Lifestyle behaviours and mental health outcome of elderly: modification of socio-economic and physical health effects

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Abstract

The lifestyle behaviours of the individual and its mediating relationships between socio-economic characteristics and physical health effects have been widely discussed in epidemiological studies. Considering a proper study framework, the relationship between lifestyle and mental health has not been rigorously established. This study is designed in an attempt to understand the direct and moderated effects of lifestyle behaviours on the mental health outcome of elderly in more systematic pathway. Using advanced statistical methods and data from *United Nation Population Fund (UNFPA)* elderly survey namely *Building Knowledge Base on Ageing in India (BKPAI)*, I measure the prevalence of anxiety and depression among the elderly. Besides this, the hypothetical framework of the study has been statistically established using two separate path model. The moderating effect of lifestyle behaviours on mental health outcome suggesting that modification of lifestyle may lead to reducing the psychological stress among elderly further promotes active and healthy ageing.

Introduction

Background

Some of the Asian countries including India experiencing population ageing at a faster rate and the indicated rate is expected to rise seven to eight times higher than any developed aged countries (e.g. Sweden, Norway) between the time-period 1990 to 2025 (Dominguez, Galioto, Ferlisi & Pineo, 2006). Estimation also forecasts that Asian Countries are set to see some of the biggest rises by 2050, one in four Asians will be older than 60 years of age. Hence, a growing concern of 'healthy ageing' has been observed in the developing economy like India. Earlier the concept of healthy ageing was more popular in the industrialized countries, and this phenomenon enlisted in the developing world by the WHO's recent program called 'Healthy Ageing', initiated between the year 2015 and 2030 to retain the welfare of the growing proportion of elderly people worldwide. The key concept of the healthy ageing is the reduction of risk in morbidity and mortality and bringing opportunity towards the wellbeing of elderly by improving a set of physical and psychological aspects such as autonomy in activities of daily living, limited or controlled non-communicable diseases, good mental health and little or no disability (Fuchs et al., 2013; WHO, 2015). This manner, the importance of promoting

healthy ageing in developing countries can be validated from two different standpoints, first, a greater life expectancy increases the burden of morbidity instead of increasing healthy active life in the oldage (Fries, 2002; Manton, Corder & Stallart, 1997; Wu, et al. 2013). Second, millions of elderly from developing countries follow unhealthy lifestyle behaviours (Farhud, 2015) which may increase the risk of future health expenditure burden on the family of the elderly as a whole. Currently, an emerging role is being identified for additional factors that overcome the boundaries of health but nonetheless influence health outcomes, such as lifestyles, built environment, and social inclusion (Steptoe, Shankar, Demakakos & Wardle, 2013; Liotta et. al, 2017). In an influential work, Fuchs (1986) argues that beyond a fairly low level in the provision of food, hygiene and basic health care, it is personal lifestyle that causes the greatest variation in health. Moreover, in order to achieve healthy ageing, the early detection of various disease and disability and modification of a number of unhealthy lifestyle behaviours and life choices have long recognised in geriatric research and public health practice (De Groot, Verheijden, De Henauw, Schroll & Van Staverman, 2004).

Human well-being and health, both are the consequences of the living environment which are continually reshaping by the shifts of lifestyle over the changing time phase. Lifestyle is a diverse phenomenon, defining lifestyle in a brief is a difficult task. It basically considers a way how an individual or a group of people lives. Broadly, lifestyle is a way of living of an individual or a group of people in a society varies with geographical, cultural, and socio-economic context with an advancement of human civilization. World Health Organization (WHO) has merged a number of the phenomenon to explain the lifestyle in a broader and simplistic way in 1986, "… the term 'lifestyle' is taken to mean a general way of living based on the interplay between living conditions in the wide sense and individual pattern of behaviours as determined by socio-cultural factors and personal characteristics". Contoyannis and Jones (2004) in their study defined lifestyle as "a set of behaviours which are considered to involve a considerable amount of free choice". Here in this study, I have adopted a narrower definition of lifestyle what made by Contoyannis and Jones which explicitly focuses on health-related behaviours without implication of individual's social and cultural characteristics.

The wave of changes in recent years of rapid lifestyle by modifying human ecology, economic and cultural practices, happening on a global scale often reproached to the effect of globalization (Chiu, Gries, Torelli & Cheng, 2011; Okumiya, 2013). Today, the diffusion of globalization does not follow a threshold line in terms of development and economy, since revolutionary advantages of globalization transforming the nature of personal destinies which influencing daily lifestyle and life choices of the individual irrespective their age and sex (Bandura, 2001; Lee & Vivarelli, 2006). Research from urban India explores that during their post-retirement days, elderly adopt a highly consumerized standard of living with less focus on age-graded restriction and healthy life development such as physical activities (Adhikari, 2015). The effect of rapid urbanization, digitalized media also restructuring the social and leisure activities of elderly which affecting the outdoor mobility of elderly, resulted into worse mental outcome (Bastos et al., 2015). As the ageing process begins, the time individual goes to the bed for sleep, wake up tend to become earlier compared to non-elderly members but recent changes in urbanized lifestyle hampering the natural hour of sleep (Tanaka & Shirakawa, 2004). Although, this evidence has not been gathered from the developing countries like India. Another study based on nationally representative data yields evidence of unsatisfactory and

unhealthy health behaviour among Indian elderly, accounts significantly higher prevalence of smoking, chewing tobacco and regular alcohol consumption compared to non-elderly members (Mutharayappa & Bhat, 2008). Presence of such unhealthy lifestyle behaviours adversely affecting individual's level of morbidity, the following may make oldage days more stressful and withering. Research in last two decades gathered the growing evidence of poor mental health outcome among the Chinese and Korean elderly living in both the community setting and shelter home (Kang & Yoo, 2012; Wilson, 2005). Due to insufficient study in the context of elderly mental health in India very little is known about the position of elderly and their mental health trends.

Being a prominent public health issue, lifestyle-related study for elderly is not taken very seriously in the developing countries like India due to the highly diversified economic characteristics of elderly. India has the problem of chronic elderly poverty from several decades in the one hand and on the other hand a plenty of Indian oldage belonging to the consumer class. This context the need for the lifestyle study has been suppressed for a long time. With the presence of greater economic variation, it is also difficult to generalize about the lifestyle behaviours of Indian elderly. However, studies available in the field of lifestyle behaviours and health outcome generally included (i) association between lifestyle and several NCDs such diabetes, cardiovascular disorder, osteoporosis etc. (Ingle & Nath, 2008; Mutharayappa & Bhat, 2008; Singh et al., 1997); (ii) association between lifestyle and disability and functionality (Velayutham, Kangusamy, Joshua, & Mehendale, 2016). Unfortunately, the researchers and policy makers from the developing countries still unrecognized the lifestyle behaviours as a contributing factor to mental health of elderly. In Indian context, the available mental health studies of elderly are more focused on the population such as shelter home elderly, homeless population, etc. (Grover & Malhotra, 2015), study based on general or community-based population is lacking in this field. Another serious issue in the mental health study is the methodological diversity while measuring mental health which makes the studies more incomparable. Moreover, study to correlate lifestyle behaviours and mental health is rare in nature, only a few studies are conducted in this issue based on large-scale survey data, mostly from the developed countries. With this background, the concern about the health impact of changing lifestyle behaviours on the mental health of elderly has gained the interest of present study. Using the advanced statistical knowledge, an attempt has been made in this study to correlate lifestyle behaviours and mental health outcomes of elderly from the community based empirical data.

Association of mental health with lifestyle behaviours: theoretical framework

The causes related to ill mental health outcome are diverse, multisectoral, interrelated which encompasses psychological, psychosocial, cultural and economic factors and their influences operate at the different hierarchy of our society such as elderly (i.e. individual), family (i.e. household), community and nation. A wide body of literature illustrates that lifestyle behaviours are unquestionably correlated with an individual's physical health. It is suggested that an increased degree of physical activity among the elderly might reduce the risk of several life taking diseases (Simons, Simons, McCallum & Friedlander, 2006). Overall, adoption of unhealthy lifestyle behaviours may give birth to a poor health condition along with several chronic diseases. For example, cardiovascular diseases can be partly attributed to poor dietary intake and inactivity in physical exercise and all (Campion, 2008), similarly respiratory

disorders and cancer can be linked with the smoking behaviour (Lundbäck et al., 2003; Siegel, Miller & Jemal, 2016). Evidence also suggests that improvements in some healthy lifestyle factors can prevent the functional limitations in the advanced age of the elderly (De Groot et al., 2004).

Healthy choices of lifestyle habits not only benefit physical health but also mental and emotional health for people of all ages (Hua et al., 2015; Walsh, 2011). Several psychological studies are agreed the general evidence that mental health issues are associated with the person's poor physical health status (Gray, Hardy & Anderson, 2009; Peel, McClure & Bartlett, 2005). Recent estimates of WHO depicts that about 40 million people in the globe suffer from psychological disorders due to risky health behaviours including alcohol and drug abuse (WHO, 2011). Likewise, improvement in lifestyle behaviours can reduce the gap in physical health status of elderly, further act as an intervention to the mental wellness (Scott & Happell, 2011). Camacho et al. found physical activity and physical exercise both have a positive association with good mental health (Camacho, Roberts, Lazarus, Kaplan & Cohen, 1991). To improve the physical health, it is necessary to add healthy diet, exercise, optimum sleep in our daily life, but when we move to the betterment of mental health we need one more additional change in healthy habit, that is social connections (Kawachi & Berkman, 2001). In a study based on Japanese elderly Takada et al. reported, adoption of healthy lifestyle behaviours like moderate physical activity and higher frequency of social activities have an improvement over the cognitive function of elderly (Takada, Park, Shigemune & Tsukiura, 2014). It is very common to experience depression or anxiety in day to day life of an individual, one might have the symptoms of both together, but the level of severity and frequency of the event may affect the mindfulness of a person.
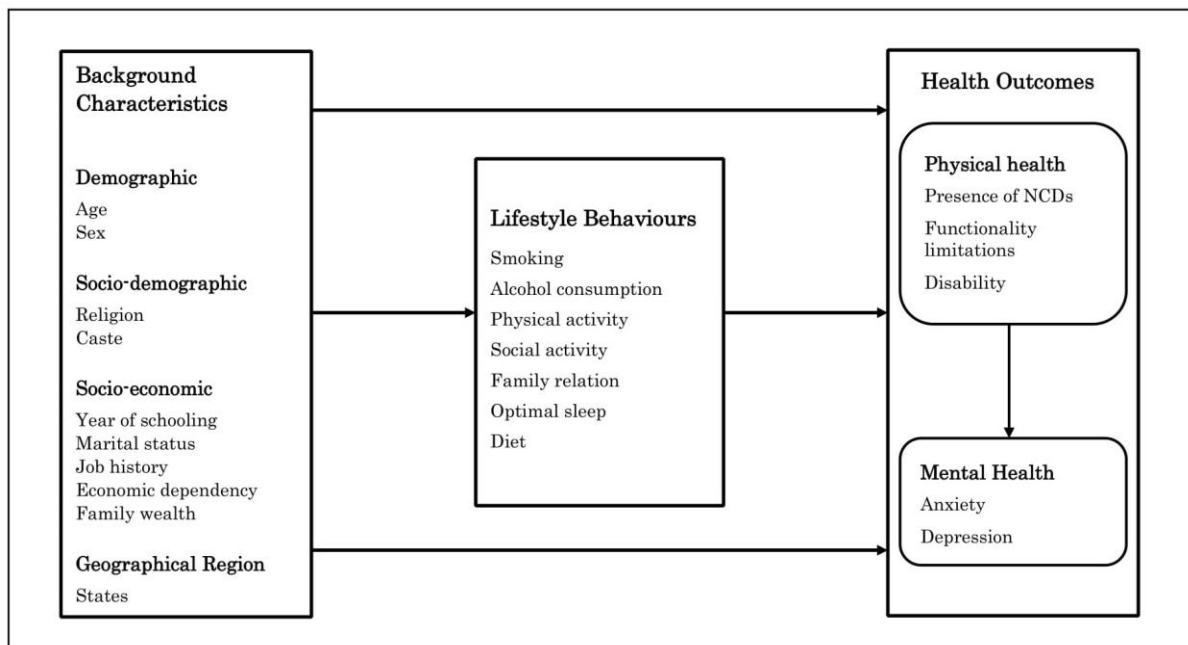
Figure 1: *Hypothetical framework for the study*

ere in this study I attempt to understand the direct and indirect effects of lifestyle behaviours on the mental health outcome of elderly in the more systematic pathway and this feature of the study makes it unique in nature. The basic concept of my study is "physical and mental well-being are intimately correlated" (Hidaka, 2012). In this study, I basically try to find out the potential linkages between lifestyle behaviour and mental well-being of elderly with the

moderating effect of physical health outcomes. So far there is no framework has been established specifically to study the association between lifestyle and mental health. This study proposes a hypothetical framework, operates through more proximate determinants (i.e. lifestyle behaviours) to influence elderly mental health, as depicted in Fig. 1.

Socio-demographic and socio-economic factors. Empirically, socioeconomic statuses of individual, household and community are the fundamental determinants of entire health outcome of a person. The socio-demographic and socio-economic factors that influence both the physical and psychological health outcomes of elderly are age, sex, religion, caste, educational attainment, marital status, occupational history, economic dependence, household wealth. The socio-economic factors of elderly basically control the material resource of elderly, key determinant to control both the lifestyle behaviours and health wellbeing in their advanced age. A number of studies supported the general evidence that material resource is a stronger determinant lifestyle behaviours and health wellbeing in developing countries, estimated to influence to their choices and to increase their skills and health behaviours related to preventive care, personal hygiene, age-related restrictions, unhealthy lifestyles and so on (Math, Chandrashekar & Bhugra, 2007). Practically, elderly with higher education are more aware of age-related restriction of health behaviours, nutrition, detection and prevention of non-communicable diseases, early detection of disability among others which results a healthy and active ageing, while in contrast, uneducated or less educated elderly may face fewer media exposures and public information related lifestyle and health behaviours. Inadequate or improper education often exacerbates elderly's inability to generate sufficient resource savings or financial security for the later part of life which may adversely affect health outcome of the individual in developing countries where public health care is weak and private health care is expensive (Balarajan, Selvaraj & Subramanian, 2011). The household wealth or economic condition secures the household goods and services for the elderly, help in promoting better health, better living environment, and ensure the nutrition demand of elderly. For instance, elderly in poor household resource condition may suffer from the adequate diet, also may produce an unhealthy living environment which triggers into poor health production.

Effect of health outcomes. Poor health outcomes among elderly including a greater degree of disability, uncontrolled non-communicable diseases and loss of functionality is a common epidemiological phenomenon in developing countries like India. It is often reported as a result of unhealthy and uncontrolled lifestyle behaviours, poor public healthcare systems and lack of health awareness of developing countries (Balarajan, Selvaraj & Subramanian, 2011; Dominguez, Galioto, Ferlisi & Pineo, 2006; Shahar, 2014). As presented in the hypothetical framework depicted in the Fig. 1, physical health of the elderly is influencing directly by the background characteristics of the elderly, or indirectly by the shaping of lifestyle behaviours of the elderly, which in turn accounts the comprehensive impact on health wellbeing. In general, lifestyle behaviours of an individual often shaped by the socio-economic condition such as level of education, occupational status, household wealth etc.

Effects modification: interaction of lifestyle behaviours. This study especially searches for potential interactive influences, where the socioeconomic situation of elderly interact to produce substantively different lifestyle behaviours further influencing the mental health outcome, or more precisely, the extent to which lifestyle behaviours may moderate, exacerbate or mediate the effects of physical health outcome on the psychological health of elderly. The lifestyle behaviours of the individual and its mediating relationships between

socio-economic characteristics and physical health effects have been widely discussed in bio-social, epidemiological and economic studies. In the field of psychological study lifestyle did not get proper attention in the earlier studies, more specifically this type of study in the context of developing countries is rare in nature. Earlier studies from the developed countries find the linkages between the psychological health and lifestyle behaviours for the elderly and the general population (Cassidy et al., 2004; Hua et al., 2015). However, the lifestyle of an individual may affect through different way, called direct and indirect effect. Here, the indirect effect of lifestyle variables may act as '*moderator variable*' to the mental health outcome as referred by Jaccard (2001). Promotion of healthy lifestyle behaviour such as physical activity, better nutrition improves the depression and stress among the elderly (Hua et al., 2015). On the other hand, unhealthy behaviours such as excessive alcohol consumption, inadequate or less hour of sleeping may increase the level of anxiety and depression (Tanaka & Shirakawa, 2004; Walsh, 2011).

Research objectives

This study makes an attempt to examine the association between lifestyle behaviours and the psychological health of the elderly. The specific objectives of this study are, first, to scientifically measure the extends of the symptom of psychological stress (i.e. anxiety and depression) among the elderly. Second, to find out the association between lifestyle behaviours and mental health outcome. Third, to investigate the moderating effects between lifestyle behaviours and mental health outcome using statistical interaction. Thus, the following research hypotheses have been made in this study: (H_1) the prevalence of anxiety and depression varies among the different sub-group of elderly, more precisely among various socio-economic and lifestyle groups; (H_2) the lifestyle behaviours of elderly may be correlated with the psychological health of elderly; (H_3) lifestyle behaviours can moderate the effects of socio-economic and physical health outcome on the psychological health of elderly.

1. Data and methods

Data source

Datasets used in the present study has been sourced from the UNFPA elderly survey namely, 'Building Knowledge Base on Ageing in India' (BKPAI), was conducted in the year of 2011 by Institute for Social and Economic Change (ISEC), Bangalore, Tata Institute of Social Sciences (TISS), Mumbai and Institute of Economic Growth (IEG), New Delhi, India. For data collection purpose a primary survey was carried out in seven states of India namely, Punjab, Himachal Pradesh, West Bengal, Orissa, Maharashtra, Kerala, and Tamil Nadu. The survey covered all four major geographical regions as a representative of one or two states from each region - Northern (Punjab and Himachal Pradesh); Southern (Kerala and Tamil Nadu); Eastern (West Bengal and Orissa) and Western (Maharashtra) and this way data are available for seven states of India (UNFPA, 2012).

The reason behind choosing particularly seven states is that all these states have a higher proportion of elderly than the national average. Based on feasibility in the level of precision and cost of the survey the sample household size was imposed equally for all the selected states

at 1280 elderly household (having at least one elderly person) for each. In order to do that eighty (80) Primary Sampling Units (for rural area PSUs were villages and for urban area PSUs were urban wards) – 40 urban and an equal number of rural had been drawn separately – with 16 households per Primary Sampling Unit (PSU) were covered in the survey (UNFPA, 2012). Both for rural and urban PSUs selection, probability proportional to size (PPS) sampling method had been adopted. Systematic sampling technique had been chosen for the selection of each household in the rural and urban area. The fieldwork for BKPAI was carried out in the seven states simultaneously during the period May to September of 2011. A total of 8,792 households were selected while the number of 8,329 household interviews were completed. Of a total of 10,604 elderly (aged 60 and above) identified from 8,329 household interviews, 9,852 elderly interviews were completed. Out of total sample size i.e. 9852, a number of 4 samples were excluded as a reason for missing values on the psychological questionnaire. Finally, the analysis has been made based on 9848 samples. However, two separate datasets i.e. individual and household have been used for this study. BKPAI data set has been identified as latest available state-level data, enriched with detailed information on individual-level data accompanied by various demographic and socio-economic aspects of elderly. As mentioned earlier, BKPAI provides data for seven states, so this study includes all the states for the fulfillment of study objectives.

Defining lifestyle, health outcome and control variables

Selection of lifestyle variables. The lifestyle variables are employed in this study, cover all four lifestyle elements mentioned by World Health Organization (WHO, 1999). These four lifestyle variables are diet intake, physical activity, tobacco use, and alcohol consumption. Another important group of lifestyle elements is often used in this field known as 'Alameda Seven'. The seven categories of lifestyle had been identified from an epidemiological study conducted in Alameda County, California in 1965 (Schoenborn, 1986). Those seven variables recognized by the Alameda study are diet, smoking, exercise, alcohol, sleep, weight and stress. The present study has chosen the lifestyle variables such a way, covers as many as possible of the 'Alameda Seven' groups. However, recent studies suggest that a physical and mental health situation of a person depend upon the family relation. Likewise, I have included family relation as a lifestyle indicator in this study. To find out the association between social relationship and psychological health of elderly social activity has been accounted as a lifestyle indicator. Sleep is also recognized as a behavioural variable and included in this study, also identified as a health factor by Alameda study. Along with these all four WHO-recommended indicators also combined. All together study considers seven lifestyle indicators, these are family relation, social activity, diet, smoking, exercise, alcohol, and sleep. Description of each variable is given below:

SMOKING. The smoking behaviour of the elderly has been measured by a categorical variable, where zero denotes to those individuals never smoked, one if the individual was a past smoker and two for the current smoker. More than one cigarette or bidi or equivalent item smoking is considered as the current user, whereas past user is those who do not smoke since last year of the study conducted.

ALCOHOL. Consumption of alcohol is measured also by a categorical variable, where zero denotes never used category, one denotes occasional user and two for the regular user.

DIET. BKPAI study was not explicitly designed as a lifestyle study of the elderly. Hence, the information on diet was limited. That way, as a measure of diet, eating breakfast has been considered. The Alameda study recognized that eating breakfast as one of the good health habits (Schoenborn, 1986). I used this indicator as a categorical variable, which equals zero if an individual does not eat breakfast, one if eats breakfast.

PHYSICAL ACTIVITY. The physical activity variable is also a categorical type. This variable has been created by summing the elderly active in household activities, outdoor activities and physical exercise. The category no physical activity can be identified by the zero value, those elderly engaged in household and outdoor activities categorised by labelling value one, two for those who engaged in physical exercise and three for those who are doing both household and outdoor activities and physical exercise.

SLEEP. A number of studies accepted seven to nine hours sleep as optimum sleep (Belloc & Breslow, 1972; Cappuccio et al., 2008). More or fewer hours of sleep is considered as an unhealthy practice. Sleep was measured as a binary variable, which equals one if an individual sleeps optimum hours of sleep and zero otherwise.

FAMILY RELATION. Family relation variable computed based on individuals living arrangement, role in family decision making and contribution to family expenditure. The family relation has three categories: low relation, moderate relation and strong relation.

SOCIAL ACTIVITY. Social activity variable employed based on an individual's participation in the various social activity. This variable categorised as no activity, occasional activity and frequent activity.

Physical health outcome variables. A three dimension of individual's health approach has been employed in this study to get a reliable physical health outcome of an elderly. These three dimensions are functionality in activities of daily living (ADL), disability and presence of chronic diseases (non-communicable diseases). These indicators of health have been identified based on self-reported approach. The description of these variables given below:

Functionality in ADL. Person's functional status often investigated as an objective indicator of physical health (Osler & Enzi, 1991). Basically, the functionality measurement widely used in various health sectors such as long-term care insurance, home, and community-based services etc. as an indirect method to understand person's level of disability (Tonner, LeBlanc, & Harrington, 2001). However, measurement of functionality specifies the level of independence, accounting for the number of assistance needs in performing activities of daily living (ADL) (LaPlante, 2010). Six types of ADL comprising bathing, dressing, toileting, mobility, continence, and feeding enlisted to represent the level of independence among elderly in the BKPAI survey data. Every single ADL reported by elderly has three response categories: 'do not require assistance', 'require partial assistance' and 'require full assistance'. The study has given a score of 0, 1 and 2 respectively for this three category and summed up all the responses according to newly given score lies between 0-12. Thus the functionality has been calculated into three ordered categories: no assistance (if score = 0), partial assistance (if score = 1 to 6) and full assistance (if score = 7+).

Disability. Disability is measured on the basis of respondents' level reporting ability to see, hear, walk, chew, speak and remember. Each question has three response categories: 'yes

fully', 'yes partially' and 'no'. These are scored as 0, 1 and 2, respectively and summed up all the responses. The generated score lies between 0-12. Finally, the disability has been categorised as an ordered variable: no disability (if score = 0), light disability (if score = 1 to 2), medium disability (if score = 3 to 6) and heavy disability (if score = 7 and above).

Presence of Disease. There exists considerable variation in defining the chronic diseases as well as non-communicable diseases. The variation also presents in the field of disease selection to describe NCDs. Here, this study limits the definition of non-communicable chronic diseases with the selection of some common NCDs (angina, Alzheimer's disease, arthritis, COPD, dementia, diabetes, hypertension, stroke, liver and gallbladder related) correlated with the lifestyle behaviour, sometimes called 'Lifestyle NCDs'. Hence, the presence of non-communicable diseases categorized into four groups as the elderly suffering from a number of NCDs. These categories are: No Disease (those who were not suffering from any chronic diseases), One Disease (those who reported to have any one of the NCDs), Two Diseases (those who reported to living with any two NCDs), Three and above (those elderly had three and more than three NCDs).

Socio-demographic and socio-economic variables. Exogenous variables used in this study are ranges from various demographic, socio-demographic and socio-economic characteristics of elderly are associated with the study objectives, such as age group, sex, marital status, educational attainment, religion, caste, residence type, occupation history, economic dependency, current working status and household wealth.

Measuring mental health

To measure the psychological health of elderly this study investigated the information of the 12-item General Health Questionnaire (GHQ), canvassed by the interview team during the survey (BKPAI, 2011). The GHQ-12 is an influential and reliable self-reported screening tool commonly used for identifying non-specific and minor psychiatric disorder in general population (Gureje & Obikoya, 1990; Goldberg et al., 1997; Hankins, 2008). Since the GHQ-12 is designed for the universal population, several researchers validated its reliability on the oldage population from the different part of the world (Kataoka & Nakamura, 2005). The validations are available from the earlier studies conducted in Indian context using translated Bengali, Hindi version of GHQ (Bandyopadhyay, Sen, Sinha & Sen, 1988; Sriram, Chandrashekar, Isaac & Shanmugham, 1989). To measure the mental health outcome of elderly I applied latent factor exploration approach to the general health questionnaire (GHQ-12), further a scale approach has been adopted to quantify the anxiety and depression prevalence. It is worth mentioning that the scale of GHQ scoring varies depending upon region and age group of study population (Van Hemert, Den Heijer, Vorstenbosch & Bolk, 1995; Goldberg et al., 1997).

Reliability measurement of the psychological questionnaire. Cronbach's alpha is a reliability test statistic generally used to examine the internal consistency of a survey instrument, describes the inter-relatedness of the items generated in the survey construct (Santos, 1999). This method was developed by Lee Cronbach in 1951. The value of Cronbach alpha (reliability coefficient) varies from 0 to 1, may differ due to the degree of interrelatedness

or dimensionality (Cronbach, 1951). Although controversies are present about the acceptable range of alpha value (Tavakol & Dennick, 2011). A group of researchers suggest higher alpha values for desired consistency in the construct (Green, Lissitz & Mulaik, 1977; Bland & Altman, 1997; Streiner, 2003). Although, Nunnally and Bernstein (1994) recommended 0.70 to 0.95 as a limit of alpha value for the psychometric constructs.

Measuring the Sampling Adequacy (MSA). Henry Kaiser in 1970 developed the Measure of Sampling Adequacy (MSA) for factor analytic data matrices, provides a statistic that indicates the proportion of variance in the variables that might be caused by underlying factors. Further, it was modified and renamed as the Kaiser-Meyer-Olkin (KMO) index. In present days a wide body of researches depends upon the KMO and Bartlett's test to check the sample adequacy for reliable factor extracting. However, the KMO index ranges from 0 to 1 and a higher value (close to 1) indicates that factor analysis would be useful with the data while the value is less than 0.5, the dataset is not permissible for the factor analysis. Kaiser (1974) suggested that KMO > .9 were *marvelous*, in the .80s, *mertitourious*, in the .70s, *middling*, in the .60s, *medicore*, in the .50s, *miserable*, and less than .5, *unacceptable*. The Bartlett's test of sphericity is meaningful to check the appropriateness before proceeding with factor analysis. This test statistic helps to assess the null hypothesis that the correlation matrix is an identity matrix. Generally, a small value (less than 0.05) of the significance level permits the dataset for an exploratory factor analysis (Fabrigar, Wegener, MacCallum & Strahan, 1999).

Statistical analysis. A number of statistical methods have been adopted to reach the quest of the study. A brief description of all the analysis has been given below:

Exploratory factor analysis. Exploratory factor analysis (EFA) is a multivariate statistical method commonly implied in factor-analytic research to extract factors (latent factors) underlying a set of measured variables. Psychological research advocates that EFA provides more accurate results when at least three or five measured variables denote each common factor included in the study (Brown, 2015; Fabrigar et al., 1999). There are numerous techniques to extract factors, although principal component analysis (PCA) and principal axis factoring (PAF) are listed as most common types. In this study, I used PAF method to extract the latent factors. However, there is no definitive, simple way to determine the number of factors. Often the number of factors to be included in a study decided by the researcher. Nevertheless, the theoretical sense of extracted factors is compulsory. The study follows the thumb rule of determining factors considering the Eigenvalues i.e. the number of factors would be equal to number of component having more than 1 Eigenvalue.

Confirmatory factor analysis. Confirmatory factor analysis (CFA) is an analytic tool generally used to test the theory when the researcher has sufficiently strong rationale regarding what factors should be in the data and what variables should define each factor (Henson & Roberts, 2006). The main purpose to imply a CFA in this study is to account the relationship between measured variables (i.e. GHQ-12) and latent factors. Based on the result of EFA this study specified a two-factorial model structure to measure the correlations among the observed variables and latent construct.

Path Analysis. The hypothetical correlation between psychological variables (i.e. anxiety and depression) and selected lifestyle and socio-demographic variables were established by the path models. Path models are recognised as a powerful statistical tool over the multiple regression to define the consistency and best fitting of a dataset while examining

a complex model (Streiner, 2005). However, path models generally carry out the properties of multiple linear regression model and estimate the magnitude and significance of correlation among a group of dependent and independent variables. The unstandardized path coefficients (β-coefficient) of the model have described the direct and indirect path of the relationship between input and output variables.

Binary logistic regression. The association of lifestyle behaviours and sociodemographic aspects of elderly with psychological health indicators has been established with the help of binary logistic regression model. Here, I used binary logistic regression model where dependent variables were categorised as binary type. The logistic regression model has the following form:

$$\text{logit(p)} = log\frac{p}{1-p} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n$$

where, $x_i\,'s$ are covariates, $\beta_i\,'s$ are coefficients and p is the probability of anxiety and depression.

Moderation analysis. The beta (β) coefficients in the path models simply show the one direction relationship between exogenous and endogenous variables. To understand the direct and indirect influences of lifestyle behaviours on the psychological health of elderly the moderation effects have been calculated. The unstandardized β-coefficients were exhibited the direct and indirect relationships between the study variables.

2. Results

**Results from reliability measurement**

It is aforementioned that psychological well-being of elderly has been measured from the 12-item General Health Questionnaire (GHQ-12). BKPAI survey covered major seven states where the proportion of elderly was more. As per information available, the team made the questionnaire first in English language and further translated into regional (state) language. While these seven states were completely different in terms of the language spoken, hence, it is significant to examine the internal consistency of the questionnaire (GHQ-12) for all the seven states separately. The value of Cronbach's alpha for overall India was 0.924, indicates a high level of internal consistency of the questionnaire. The Cronbach's alpha values for individual states range from 0.696 (for West Bengal) to 0.976 (for Tamil Nadu), suggested that although the questionnaire translated into multiple languages it is valid across all seven states. Moreover, the study includes the respondents (N=9848) from all the seven states to represent the psychological outcome of Indian elderly. The Cronbach's alpha values for all the states given in table 1.

Results from Measuring the Sampling Adequacy (MSA)

The outputs from KMO and Bartlett's test of sampling adequacy was described in table 2. The value of KMO for overall India (0.930) suggested that the study have an adequate sample to perform a factor analysis. The KMO value for all seven states range from 0.858 (West Bengal) to 0.951 (Tamil Nadu) and Bartlett's test statistic was found to be highly statistically significant (p<0.001) for all the states indicating a very good number of sample in the state level.

Results from factor analysis

The twelve items of GHQ were employed together to perform the exploratory factor analysis. Therefore, table 3 shows the eigenvalues obtained from the explanatory factor analysis (EFA). As per result, there are two components where the variance was maximum. The first component shows about 48 per cent of variance whereas the second component shows 11 per cent of variance. I have considered these two greater variances as the latent factors, based on these two latent factors the study is expected to proceed for the CFA. Depending upon these eigenvalues a scree plot has been made present in figure 3. Table 4 presents a correlation matrix of inter-item factorability to examine the relationship between the individual batteries of GHQ-12. The standardized regression weights (coefficients) for the confirmatory factor analysis model was described in table 5. The standardised coefficients of the model show the correlation between individual variables and the latent constructs. Figure 3 shows the structural model for the confirmatory factor analysis of GHQ-12. The covariance for the CFA tabulated in table 6.
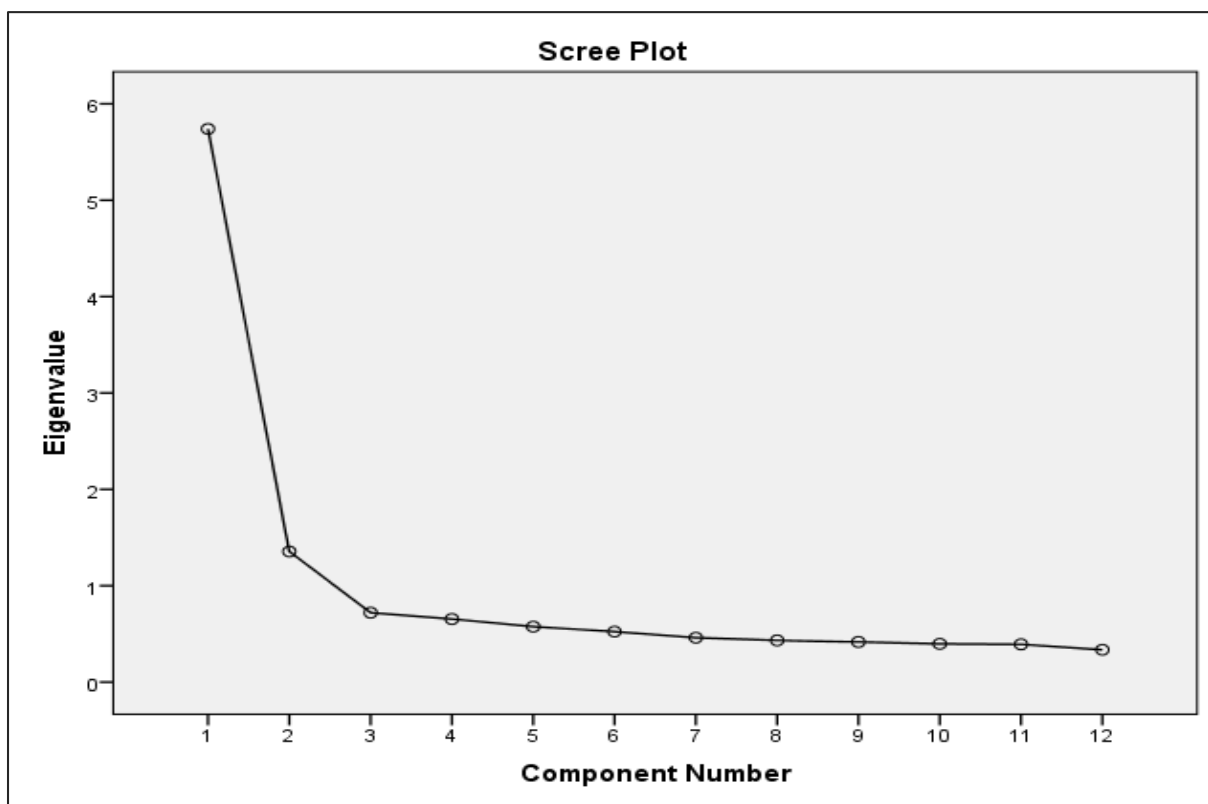
Figure 2: Scree Plot showing the Eigenvalues

The goodness of fit statistics for the confirmatory factor analysis was given in table 7. Goodness of fit statistics (GFI) value for the model was 0.972. The adjusted goodness of fit index (AGFI) is a corrected measure of GFI, value for AGFI was 0.956. Both the indices range between 0 and 1 while a cut-off of 0.90 indicates the satisfactory model fit (Brown, 2015). The normed fit index (NFI) is another index used as an indicator of model fit. In this case, the value of NFI was 0.976. Tucker and Lewis in 1973 developed another fit index known as Tucker-Lewis index (TLI), this index also known as non-normed fit index (NNFI). The value of NFI and TLI (NNFI) range from 0 and 1, with a cut-off of 0.95 indicates a good model fit. In this case, NFI and TLI were 0.976 and 0.968 respectively. Comparative fit index (CFI) examines

the inconsistency between the data and the hypothetical model. However, CFI values lie between 0 and 1, while greater values suggest a better fit. Earlier, a cut-off of 0.90 was considered to acceptable fitting value, but recent studies suggest a CFI value of 0.95 or above as an indicator of good fit. This study found a CFI value of 0.976, indicating a good model fit. The root means square error of approximation (RMESA) is an absolute test statistic, popularized by Browne and Cudeck (1993) which is commonly used as a measure of goodness of fit in CFA. The RMSEA ranges from 0 to 1, a smaller value indicates a better model fit. MacCallum et al. (1996) used 0.01, 0.05, and 0.08 to indicate excellent, good, and mediocre fit respectively. Hu and Bentler (1999) provided the value of RMESA less than 0.05 (or 0.06) as *"golden thumb rules."* The value of RMESA estimate for CFA was 0.059, accepted as a decent model fit.
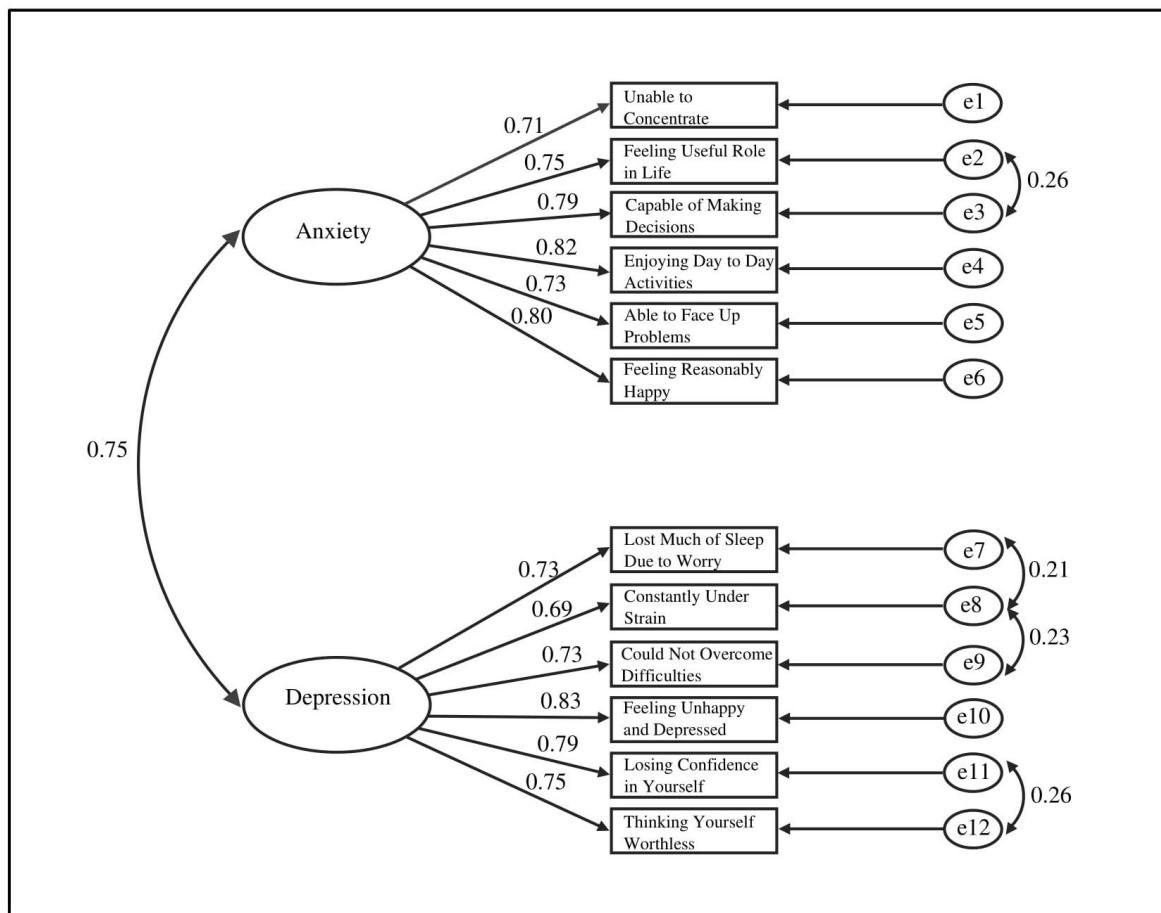
Figure 3: *Confirmatory factor analysis (CFA) for two latent constructs*

Results from path analysis

Table 8 illustrates the regression weights (correlation coefficients) of the Path Model-I, shows the relationship between anxiety and selected lifestyle and socio-demographic variables. Figure 4 shows the degree and direction of correlation (direct and indirect) of path model. The result of path analysis shows that social activity has a negative effect on anxiety (β=-0.143, p<0.001). Economic dependency shows a positive association (β=0.145, p<0.001) with the anxiety of the elderly. Moreover, advancement of the age of the elderly also positively associated with the anxiety. Physical activity has a direct as well as the indirect effect on anxiety. The direct effect shows that anxiety is negatively affected by physical activity (β=-0.318, p<0.001). Physical

activity has an indirect effect on anxiety, for example, physical activity shows a negative association with NCDs while NCDs were positively associated with the anxiety of elderly. Once the disability and functionality in ADLs increases among the elderly the probability of reporting anxiety also increase.
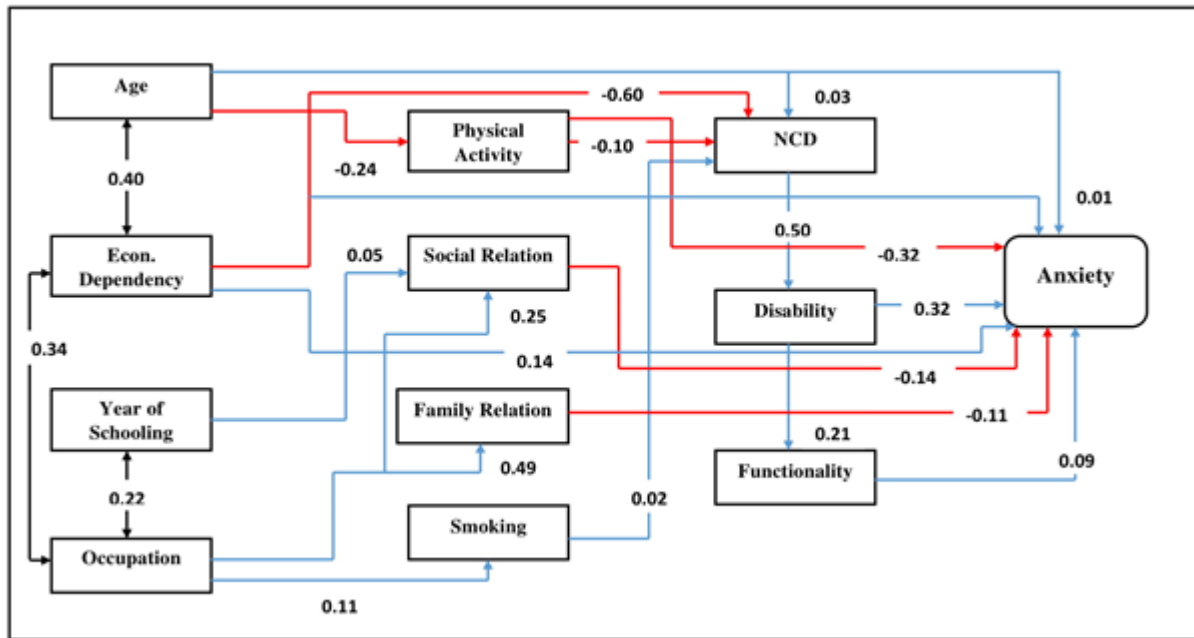
Figure 4: *Path Model-I showing the relationship between anxiety and other covariates*

The regression weights (correlation coefficients) of the Path Model-II presented in table 9. The path coefficients describe the magnitude of the relationship between anxiety and selected lifestyle and socio-demographic variables (figure 5). The result of this path model suggests that functionality (β=0.097, p<0.001) and disability (β=0.194, p<0.001) were positively correlated with the depression of the elderly. Family relation (β=-0.141, p<0.001) and social activity (β=-0.080, p<0.001) were associated negatively with the depression. Economic dependency of elderly shows a positive association with the depression but this result is not statistically significant. Occupation plays a significant role in increasing social activity and the family relation which has a further association with the depression. The association between the presence of non-communicable diseases and depression found insignificant.

Results from descriptive analysis

Table 10 shows the results of descriptive analysis indicating the prevalence of anxiety and depression among the elderly by different background characteristics. Result indicates that overall prevalence of anxiety and depression among the elderly from seven different states were 34.8 percentage and 27.4 percentage respectively. The prevalence of both the psychological indicator anxiety and depression increased with the age of elderly. Elderly aged 80 and above reported maximum anxiety (52.1%) and depression (34.5%) compared to other age groups. Females compared to their male counterpart reporting more prevalence of anxiety and depression.

Figure 5: *Path Model-II showing relationship between depression and other covariates*

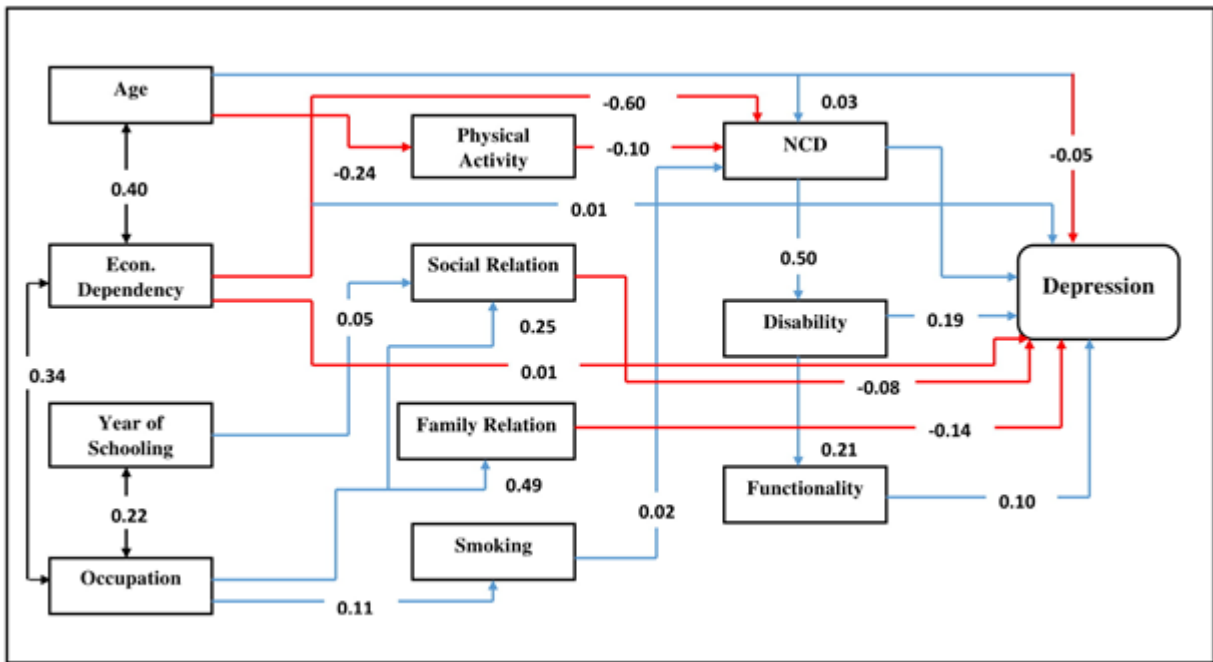Based on the result of descriptive analysis we would expect that year of schooling may negatively associate with anxiety and depression in the later life of elderly. Once the year of schooling increases among the elderly the prevalence of anxiety and depression declines sharply. Maximum reporting of anxiety (45.7%) and depression (35.8%) found among those elderly had no schooling. In terms of religious groups, the elderly from Christian and Sikh community were reporting less anxiety (17.2%, 20.8% respectively) and depression (18.2%, 11.3% respectively) whereas Muslim elderly reporting maximum anxiety (40.9%) and depression (30.6%) among the group. Rural elderly compared to urban were reporting more anxiety and depression. Occupation history of an individual tends to have a negative correlation with the mental health.

Result indicates that elderly in higher job level were reporting less depression and anxiety compared to those elderly had type I or type II job. Again, the economic dependency shows a contrasting relationship with the anxiety and depression score of elderly, economically independent elderly was suffering less from the mental stress compared to fully dependent elderly (anxiety 20.4% vs. 42.0%; depression 17.9% vs. 32.9%). Elderly with strong family and social bonding were reporting less anxiety and depression compared to lower relation group. Result also suggest that physical activity was also negatively associated with the prevalence of anxiety and depression among the elderly. Subjective health is expected to be associated with mental health of elderly. Those elderly reported their health as a poor category, had relatively more anxiety and depression than those elderly reported their health as good or very good category. Assistance need in the activities in daily life (ADLs) appear to have a positive association with the prevalence of anxiety and depression. Those elderly reported more functional limitations to perform ADLs, reporting more psychological stress than those elderly need light or no assistance. Household wealth of elderly was also associated negatively with the psychological health of elderly. Having the highest wealth quintile elderly found better healthy psychological health compared to a lowest household quintile.

Results from multivariate analysis

The odds ratios (ORs) from the logistic regression models have been illustrated in table 11, indicate the association between mental health indicators and several socio-demographic and lifestyle behaviours of elderly. Result shows that social activity has a negative effect on anxiety. Elderly had a strong social activity were 0.62 times (OR=0.618, p<0.001) less likely to report anxiety compared to those elderly had a low social activity. Although, no statistically significant association found between social activity and depression. On the other hand, family relation was also negatively associated with anxiety and depression of elderly. For instance, elderly had a medium family relation was 0.70 times (OR=0.681, p<0.01) and 0.51 times (OR=0.509, p>0.001) less likely to report anxiety and depression respectively than those elderly had a low family relation. Physical activity was associated with the psychological health of elderly in a negative way. For example, those elderly engaged in household work were 0.65 times and 0.82 times less to report anxiety and depression respectively. Once the level of functional limitations in ADLs increase the likelihood of reporting anxiety and depression increase among the elderly. Elderly need heavy assistance to perform ADLs reported 2.6 (OR=2.634, p<0.001) times higher anxiety and 1.9 times (OR=1.926, p<0.001) higher depression compared to those elderly do not need any assistance in ADLs.

Similarly, disability also has a direct positive role in well-being of psychological health of elderly. Elderly with medium and heavy disability reporting 3.84 times and 4.2 times respectively more anxiety compared to those elderly had no disability. Moreover, the presence of non-communicable diseases among elderly uprising the level of anxiety and depression. Elderly suffering from three and more non-communicable diseases (NCDs) reported 1.6 times (OR=1.598, p<0.001) more depressed than those elderly had no NCD. Result also shows that anxiety increases when becomes aged whereas the association between age and depression found statistically insignificant. The level of education inversely correlated with the psychological health of elderly. The elderly having more than 8 years of schooling were less likely to report anxiety (OR=0.490, p<0.001) and depression (OR=0.562, p<0.001) in their oldage. Result also indicates that economic dependency affects individual's psychological health in their oldage. The economically independent older persons reporting less anxiety and depression compared to economically dependent one. The outcomes of logistic regression also support the result of descriptive analysis in terms of association between house hold wealth and psychological health of elderly. Greater wealth group reporting a lower level of anxiety and depression.

Moderating relationships

The result of moderation analysis has been presented in table 12. In the moderation analysis, a number of interaction terms have been added into a logistic regression analysis model. Physical activity moderated the influence of presence of NCDs on anxiety (Presence of NCDs × Physical Activity, β= -0.147, p<0.05) and depression (Presence of NCDs × Physical Activity, β= -0.107, p<0.05). Economic dependency among elderly positively associated with the anxiety and depression. Social activity appeared to buffer the effect of economic dependency on anxiety (Economic dependency × Social activity, β= -0.041, p<0.01) and depression (Economic dependency × Social activity, β= -0.057, p<0.01) negatively. Social activity also influenced the effect of NCDs on anxiety (Presence of NCDs × Social Activity, β= -0.021, p<0.01) and

depression (Presence of NCDs × Social Activity, β= 0.041, p<0.01) in a negative and positive direction respectively.

Robustness check

The association between lifestyle behaviour (variables used in this study) and the physical health status of elderly such as self-reported health, functionality in activity in daily livings and presence of non-communicable disease has been examined using ordered and multinomial logistic regression model. The results are similar as shown in the path model in this study. For example, physical activity is negatively associated with the presence of non-communicable diseases among elderly.

3. Discussion

This paper has measured the extend of negative mental health outcome of elderly using two common symptoms namely anxiety and depression from BKPAI data on GHQ-12 questionnaire. This two common symptom of general psychological stress have been identified from GHQ-12 by examining the factor structure of the Indian elderly by employing the exploratory and confirmatory factor analysis model. Its novelty is to define and use more standardized measures of psychological stress among the elderly. Earlier studies used GHQ-12 to examine the psychological stress by a general scoring method which accounts the overall stress of an individual not a clear picture of mental health condition (Hamer, Molloy, Stamatakis, 2008; Reuter & Härter, 2001). Besides this, the study examined the association of lifestyle with anxiety and depression by drawing statistical path. The direct effect of lifestyle and health outcome on mental health have been investigated using binary logistic model whereas, the moderating effects of lifestyle have been explored by moderation analysis. A number of key findings emerged from the study:

First, variation in negative mental health outcome (i.e. anxiety and depression) among the elderly are clearly accounted for by unhealthy lifestyle behaviours such as no physical activity, absence of social activity, poor family relation. On the other hand, presence of heavy disability, more NCDs and loss of functionality in ADLs among elderly made them mentally distressed. Such findings which are in line with the previous studies that have attempted to reveal the psychological health of condition of person with poor physical health or with a presence of life-threatening disease such as cancer, cardiovascular disorder etc. (Hamer, Molloy & Stamatakis, 2008; Reuter & Härter, 2001). Socio-economic risk factors such as educational attainment, economic dependence and household wealth condition also play a significant role to control the anxiety and depression in advanced age of elderly. One general explanation would be, the scanty health care services including proper diet, medicine, elderly daily needs often triggered by the poor household wealth as well as the economic dependence of elderly hence, elderly from lower economic strata come to be more psychologically distressed group with the absence of adequate social security in developing countries (Bloom, Mahal, Rosenberg & Sevilla, 2010; Rajan, 2014). Both qualitative and quantitative studies have found that individuals who have financial or physical assets may feel more control on their lives, leading to less vulnerability to anxiety and depression or less severe psychological symptoms (Carter, Blakely, Collings, Gunasekara & Richardson, 2009; Groh, 2007).

Second, the lifestyle behaviours are estimated to significantly modify the relationship between negative mental health outcome of elderly, as per the moderation analysis. Both the psychological symptom of distress, anxiety and depression are moderated by the interaction of physical activity of elderly. Elderly with of NCDs but active in moderate physical activities reported less anxiety and depression. Earlier one study in Chicago by Fan and colleague (2011) found that physical activity has the mitigating effects on stress directly and indirectly through the encouraging the socialization opportunities. Result of this study also confirms the moderation effect of social activity on mental health outcome of elderly. It is well known that uncontrolled non-communicable disease has a negative impact on a person's mental health. Such effect expected to be reduced while individual is engaged in various social activities. This relationship well explained in sociological theory, the social isolation limits the social networking participation which in turn lowering the social support, social integration and social capital of an individual may reduce psychological well-being (Fiori, Antonucci, & Cortina, 2006). On the other hand, an increased degree of social activity positively influences the on the social networking tie, directly produce positive psychological states such as sense of purpose, belonging, and security, as well as recognition of self-worth (Kawachi & Berkman, 2001).

4. Conclusion

Earlier this has been estimated that a large number of premature deaths can be prevented by healthy diet, sufficient physical activity and low alcohol consumption. Results of this study provide further support that unhealthy lifestyle factors such as regular smoking, low level of physical activity are independently associated with an increased rate of morbidity and bad mental health - or unhealthy ageing. Therefore, the modification of lifestyle behaviours may lead to reducing the health care costs and a higher quality of life among the steadily growing group of the older population. At present, mental health and how it is associated with lifestyle behaviours of elderly in later life is not a priority area of health policy and research in many low-income countries. But, elderly mental health needs to be recognised as a key public health issue and appropriate strategies, policies and practices put in place, otherwise, this group of population will suffer in silence. The findings of present studies strongly suggest that re-examining lifestyle behaviours and ensuring a good physical health outcome will be effective in greatly reducing the number of elderly with poor mental health symptoms like depression and anxiety. Thus far, a comfortable healthy ageing will not only result in a clear increase in the quality of life among themselves, but will also be important in leading to increased well-being in the family and caregivers of the elderly, and society as a whole. The result from this study also suggests that there is an urgent need for preventing life-threatening non-communicable diseases and disability that significantly associated with the poor mental health outcome. An increased health care services combined with healthy lifestyle factors may improve the overall health of elderly that promotes healthy ageing. One possible way-out to reduce the burden of unhealthy lifestyle behaviours and at the same time adaptation of healthy behaviours is the strategical improvement in the sector of elderly health promotion programme and health guidance from both the government and non-government side.

5. Limitation of the study

Even though the findings of this study are relevant as well as consistent with the findings of previous studies but we have to take into consideration some limitations of the study. From the analyses, we cannot predict the uncertainty about the temporal direction of the association between mental health and lifestyle behaviours, which cannot be established due to the cross-sectional survey design of the present study. All the information was collected about lifestyle behaviours and health condition of elderly based on the limited interview, elderly could have better informed if the repeated interviews were scheduled. Another vital limitation of the present study is the self-reported nature of data. There was no further scope for diagnosing and validating the reported health responses such as non-communicable diseases, functional limitations by the respondent.

However, the initiatives and experiences have opened up vast possibilities in this field for the near future. In this context, further research is required with appropriate measures to understand the lifestyle behaviours and wellbeing of elderly. Of course, there is a good opportunity to conduct a national level study including all states of India to widen up the level of understanding of lifestyle variations and its effect on psychological health outcomes among the elderly in India, which might be subject to availability of data.

6. Acknowledgement

7. References

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Appendix

Table 1: The Croncabh's alpha values for GHQ-12 by States of India, 2011

State Name	Cronbach's Alpha
Himachal Pradesh	0.930
Punjab	0.894
West Bengal	0.696
Orissa	0.893
Maharashtra	0.907
Karnataka	0.976
Tamil Nadu	0.916
Overall India	0.924

Source: Author's analysis based on BKPAI survey data, 2011

Table 2: The Kaiser-Meyer-Olkin (KMO) index for Measuring Sample Adequacy (MSA)

State Name	Kaiser-Meyer-Olkin values	Bertlett's Test of Sig.
Himachal Pradesh	0.949	0.000
Punjab	0.906	0.000
West Bengal	0.858	0.000
Orissa	0.916	0.000
Maharashtra	0.903	0.000
Karnataka	0.913	0.000
Tamil Nadu	0.951	0.000
Overall India	0.930	0.000

Source: Author's analysis based on BKPAI survey data, 2011

Table 3: The Eigen values obtained from exploratory factor analysis of GHQ-12 (Component)

Component	Initial Eigenvalues		
	Total	**% of Variance**	**Cumulative %**
1	5.740	47.831	47.831
2	1.355	11.293	59.124
3	0.720	6.000	65.124
4	0.654	5.450	70.574
5	0.575	4.791	75.365
6	0.524	4.363	79.728
7	0.460	3.837	83.566
8	0.432	3.604	87.169
9	0.416	3.467	90.636
10	0.397	3.305	93.941
11	0.392	3.264	97.204
12	0.335	2.796	100.000

Source: Author's analysis based on BKPAI survey data, 2011
Extraction Method: Principal Axis Factoring (PAF).

Table 4: Correlation matrix shows the inter-item factorability of GHQ-12

Correlation Matrix													
		Unable to concentrate	Sleepless due to worry	Under strain	Unable to overcome difficulties	Unhappy and depressed	Losing confidence	Thinking worthless	Playing useful role	Capable of making decision	Enjoying day to day life	Face up problems	Reasonably happy
Correlation	Unable to concentrate	1.000											
	Sleepless due to worry	0.442	1.000										
	Under strain	0.325	0.506	1.000									
	Unable to overcome difficulties	0.347	0.421	0.514	1.000								
	Unhappy and depressed	0.408	0.505	0.480	0.479	1.000							
	Losing confidence	0.453	0.458	0.398	0.439	0.557	1.000						
	Thinking worthless	0.418	0.466	0.414	0.440	0.528	0.596	1.000					
	Playing useful role	0.445	0.345	0.315	0.358	0.389	0.452	0.488	1.000				
	Capable of making decision	0.475	0.356	0.297	0.323	0.384	0.435	0.418	0.630	1.000			
	Enjoying day to day life	0.516	0.365	0.273	0.305	0.393	0.429	0.416	0.519	0.593	1.000		
	Face up problems	0.419	0.290	0.288	0.346	0.322	0.357	0.341	0.477	0.514	0.556	1.000	
	Reasonably happy	0.472	0.350	0.282	0.317	0.403	0.444	0.428	0.514	0.537	0.603	0.558	1.000

Source: Author's analysis based on BKPAI survey data, 2011

Table 5: Standardized Regression Weights for Confirmatory Factor Analysis Model

			Estimate	S.E.	C.R.	P Label
A	<---	Cons1	.710			
H	<---	Cons1	.747	.015	69.247	***
I	<---	Cons1	.791	.015	73.304	***
J	<---	Cons1	.821	.015	76.240	***
K	<---	Cons1	.729	.015	68.021	***
L	<---	Cons1	.801	.015	74.530	***
B	<---	Cons2	.730			
C	<---	Cons2	.686	.013	72.908	***
D	<---	Cons2	.729	.014	68.906	***
E	<---	Cons2	.829	.015	78.244	***
F	<---	Cons2	.794	.015	74.543	***
G	<---	Cons2	.753	.015	70.521	***

Source: Author's analysis based on BKPAI survey data, 2011
Note: A=Unable to concentrate; B=lost sleep due to worry; C=constantly under strain;
D=Couldn't overcome difficulties; E= Felling unhappy and depressed; F=Losing self-confidence;
G=Thinking worthless yourself; H=Playing useful role in life; I=Capable to making decisions;
J=Enjoying day-to-day activities; K=Able to face up problems; L=Feeling reasonably happy;
Cons1=latent construct 1 (recognized as anxiety), Cons2=latent construct 2 (recognized as depression)

Table 6: Covariances for Confirmatory Factor Analysis (CFA) Model

			Estimate	S.E.	C.R.	P Label
Cons1	<-->	Cons2	.286	.007	43.697	***
e2	<-->	e3	.067	.003	20.075	***
e11	<-->	e12	.095	.005	18.350	***
e7	<-->	e8	.093	.005	18.399	***
e8	<-->	e9	.098	.005	19.693	***

Source: Author's analysis based on BKPAI survey data, 2011
Note: e2, e3, e8, e9, e11, e12 are unmeasured latent factors
Cons1=latent construct 1 (recognized as anxiety), Cons2=latent construct 2 (recognized as depression)

Table 7: Model Fit Indices for Confirmatory Factor Analysis (CFA)

Name of indexes	Index values
GFI	0.972
AGFI	0.956
NFI (Delta 1)	0.976
RFI (rho 1)	0.967
IFI (Delta 1)	0.976
TLI (rho 2)	0.968
CFI	0.976
RMSEA	0.059

Source: Author's analysis based on BKPAI survey data, 2011

Table 8: Unstandardized Beta coefficients for Path Model-I

Paths			Estimate	S.E.	C.R.	P Label
Physical Activity	<---	Age	-.024	.001	-21.054	***
Smoking	<---	Occupation	.107	.006	18.134	***
NCD	<---	Physical Activity	-.014	.013	-9.115	***
NCD	<---	Smoking	.015	.017	7.877	***
NCD	<---	Age	.027	.001	17.927	***
NCD	<---	Econ. Dependency	-.060	.012	-4.806	***
Disability	<---	NCDs	.502	.017	29.573	***
Functionality	<---	Disability	.207	.007	30.377	***
Social Activity	<---	Year of Schooling	.049	.004	12.027	***
Family Relation	<---	occupation	.486	.013	37.095	***
Social Activity	<---	occupation	.249	.019	13.215	***
Anxiety	<---	Physical Activity	-.318	.024	-13.282	***
Anxiety	<---	Disability	.318	.012	27.512	***
Anxiety	<---	Functionality	.095	.016	6.057	***
Anxiety	<---	Family Relation	-.111	.014	-7.853	***
Anxiety	<---	Social Activity	-.143	.011	-12.817	***
Anxiety	<---	Age	.013	.003	4.485	***
Anxiety	<---	Econ. Dependency	.145	.024	6.166	***

Source: Author's analysis based on BKPAI survey data, 2011
Note: *** indicates the level of significance, when p<=0.001

Table 9: Unstandardized Beta coefficients for Path Model-II

Paths			Estimate	S.E.	C.R.	P Level
Physical Activity	<---	Age	-.024	.001	-21.054	***
Smoking	<---	Occupation	.107	.006	18.134	***
NCD	<---	Physical Activity	-.014	.013	-9.115	***
NCD	<---	Smoking	.015	.017	7.877	***
NCD	<---	Age	.027	.001	17.927	***
NCD	<---	Econ. Dependency	-.060	.012	-4.806	***
Disability	<---	NCD	.502	.017	29.573	***
Functionality	<---	Disability	.207	.007	30.377	***
Social Activity	<---	Year of Schooling	.049	.004	12.027	***
Family Relation	<---	Occupation	.486	.013	37.095	***
Social Activity	<---	Occupation	.249	.019	13.215	***
Depression	<---	NCD	.021	.019	1.137	***
Depression	<---	Disability	.194	.011	17.833	***
Depression	<---	Functionality	.097	.015	6.524	***
Depression	<---	Family Relation	-.141	.013	-10.532	***
Depression	<---	Social Activity	-.080	.011	-7.597	***
Depression	<---	Age	-.005	.003	-2.067	.039
Depression	<---	Econ. Dependency	.012	.022	.547	.585

Source: Author's analysis based on BKPAI survey data, 2011
Note: *** indicates the level of significance, when p<=0.001

Table 10: Anxiety and Depression Score of elderly by lifestyle and other socio-demographic aspect in India, 2011

Background Characteristics	Anxiety Score		Depression Score		N
	Up to 2	3 and above	Up to 2	3 and Above	
Age†					
60 – 69	70.7	29.3	75.2	24.8	6236
70 – 79	58.8	41.5	69.2	30.8	2600
80 and above	48.9	52.1	65.5	34.5	1012
Gender†					
Male	69.2	30.8	75.1	24.9	4669
Female	61.6	38.4	70.4	29.6	5179
Marital Status†					
Never Married	69.6	30.4	69.6	30.4	92
Currently Married/ Living Together	70.7	29.3	75.7	24.3	5883
Widowed/Separated	56.9	43.1	68.1	31.9	3873
Year of Schooling†					
No Schooling	54.3	45.7	64.2	35.8	4526
Less than 1 to 4	61.0	39.0	71.5	28.5	1317
5 to 8	72.2	27.8	77.8	22.2	1908
8 and above	85.1	14.9	86.8	13.2	2097
Religion†					
Hindu	63.8	36.2	70.9	29.1	7780
Muslim	59.1	40.9	69.4	30.6	804
Christian	82.8	17.2	81.8	18.2	325
Sikh	79.2	20.8	88.7	11.3	823
Others	56.9	43.1	71.6	28.4	116
Caste†					
Schedule Caste	60.0	40.0	67.8	32.2	1898
Schedule Tribe	53.4	46.6	65.4	34.6	485
OBC	64.5	35.5	68.2	31.8	3351
Others	69.7	30.3	79.2	20.8	4114
Residence Type†					
Rural	60.7	39.3	69.3	30.7	5134
Urban	70.2	29.8	76.2	23.8	4714
Occupation†					
Never worked as paid worker	63.5	36.5	73.5	26.5	3584
Type I	58.3	41.7	64.9	35.1	3281
Type II	71.8	28.2	77.7	22.3	2412
Type III	87.0	13.0	87.4	12.6	207
Type IV	87.2	12.8	90.8	9.2	218
Type V	89.7	10.3	91.8	8.2	146
Economic Dependency†					
Fully	58.0	42.0	67.1	32.9	4929
Partially	65.2	34.8	74.1	25.9	2431
Not	79.6	20.4	82.1	17.9	2488
Current working status†					
Not worked	63.4	36.6	71.1	28.9	4000
Worked less than 6 months	74.5	25.5	75.4	24.6	1847

Worked more than 6 months	56.4	43.6	66.9	33.1	417
Never worked as paid worker	63.5	36.5	73.5	26.5	3584
Role in family†					
No role	40.3	59.7	46.5	53.5	718
Medium role	62.7	37.3	72.0	28.0	4928
Strong role	72.4	27.6	77.8	22.2	4202
Social Activity †					
No participation	55.9	44.1	67.0	33.0	3524
Occasional	68.6	31.4	74.6	25.4	4775
Frequent	76.0	24.0	79.2	20.8	1549
Physical Activity†					
No activities	39.9	60.1	56.3	43.7	701
Only household	63.1	36.9	68.5	31.5	5755
Only exercise	50.7	49.3	71.9	28.1	203
Household and exercise	75.5	24.5	83.6	16.4	3189
Smoking					
Never used	65.1	34.9	72.6	27.4	8455
Currently not using	67.1	32.9	73.3	26.7	415
Regularly using	65.8	34.2	72.5	27.5	977
Alcohol†					
Never used	64.6	35.4	72.3	27.7	9111
Occasionally Using	68.0	32.0	74.0	26.0	412
Regularly using	79.1	20.9	79.4	20.6	325
Optimum Sleep†					
No	74.3	25.7	79.6	20.4	666
Yes	64.6	35.4	72.1	27.9	9182
Breakfast†					
No	66.9	33.1	74.9	25.1	5023
Yes	63.5	36.5	70.3	29.7	4825
Self-reported health†					
Poor	40.9	59.1	56.3	43.7	1687
Fair	57.5	42.5	67.2	32.8	3611
Good	77.4	22.6	80.0	20.0	2946
Very Good	86.0	14.0	88.3	11.7	1604
Functionality†					
No assistance	67.9	32.1	74.3	25.7	9110
Partial assistance	34.1	65.9	53.4	46.6	599
Full assistance	26.6	73.4	45.3	54.7	139
Disability†					
No disability	80.3	19.7	81.3	18.7	2670
Light disability	65.7	34.3	73.8	26.2	5416
Medium disability	42.0	58.0	56.4	43.6	1535
Heavy disability	33.5	66.5	52.9	47.1	227
Presence of NCD†					
No disease	70.8	29.2	76.0	24.0	3880
Single disease	62.3	37.7	70.5	29.5	3374
Two disease	60.2	39.8	72.0	28.0	1723
Three and more	61.8	38.2	67.3	32.7	871
Wealth†					
Lowest	45.3	54.7	54.8	45.2	1960
Second	56.7	43.3	65.8	34.2	1974

Middle	67.5	32.5	74.7	25.3	1938
Fourth	74.4	25.6	80.9	19.1	1960
Highest	81.8	18.2	86.6	13.4	2016
State†					
Himachal Pradesh	79.9	20.1	82.5	17.5	1482
Punjab	80.8	19.2	90.1	9.9	1366
West Bengal	48.3	51.7	64.6	35.4	1275
Orissa	51.2	48.8	61.4	38.6	1481
Maharashtra	57.1	42.9	76.3	23.7	1435
Kerala	79.6	20.4	78.5	21.5	1365
Tamil Nadu	59.2	40.8	55.2	44.8	1444
Total	**65.2**	**34.8**	**72.6**	**27.4**	**9848**

Source: Author's analysis based on BKPAI survey data, 2011

Note: †Chi-square test statistic are significant when $p<=0.05$

Anxiety and depression score up to 2 considered as 'mild' while 3 and above considered as 'severe'

Occupation are coded as National Classification of Occupations (NCOs) of India, 2015

Table 11: Association of anxiety (score ≥ 3) and depression (score ≥ 3) with lifestyle behaviours along with other socio-demographic aspect of elderly: results from logistic regression model

Predictors	Anxiety				Depression			
	Odds Ratio	P>z	95% Conf. Interval		Odds Ratio	P>z	95% Conf. Interval	
Social Activity (Ref. No)								
Occasional	**0.771**	0.010	0.684	0.967	**1.012**	0.826	0.907	1.129
Frequent	**0.618**	0.000	0.594	0.840	**1.039**	0.647	0.883	1.223
Family Relation (Ref. Low)								
Medium	**0.681**	0.000	0.568	0.817	**0.509**	0.000	0.427	0.606
Strong role	**0.759**	0.013	0.610	0.944	**0.572**	0.000	0.461	0.709
Smoking (Ref. Never)								
Currently not using	**1.051**	0.720	0.802	1.376	**0.985**	0.915	0.750	1.295
Regularly using	**0.918**	0.340	0.770	1.095	**0.915**	0.338	0.764	1.097
Alcohol Consumption (Ref. Never)								
Occasionally	**0.963**	0.785	0.736	1.260	**0.994**	0.964	0.754	1.309
Regularly	**0.670**	0.011	0.492	0.912	**0.892**	0.461	0.658	1.209
Physical Activity (Ref. No activity)								
Only household	**0.652**	0.000	0.540	0.788	**0.816**	0.031	0.678	0.982
Only exercise	**1.150**	0.447	0.802	1.648	**0.749**	0.131	0.515	1.089
HH and exercise	**0.537**	0.000	0.439	0.658	**0.493**	0.000	0.402	0.605
Optimal Sleep (Ref. No)								
Yes	**1.400**	0.001	1.145	1.713	**1.305**	0.013	1.057	1.611
Diet (Ref. No)								
Yes	**1.022**	0.656	0.929	1.125	**1.107**	0.044	1.003	1.222
Functionality (Ref. No assistance)								
Partial assistance	**1.992**	0.000	1.628	2.438	**1.412**	0.000	1.164	1.713
Full assistance	**2.634**	0.000	1.715	4.046	**1.926**	0.001	1.311	2.831
Disability (Ref. No disability)								
Light disability	**1.904**	0.000	1.683	2.154	**1.456**	0.000	1.281	1.655
Medium disability	**3.836**	0.000	3.256	4.520	**2.723**	0.000	2.305	3.217
Heavy disability	**4.205**	0.000	3.006	5.882	**2.462**	0.000	1.784	3.397
NCDs (Ref. No NCDs)								
Single	**1.282**	0.000	1.146	1.435	**1.293**	0.000	1.151	1.452
Two	**1.347**	0.000	1.170	1.550	**1.214**	0.010	1.048	1.407
Three and more	**1.218**	0.037	1.012	1.466	**1.598**	0.000	1.325	1.928
Age in Years (Ref. 60 – 69)								
70 - 79	**1.199**	0.001	1.073	1.341	**1.025**	0.676	0.912	1.152
80 and above	**1.122**	0.080	0.748	1.627	**0.879**	0.147	0.738	1.046
Sex (Ref. Male)								
Female	**0.824**	0.014	0.706	0.962	**0.932**	0.384	0.797	1.091
Marital Status (Ref. Never married)								
Currently Married	**1.094**	0.717	0.673	1.779	**0.715**	0.176	0.440	1.162
Divorced/Separated	**1.349**	0.230	0.827	2.199	**0.722**	0.191	0.443	1.177
Religion (Ref. Hindu)								
Muslim	**0.958**	0.626	0.808	1.137	**0.888**	0.181	0.745	1.057
Christian	**0.489**	0.000	0.354	0.676	**0.827**	0.232	0.606	1.129
Sikh	**0.532**	0.000	0.435	0.650	**0.390**	0.000	0.306	0.496
Other	**1.130**	0.568	0.744	1.715	**0.786**	0.289	0.504	1.226
Caste (Ref. Schedule caste)								
Schedule Tribe	**1.162**	0.188	0.929	1.453	**0.895**	0.339	0.713	1.123
OBCs	**1.047**	0.519	0.911	1.202	**1.153**	0.045	1.003	1.326

	B	S.E.	Sig.		B	S.E.	Sig.	
Others	**1.070**	0.337	0.932	1.230	**0.837**	0.015	0.726	0.967
Year of Schooling (Ref. No schooling)								
Less than 4	**0.840**	0.016	0.729	0.968	**0.721**	0.000	0.622	0.836
5 to 8	**0.700**	0.000	0.610	0.803	**0.692**	0.000	0.600	0.799
Above 8	**0.490**	0.000	0.410	0.585	**0.562**	0.000	0.467	0.676
Occupation (Ref. Never worked)								
Type I	**1.155**	0.044	1.004	1.330	**1.316**	0.000	1.140	1.518
Type II	**1.103**	0.266	0.928	1.310	**1.217**	0.029	1.020	1.453
Type III	**0.854**	0.499	0.541	1.349	**1.117**	0.635	0.707	1.764
Type IV	**0.887**	0.603	0.564	1.395	**0.810**	0.414	0.488	1.344
Type V	**0.754**	0.352	0.416	1.367	**0.853**	0.627	0.451	1.616
Economic Dependency (Ref. Fully)								
Partially	**0.707**	0.000	0.611	0.817	**0.695**	0.000	0.599	0.807
Not	**0.524**	0.000	0.445	0.618	**0.643**	0.000	0.543	0.761
Wealth (Ref. Lowest)								
Second	**0.753**	0.000	0.655	0.865	**0.754**	0.000	0.656	0.867
Middle	**0.534**	0.000	0.459	0.622	**0.581**	0.000	0.498	0.677
Fourth	**0.409**	0.000	0.348	0.481	**0.454**	0.000	0.384	0.536
Highest	**0.311**	0.000	0.258	0.375	**0.362**	0.000	0.298	0.441
Constant	**0.906**	0.752	0.492	1.670	**1.248**	0.479	0.676	2.302

Source: Author's analysis based on BKPAI survey data, 2011
Note: Dependent variable: Anxiety (score ≥ 3 coded as 1, otherwise 0) and Depression (score ≥ 3 coded as 1, otherwise 0)
Occupation are coded as National Classification of Occupations (NCOs) of India, 2015

Table 12: Moderation analysis using logistic regression model

Variables	Anxiety			Depression		
	B	**S.E.**	**Sig.**	**B**	**S.E.**	**Sig.**
Functionality in ADLs	**0.051**	0.030	0.091	**0.045**	0.026	0.080
Presence of Disability	**0.245**	0.025	0.000	**0.198**	0.024	0.000
Presence of NCDs	**0.372**	0.054	0.000	**0.196**	0.051	0.000
Functionality*PA	**0.043**	0.025	0.086	**0.023**	0.021	0.269
Presence of NCDs*PA	**-0.147**	0.026	0.000	**-0.107**	0.026	0.000
Presence of Disability*PA	**0.004**	0.013	0.727	**-0.019**	0.013	0.129
Economic Dependency	**0.422**	0.041	0.000	**0.377**	0.047	0.000
Year of Schooling	**-0.051**	0.010	0.000	**-0.037**	0.015	0.000
Economic Dependency*SA	**-0.041**	0.012	0.000	**-0.057**	0.012	0.000
Year of Schooling*SA	**-0.001**	0.003	0.679	**-0.002**	0.013	0.413
Presence of NCDs*Smoking	**0.010**	0.029	0.728	**0.005**	0.022	0.864
Presence of NCDs*SA	**-0.021**	0.012	0.087	**0.041**	0.011	0.000
Constant	**-0.597**	0.286	0.037	**0.179**	0.294	0.054
-2 Log Likelihood	**10665.495**			**10296.286**		
Cox & Snell R Square	**0.189**			**0.121**		
Nagelkerke R Square	**0.260**			**0.175**		

Source: Author's analysis based on BKPAI survey data, 2011
Note: PA=Physical Activity; SA=Social Activity
Dependent variable: Anxiety (score ≥ 3 coded as 1, otherwise 0) and Depression (score ≥ 3 coded as 1, otherwise 0)