (2005) used telephone-administered survey data on LTPA, perception of the neighborhood environment and self efficacy. They used logistic regression model to see the association of LTPA with environmental correlates, controlling for gender and some other socio-demographic correlates. They found that relationship between LTPA and the environmental correlates were quite different for males as compared to females.  Chen et al. (2007) used socio-demographic correlates to explain LTPA. They applied logistic regression modeling and concluded that LTPA is inversely related to age, television viewing, being a female, and rural residence. Regarding Pakistan no attempt has been made to see the potential correlates of LTPA and consequently the functional form of the relationship between LTPA and various correlates. This study is an attempt to model LTPA for university students of Islamabad (capital city of Pakistan) and see various trends.

### 3.1 Present Study

We have considered the family income, parental education, sector of residence and the variables considered by Bengoechea et al. (2005) and Chen et al. (2007). Sector of residence has been included because the facilities of walking tracks, street safety levels etc. are perceived to be different in different sectors of Islamabad. We have used association measures and logistic regression model to see the strength of dependency of LTPA and various correlates.

### 3.2 Sampling Methodology

Respondents have been chosen from six different areas of Islamabad, enlisted in Table 1. We have assigned random numbers to following sectors of Islamabad E to I (1 to 4), through RAND command of Microsoft Excel 2007.

Out of these randomly generated numbers, six numbers are chosen to help us in selecting the sectors to be surveyed.  These six numbers are chosen using stratified random sampling with equal allocation; stratification variable is "perception of a sector as being lower class, middle class or upper middle class".  Field workers were briefed in detail that they should spread the sample across different streets of each sectors and across different residential units (such as huts/ shacks etc.) in slums. Addresses of the respondents have been noted and random checks have been done by duplicating some of the housing units by different surveyor.

### 3.3 Study Variable

We are interested in analyzing LTPA so it serves as the study variable. LTPA is measured as a binary variable, by requesting the respondents to answer a Yes/No to the following statement "Have you performed any LTPA during last two weeks". Definition of LTPA has been printed on the top of the questionnaire to avoid misconception. For illiterate/semi-literate respondents the definition has been read aloud in Urdu/Punjabi (Two most commonly used languages in Pakistan). Athletic, recreational or occupational activities that require physical skills and utilize strength, power, endurance, speed, flexibility, range of motion or agility (quickness). ( Free dictionary by Farlex). If a respondent answers a "Yes" then he/she is requested to identify the type of LTPA performed, out of twelve different options as given in Table 4. Respondents have also been asked to report the duration of session frequency with which they performed the reported LTPA. In order to classify individuals as optimally active, non-optimally active and inactive, we followed Taiwan Executive Yuan (2004); respondents with a frequency of 3 or more with duration of at least thirty minutes that made them breath hard have been classified as optimally active. In this way we have calculated an "Activity Index" (AI) for each respondent; AI=1 for optimally active, 2 for non-optimally active and 3 for inactive. Respondents who did not perform any LTPA have been denominated as inactive and rest of the respondents as non-optimally active.

### 3.4 Socio-demographic Correlates

Information about the respondents' age, gender, education, parental education, income, and sector of residence has been recorded. Age has been measured as a categorical variable on ordinal scale with digit one representing whose age is less than twenty years, two for age over twenty but less than forty five years and three for age over forty five. Gender has been measured on nominal scale with digit one and two representing males and females respectively. Education and parental education have been measured on ordinal scale with one representing less than five years of schooling, two for more than five but till twelve years of education and three for over twelve years of education.  Income has been measured on ordinal scale with digit one representing income between 0-10,000, 2 representing 10,001-25,000 and 3 for 25,000 or more.  Sector of residence has been recorded as a nominal variable with 1 for G.10.1, 2 for G.10.2, 3 for Slums of G.11, 4 for F.10.2, 5 for Slums of G.8 and 6 for F.6.2.

### 3.5 Environmental Correlates

Following criteria of International Physical Activity Prevalence Study Environmental Survey Module, we asked eight questions to estimate the perceptions about neighborhood that may be associated with LTPA. These questions are given in Table 3 and responses have been measured as a binary variable (Yes/No).

### 3.6 Cognitive Correlates

Following Rodgers (2001) and Bengoechea et al. (2005), a self-efficacy score was derived by taking the mode of the responses to three self efficacy questions; (i) I perform PA even if I face fatigue (ii) I perform PA even if I face time constraint and (iii) I perform PA even in bad weather. Though researchers have been using arithmetic mean as the averaging for these cognitive variables but use of mode for ranked data is more appropriate (see Jamieson (2004)).  So, in this article, mode is used as a summary value for variables on intervals weaker than interval scale.

### 4.1 Data Analysis and Results

In this section we discuss the techniques and methods used to analyze the sample data in the context of various survey errors, modeling the functional form of relationship between LTPA and its correlates.

### 4.2 Non-Sampling Errors

It is a common feature of surveys to face the issue of non-response and not-at-homes. We have faced 5 % non-response in slums while in different sectors we have faced 7% not-at-homes and 4% non-response.

### 4.3 Measures Used for Association of Attributes

We have used "Gamma Coefficient" for nominal-ordinal and ordinal-ordinal association. For nominal-nominal association we have used "Phi and Cramer-V" proposed by Swedish mathematician and statistician Harald Cramér (see reference number 9).

### 4.4 Prevalence of LTPA

Overall 63% reported doing LTPA, however only 12.2% have been found as optimally active. Activity index is found unrelated with gender (p-value of 0.196 both for Phi and Cramer-V).

As shown in Table 4, Jogging is found to be most practiced LTPA which is then followed by Ball sports and Walking.

## 4.5 Association of LTPA-Category with Sector of Residence

We applied association tests on sector of residence vis-à-vis LTPA prevalence. A significant association has been observed between these two variables. This means that decision to perform LTPA depends on the sector of residence. This may mean that the LTPA facilities (such as walking tracks, parks etc) are not same across different sectors of Islamabad.

## 4.6 Association of LTPA-Category with Gender and Family Income

As shown in Table 5, jogging, ball sports and weight lifting activities are found to be significantly associated with gender. For the purpose of compaction we have not shown all the relevant tables here (and they can be obtained on request). However swimming and mountain climbing are found to be significantly associated with income. For the 7.4% respondents who do mountain climbing, 3.7% are from the income category 1. So we may say that mountain climbing is an activity that is preferred and affordable also by the lower class segment of the society. For the 10.1 % respondents who do swimming, 5.3% are from the income category 3 and remaining 4.7% from the income category 2. This may indicate that swimming is not preferred by the lower and the middle class. This may be indicative of lesser affordability of doing swimming with lower income. Although, in Islamabad, individuals belonging from the so-called economically lower class individuals are seen swimming in gullies and ravines. But probably no such individuals have been chosen in our sample.

## 4.7 Association of LTPA-Category with Education

Ball sports and Cycling are found significantly related with respondents' educational level (with a p-value < 2%). Out of the total 67.2% respondents who do ball sports, 61.4% are from the education category 2 and 3. Out of 38.1 respondents who do bicycling, 33.3% are from education category 2 and 3.

## 4.8 Association of LTPA with Various Correlates

For the purpose of compaction, tables related to the below mentioned discussion, have not been suffixed in this article, and may be obtained from the author. Overall LTPA is found to significantly related with sedentary time (p-value=0.000 both for Phi and Cramer-V), gender (p-value=0.000), educational status (p-value<0.02), parental education (p-value<0.1), smoking status (p-value=0.000), income (p-value<0.02). Majority of those who do LTPA are found to be females and the gamma coefficient is negative for LTPA vs. gender, suggesting an inverse relationship between LTPA and gender. Majority of those who do LTPA are found to report from higher parental educational levels and the gamma coefficient is also positive, suggesting that parents are more educated then it may increase the likelihood of their children doing LTPA. LTPA is found to be related with income and gamma coefficient is positive, suggesting that as higher income may be observed with increases likelihood of participating in LTPA. Sedentary time is found to be related with income (p-value< 0.05) and the gamma coefficient is negative, suggesting that as greater income has been observed with more LTPA. It may mean that, *cetris peribus,* in Islamabad richer persons spend less time in sitting. This may arise concerns in the mind of the readers because generally it is perceived that poorer persons have less time to sit; to do their house chores and bread-earning. But it seems that in Islamabad richer persons are more health conscious and therefore prefer to spend less time in sitting idle.

Regarding gender classification, 15 and 25.7 percent of the females and males, respectively, spent 5 to 6 hours of average in sitting daily. However average number of sitting hours does not differ significantly across males and females (t=-1.571 and p-value=0.117). For males those who do LTPA the average number of daily sitting hours are found to be significantly lesser than the same average for males without LTPA (t=4.687 and p-value=0.000). For females those who do LTPA the average number of daily sitting hours are found to be significantly lesser than the same average for males without LTPA (t=1.950 and p-value=0.027). This may suggest that respondents are doing LTPA by choice and by virtue of keeping themselves as healthy. Now we present the results vis-à-vis the perceived environmental correlates (PEC). Two of the PEC, namely "Crime" and "Easy access to shops/stores" are found to be significantly associated with gender; former at 1% and later at 10% level of significance. "Easy access to places for physical activity" has been found significantly associated with "Family income". This may mean that those who are financially better-off deem the places to be easily accessible or they choose their residences in such location where such places are easily accessible. This assertion is reinforced by results of significant association of "Side-walks" with "Sector" (p-value=0.000). Further "Sector of residence" " is found significantly associated with "Low-Cost Recreation" (p-value=0.024) and Trend (p-value=0.009). Now we present the results vis-à-vis the "Efficacy Index" (EI). We find significant positive association between EI and gender (p-value =0.000), with 83 % of the males who do LTPA, stating that they are able to tackle at least one of the fatigue, bad weather and time constraints. The same figure for females has been 47.3 %.

We find significant positive association between EI and "Parental Education" (p-value=0.001); out of the 189 respondents who reported EI=1, 2, approximately 83% has been from parental education category 2 or 3. Respondent's own educational status is also associated with EI (p-value=0.000); out of the 189 respondents who reported EI=1, 2, approximately 73% has been from education category 2 or 3. Smoking status has been found to significantly associated with EI (p-value =0.000); out of the 189 respondents who reported EI=1, 2, approximately 77% have reported never-smoked or very less smoking.

## 5. Functional Modeling of LTPA

We now present the formal functional relationship of LTA with potential correlates. Based on analysis of association of LTPA with different variables we choose Income, parental education, weight, smoking, gender and age as explanatory variables of LTPA in the multivariate logistic regression setup. We have used stepwise forward likelihood ratio method of estimation. Omnibus tests of model coefficients provide significant results for model (see Table 6). These tests suggest that the fitted model is plausible for the data.  Hosmer and Lemeshow tests (see Shah and Barnwel (2003)) also provide p-values greater than 0.05 which is considered adequate for a good model (see Shah and Barnwell (2003)). In the linear regression model, the coefficient of determination summarizes the proportion of variance in the dependent variable associated with the predictor (independent) variables. For regression models with a categorical dependent variable, it is not possible to compute a single coefficient of determination statistic that has all of the desirable characteristics. So there are different coefficients used for logistic regression. The computer package *SPSS 17* provides "-2 Log likelihood", "Cox & Snell R Square" and "Negelkerke R Square", for analysis of logistic regression models. The following methods are used to estimate the coefficient of determination;

Cox and Snell's $R^2$ (see Cox and Snell (1989)) is based on the log likelihood for the model compared to the log likelihood for a baseline model. However, with categorical outcomes, it has a theoretical maximum value of less than 1, even for a "perfect" model. Nagelkerke's $R^2$ (see Nagelkerke (1991)) is an adjusted version of the Cox & Snell $R^2$ that adjusts the scale of the statistic to cover the full range from 0 to 1. What constitutes a "good" $R^2$ value varies between different areas of application. While these statistics can be suggestive on their own, they are most useful when comparing competing models for the same data. The model with the largest $R^2$ statistic is "best" according to this measure. So if we see Table…., our model improves step by step (if we see third and fourth columns). If we see Table 9, we can see that our model identifies the respondents correctly, as per the categorical variables considered, about seventy nine times out of hundred attempts. If we analyze the "Model If Term Removed" results, given in Table 10, we can easily see that considered variables are potential explanatory variables for LTPA; significance of term removal being very low.   The maximum p-value for term removal is 0.011 which is for association of LTPA with income. So we can conclude that in our sampled data, association of income with LTPA is relatively weaker than pair-wise association of LTPA with, parental education, weight, smoking, gender and age.

## *6. Discussion and Conclusions*

This study has been made to examine the prevalence and potential correlates of LTPA in Islamabad. It is found that about 67% of Islamabad's residents perform LTPA, however only 26% were found optimally active. Lesser LTPA was observed with more age, lesser education, lesser parental education, and lesser income. For the considered categories of LTPA only jogging, ball sports and weight lifting are found to be dependent on gender with mean outscoring women in these categories. Jogging has been found to most practiced LTPA which is then followed by ball sports and walking. Income, parental education, weight, smoking, gender, sector of residence and age are potential correlates of LTPA for the residents of Islamabad.

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**Table 1: Distribution of Sample by Sector**

| Sector | Perceived Class | Respondents Surveyed | Percentage Share |
|---|---|---|---|
| F.10.2 | U.M/U | 63 | 21.1 |
| G.10.1 | M/U.M | 48 | 16.1 |
| G.10.2 | M/U.M | 48 | 16.1 |
| Slums of G.11 | L | 27 | 9.0 |
| Slums of G.8 | L | 54 | 18.1 |
| F.6.2 | U.M/U | 59 | 19.7 |
| Total | | 300 | 100 |

(U=Upper Class, U.M= Upper Middle Class, M= Middle Class, L=Lower Class)

**Table 2: Distribution of Sample by Income**

| Monthly Income/Earnings | Respondents | Percentage share |
|---|---|---|
| 0 to 10,000 | 81 | 27.0 |
| 10,001 to 25,000 | 122 | 40.7 |
| 25,000 or more | 97 | 32.3 |

**Table 3: Perception about neighborhood**

| Question | Statement |
|---|---|
| 1 | Many shops, stores, or other places to buy things are within easy walking distance of my home. |
| 2 | There are sidewalks on most of the streets in my neighborhood |
| 3 | My neighborhood has several free or low cost recreation facilities such as parks, walking trails, bike paths and recreation centers. |
| 4 | The crime rate in my neighborhood makes it unsafe to go for walks at night |
| 5 | There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood |
| 6 | I see many people engaging in physical or playing sports and active games |
| 7 | There are many interesting things to look at while walking in my neighborhood |
| 8 | I have easy access to places where I can get physical activity |

**Table 4: Categories of LTPA**

| LTPA | Percentage Performing |
|---|---|
| Jogging | 73.5 |
| Ball Sports. | 67.2 |
| Walking | 64.0 |
| Yoga/Aerobics | 45.5 |
| Cycling | 38.1 |
| Weight Lifting | 34.4 |
| Dance | 14.3 |
| Stair Climbing | 10.6 |
| Swimming | 10.1 |
| Others | 9.5 |
| Mountain Climbing | 7.4 |
| Rope Skipping | 5.8 |

**Table 5: Association of LTPA and gender**

| Dependence on gender | P-value for Gamma Coefficient of association | Statistical strength Of relationship |
|---|---|---|
| Jogging | 0.000 | Significant |
| Ball Sports | 0.007 | Significant |
| Weight Lifting | 0.000 | Significant |

**Table 6: Omnibus Tests of Model Coefficients**

| | | Chi-square | df | Sig. |
|---|---|---|---|---|
| Step 1 | Step | 76.340 | 2 | .000 |
| | Block | 76.340 | 2 | .000 |
| | Model | 76.340 | 2 | .000 |
| Step 2 | Step | 32.585 | 1 | .000 |
| | Block | 108.924 | 3 | .000 |
| | Model | 108.924 | 3 | .000 |
| Step 3 | Step | 23.171 | 2 | .000 |
| | Block | 132.095 | 5 | .000 |
| | Model | 132.095 | 5 | .000 |
| Step 4 | Step | 14.812 | 2 | .001 |
| | Block | 146.907 | 7 | .000 |
| | Model | 146.907 | 7 | .000 |
| Step 5 | Step | 9.013 | 2 | .011 |
| | Block | 155.921 | 9 | .000 |
| | Model | 155.921 | 9 | .000 |

**Table 7: Hosmer and Lemeshow Test**

| Step | Chi-square | df | Sig. |
|---|---|---|---|
| 1 | .000 | 1 | 1.000 |
| 2 | .000 | 4 | 1.000 |
| 3 | 5.627 | 8 | .689 |
| 4 | 1.531 | 8 | .992 |
| 5 | 8.391 | 8 | .396 |

**Table 8: Model Summary**

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|
| 1 | 319.034[a] | .225 | .307 |
| 2 | 286.449[a] | .304 | .416 |
| 3 | 263.278[a] | .356 | .486 |
| 4 | 248.466[a] | .387 | .529 |
| 5 | 239.453[a] | .405 | .553 |

**Table 9: Classification Table[a]**

| | | | Predicted | | |
|---|---|---|---|---|---|
| | | | PA | | |
| | Observed | | .00 | 1.00 | Percentage Correct |
| Step 1 | PA | .00 | 68 | 43 | 61.3 |
| | | 1.00 | 44 | 145 | 76.7 |
| | Overall Percentage | | | | 71.0 |
| Step 2 | PA | .00 | 57 | 54 | 51.4 |
| | | 1.00 | 22 | 167 | 88.4 |
| | Overall Percentage | | | | 74.7 |
| Step 3 | PA | .00 | 83 | 28 | 74.8 |
| | | 1.00 | 39 | 150 | 79.4 |
| | Overall Percentage | | | | 77.7 |
| Step 4 | PA | .00 | 80 | 31 | 72.1 |
| | | 1.00 | 32 | 157 | 83.1 |
| | Overall Percentage | | | | 79.0 |
| Step 5 | PA | .00 | 76 | 35 | 68.5 |
| | | 1.00 | 27 | 162 | 85.7 |
| | Overall Percentage | | | | 79.3 |

**Table 10: Model if Term Removed**

| Variable | | Model Log Likelihood | Change in -2 Log Likelihood | df | Sig. of the Change |
|---|---|---|---|---|---|
| Step 1 | Smoking | -197.687 | 76.340 | 2 | .000 |
| Step 2 | gender | -159.517 | 32.585 | 1 | .000 |
| | Smoking | -176.193 | 65.937 | 2 | .000 |
| Step 3 | gender | -145.456 | 27.635 | 1 | .000 |
| | Weight | -143.224 | 23.171 | 2 | .000 |
| | Smoking | -164.125 | 64.972 | 2 | .000 |
| Step 4 | gender | -134.634 | 20.801 | 1 | .000 |
| | parental.edu | -131.639 | 14.812 | 2 | .001 |
| | Weight | -135.271 | 22.075 | 2 | .000 |
| | Smoking | -159.130 | 69.793 | 2 | .000 |
| Step 5 | gender | -129.561 | 19.669 | 1 | .000 |
| | parental.edu | -127.783 | 16.112 | 2 | .000 |
| | Weight | -130.338 | 21.224 | 2 | .000 |
| | Smoking | -155.947 | 72.442 | 2 | .000 |
| | Income | -124.233 | 9.013 | 2 | .011 |