Hard Pill to Swallow: Socio-economic Factors behind Non-communicable Diseases of Employed Persons in Sri Lanka

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Abstract

Non-communicable diseases shorten the life expectancy and pave the way for an increase in the mortality and state of disabilities in humans while it has become a global challenge, with the present epidemic transition. Most of the lower and middle-income countries, including Sri Lanka, are currently giving priority to this issue in their respective health policies. The main objective of this research was to study socio-economic factors that affect the prevalence of non-communicable diseases among employed persons in general, with a special focus on two selected diseases. Micro-level secondary data from the Household Income and Expenditure Survey of Sri Lanka 2016 was used for this study. The Logit regression models were used for data analysis with the dependent variables for the prevalence of non-communicable diseases, having diabetes, and blood pressure. The study has found that factors of age, being female, and being Indian Tamil persons, positively affected the occurrence of non-communicable diseases; while factors like living in the rural and estate sector, age square, being clerical workers, elementary workers, and agriculture workers affected it negatively. Profession-specific policies are further suggested to minimize the negative implications of non-communicable diseases in Sri Lanka.

Keywords: Non-communicable diseases, blood pressure, diabetes, occupation-specific health, healthy employment policies

INTRODUCTION

Non-communicable diseases (NCDs) are interpreted as "long term, generally slow progressing diseases (World Health Organization, 2011). Non-communicable diseases are identified as diseases that are non-transmittable and non-spreading, among others. While non-communicable diseases have become a global challenge, epidemiological transition paves the way for an increase in the mortality of humans by shortening their life expectancy and increasing their health-related vulnerabilities. There are four main categories of non-communicable diseases, namely cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes (Allen & Feigl, 2017). Non-communicable diseases have been confirmed as the main reason for adult diseases and deaths (Oli et al., 2013). Those are a collection of genetic, physical, environmental, and behavioural factors (Embuldeniya, 2018). Presently, there is a rapid increase in non-communicable diseases. While non-communicable diseases are severely affecting the low-income and middle-income earners in the world, they create a huge demand for health systems and social welfare. Productivity in workplaces also decreases as a result of non-communicable diseases. They tend to reduce the allocation of resources for other basic human needs within families. Non-communicable diseases (NCDs) are expected to increase considerably worldwide within the next few decades and the increasing urbanisation and globalisation in developing countries is also a cause for this (World Health Organization, 2011). Recent data released by the

World Health Organisation indicates that NCDs account for an average of 80% of the deaths in low and middle-income countries, while they are accountable for only 20% of the deaths in higher-income countries. Hence, this is emerging as the main health issue in developing countries (Tawa et al., 2011). Soloman et al. (2017) also found that the largest contributor to the number of deaths worldwide is chronic non-communicable diseases that are caused by tobacco and liquor use, unhealthy dietary patterns (overweight and excess fatty foods), and physical inactivity. The severity of the NCDs also depends on gender, age, ethics, and employment status (Tawa et al., 2011). This will further create a huge economic burden on the globe, accounting for the cost of 47 trillion US dollars within the next two decades, leading to pushing millions of people into poverty (Allen & Feigl, 2017).

More than three-fourths of the deaths in Sri Lanka are due to non-communicable diseases and one in five persons dies of NCDs, thus showing the severity of the problem within the country (NCDs Country Profile, WHO, 2018). Among the total deaths in 2016, 83% is from non-communicable diseases and this is a considerably higher rate than in the world context, recording 72% in 2016. The challenge was mainly by the rapid population aging in Sri Lanka and the situation would worsen within the next two decades.

An operation launched by the United Nations Inter-active Task Force for Sri Lanka in October 2015 concluded that the spread of non-communicable diseases has become a grave

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challenge to the economy and public health due to tobacco usage, unhealthy dietary patterns, use of harmful liquor, and the physical weaknesses of human capital (NCDs Country Profile, WHO, 2018). Presently, the unexpected risk of death from non-communicable diseases is already higher in Sri Lanka than in developed countries. However, the NCD risk factors are still low in Sri Lanka but are expected to increase in the forthcoming years (Rannan-Eliya et al., 2010) with rapid population aging expected to create negative economic consequences as a result after 2030. The high tendency for having non-communicable diseases like diabetes, kidney diseases, high blood pressure, etc. would be the biggest challenge before the economy thereafter, as mentioned by Embuldeniya (2018). Identifying the factors associated with the prevalence of non-communicable diseases would be important to have prior goal setting to reduce NCDs to align with the third goal of SDGs, which is to be achieved in 2030. The main objective of this study is to identify the socio-economic factors that affect non-communicable diseases in Sri Lanka.

LITERATURE REVIEW

The demographic, socio-economic, and spatial factors associated with the prevalence of NCDs were found in different countries according to the previous research. Economic factors associated with NCDs mainly cover employment status and occupation. Occupation-specific health threats in different sectors were analysed with the causes for different non-communicable diseases. According to Rodriguez-Fernandez et al. (2015), heart attacks are higher among workers engaged in the mining industry. Individuals working in the sectors like cement companies, cotton industries, dye industries, etc. are affected by illnesses like breathing disabilities and skin ailments (House, 1974). Lung cancers which were highly prevalent due to higher percentages of tobacco use among employees in the blue-collar job sector can be prevented by launching well-targeted healthcare programmes for them (Sorensen et al., 2004). It has also been found that mental stress based on the nature of a profession contributes considerably towards chronic illnesses. Morikawaet. al. (1997) points out that the spread of diabetes is higher among workers engaged in the transport sector and the percentage of deaths due to heart attacks is also high among them. Less physical activities, irregular work schedules, and higher occupation-related psychological stress are the reasons for this. A study in Hong Kong has also reported that the spread of diabetes was higher among transport and air traffic controllers and the percentage of deaths due to heart attacks was higher among them due to less physical activities, irregular work schedules, and higher occupational-specific mental stresses and the symptoms of high mental stress in these professions (Ng,1988). It was found that chronic high blood pressure and coronary heart diseases were high among men and women in jobs with a higher prevalence of mental and social stresses in Finland (Pereira et al., 1998). Fishermen in Southern India who report relatively poor socio-economic status are also affected by non-communicable diseases due to seated physical activities, stress, poor sleep, poor dietary practices, and increased waist circumference, while most of them have unfavourable lipid profiles (Doddamani et al., 2021).

Although Ghaffar et al. (2004) have mentioned that the possibilities for low-income families to be exposed to non-communicable diseases are high, the opposite was presented by the World Health Organization (2002) mentioning that non-communicable diseases are increasing among wealthy people.

Similarly, it has been found that the number of working hours positively affects the occurrence of heart attacks (Rodriguez-Fernandez et al., 2015). Increasing work hours generally cause depression, migraine, high blood pressure, and heart ailments among people. Similarly, there are increasing possibilities for the occurrence of obesity, mental stress, and irregular life patterns among individuals due to increasing work hours (Shields, 1999). Similarly, the economic status is conversely connected to the probability of the occurrence of at least one non-communicable disease among women (VanMinh et al., 2008). Most of the evidence in middle-income countries points to the occurrence of higher risks of non-communicable diseases among people in the lower socio-economic levels (Marmot & Bell, 2019). According to Al-Hanawi & Keetile (2021), there is a relationship between employment status and income with obesity and high blood pressure. Also, it further proved the high possibility of having high blood pressure among government, non-government and self-employed persons. Biswas et al. (2019) has found that the prevalence of high blood pressure and overweight/obesity is considerably high among people with higher education, living in the urban sector, being non-manual workers, enjoying wealthy socio-economic backgrounds, etc.

NCDs are related to the macroeconomic performances of the country as well. With the unhealthy behaviour and physical weaknesses in developing countries, the higher costs incurred on non-communicable diseases lead to the loss of household income. People, especially in low-income countries, are often trapped in the vicious cycle of non-communicable diseases and poverty (Embuldeniya, 2018). Hence, the first hypothesis for the study was developed as follows:

H1: Non-communicable diseases are affected by economic factors in Sri Lanka.

Another important factor for NCDs is the age of the worker and the gender (being a male). Those were positively affected by the occurrence of heart attacks (Rodriguez-Fernandez et al., 2015). It has been found that chronic illnesses are the highest among the rural elderly population in Vietnam (Van Minh et al., 2008). Further, various complications due to ageing positively affect chronic and non-communicable diseases (Ahmed et al., 2009). Similarly, while there is an increase in the spread of non-communicable diseases with ageing, it creates heavy economic impacts within families due to the increase in their NCD risks (Kasturiratne et al., 2009). Factors like physical inactivity and obesity with ageing raise the probability of the increase in non-communicable diseases. It has been observed that the spread of chronic diseases increases with age (Ahmed et al., 2009). A study done by Al-Hanawi & Keetile (2021) has found that obesity and overweight are related to age and marital status which could lead to NCDs in Saudi Arabia. This also found that the probability of having hypertension is relatively higher among females than men. Li et al. (2020) also come up with the conclusion that females have a higher likelihood of having hypertension and diabetes and NCDs are highly prevalent among the elderly, minor ethnic groups, and poor people in China. Higher obesity is a significant factor among females than males in Ghana and this creates a risk of having NCDs for females rather than males (Minicuci et al., 2014). Gender, the level of education, residential sector, and wealth status are associated with NCDs according to Mwangi et al. (2020). The high prevalence of obesity among

middle-aged persons and the higher prevalence of obesity among females were also identified in this study. Rengma et al., 2015 also showed that obesity is increasing among the people in the age groups of 30-39 and 40-49 and that this has a higher relationship with education, employment, and higher income levels.

It has been found that excessive fatigue due to being a male affects positively in causing heart attacks (Rodriguez-Fernandez et al., 2015). Social and traditional factors influence the occurrence of non-communicable diseases like heart ailments. Accordingly, the gender and nationality of a person influence this (House, 1974). As reported by the World Health Organisation (2014), around twenty percent die due to cancer in Seychelles. Among them, the percentage of cancer deaths for men is 227 in every 100,000 males and 96 in every 100,000 females. Cervical cancer (20%), breast cancer (15%), and Kaposi's sarcoma are the most common non-communicable diseases among women (Mayosi et al., 2009).

As stated by Pereira et al. (1998), a higher level of smoking and liquor use is related to employment status among men, while there is no such relationship between women. It has been found that they face a higher risk of metabolic non-infections. Hence, among women, there are no clear relationships between occupational status and non-communicable diseases. Also, according to Ahmed et al. (2009), non-communicable diseases can occur based on factors like wide tobacco use, less consumption of fruits and vegetables among men, and less physical activity among women.

When considering the residential sector, the spread of non-communicable diseases increases with the changes in the lifestyles of people due to globalization and urbanization (Tawa et al., 2011). Non-communicable diseases increase with urbanization as the urban lifestyles reduce the opportunities for physical activities, expose people to environmental pollution and stress, and their increased ability to obtain processed and unhealthy foods. Furthermore, increased urbanization results in changing traditional healthy habits into unhealthy habits (World Health Organization , 2011). Similarly, Revathi and Johnson (2019) point out that living in unfavourable areas creates risks for the higher prevalence of non-communicable diseases. It has been revealed that the spread of chronic diseases is considerably high among people with low education levels, unhealthy dietary patterns, and health habits (VanMinh et al., 2008). The elderly people in the rural sector have a higher prevalence of NCDs and enhancing primary healthcare factors was identified as a mandatory requirement to prevent this, according to Maimela et al. (2016). However, Minicuci et al. (2014) presents an opposite argument on this matter, showing the higher prevalence of NCDs among urban residents than the rural residents.

Ahmed et al. (2009) has discovered that Vietnam's education level is related to the probability of the risks of non-communicable diseases. The increase in the education level increases the awareness of common chronic diseases, thus leading to reduced NCDs. As stated by Embuldeniya (2018), there is also a relationship between the education level and the prevailing level of non-communicable diseases in Sri Lanka. According to Williams et al. (2018), low education has a higher relationship with NCDs in Ethiopia, while the higher occurrence of NCDs among unskilled workers is a significant factor in Nigeria. The same finding was confirmed by Tumas et al. (2021), indicating that low education increases high blood pressure and obesity for both men and women, while the higher occurrence of diabetes was reported for women.

However, an Indian study shows a positive relationship between higher education and NCDs for women, while excessive usage of tobacco and liquor too could increase NCDs.

According to research conducted by Teh et al. (2014), it has been revealed that the chances for the occurrence of non-communicable diseases like diabetes, blood pressure, cholesterol, etc. change according to the various ethnic groups living in Malaysia. When considering the marital status, there are higher possibilities for the occurrence of non-communicable diseases like diabetes, blood pressure, cholesterol, etc. when certain individuals become obese after their marriage (Emamian et al., 2011). Hence, the second hypothesis for the study can be constructed as follows:

H2: NCDs are affected by social and demographic factors and spatial factors in Sri Lanka.

RESEARCH METHODOLOGY

Secondary data from The Household Income and Expenditure Survey (HIES) - 2016, conducted by the Department of Census and Statistics, is used for the study. All individuals with and without non-communicable diseases in Sri Lanka during the year 2016 are considered for the study. Thirty thousand nine hundred and nineteen (30,919) observations remained for the analysis as the sub-sample, including only the employed population from the total of 88,281. When compiling data, the variables of special education and non-categorised security forces were removed due to insufficient data. Three Logistic regression models are used for the data analysis for the prevalence of non-communicable diseases, prevalence of diabetics and for the prevalence of high blood pressure among employed persons.

$$\text{Li} = \ln\left[\frac{pi}{1-pi}\right] = \alpha i + \beta_i X_i + \beta_i D_i + u_i$$

Where,

Pi= Probability of having non-communicable diseases, (1-Pi) = Probability of not having non-communicable diseases, αi=Intercept, β_i=slope coefficients, Di=Dummy variables (Residential sector, marital status, Ethnicity, Gender, Education level, Occupation) Xi=continuous explanatory variables (Age, Age2 and u_i=Error term).

The independent variables used for the analysis in this study were selected based on the conceptual framework derived from the literature review and on the availability of the socio-economic and demographic variables in HIES (2016).

The data set used for the analysis consisted of two sheets, including the socio-demographic factors (Section 1) and health factors (Section 3) Health, and these two were added for a single data file. Question 13 in section 3A related to the topic of health - that is, the question 'Is there a non-communicable disease?' in the questionnaire used to collect data for the Household Income and Expenditure Survey– 2016, was used to prepare the dependent variables. Here, the variable on the prevalence of non-communicable diseases as a whole was prepared first. Thereafter, if there is a non-communicable disease, then it was noted as 1, and if not it was noted as 0. Question No. 14 in Section 3A under the topic Health in the HIES (2016) which includes the type of NCDs (diabetes or blood pressure) was used to prepare the two specific dependent variables. (If suffering from diabetes, it was noted as 1 and if not as 0. The variables for having blood pressure were also done similarly). When preparing the independent variables, they are categorized under two sections: socio-demographic factors and economic factors. This study uses age, gender, residential sector, marital

status, ethnicity, and educational level as socio-demographic factors. Occupations are used as economic factors. These variables are prepared and presented as dummy variables.

DATA ANALYSIS, RESULTS, AND DISCUSSION

Non-communicable diseases are caused by different socio-economic and demographic factors of people. Occupation-specific factors were discussed as a serious component in the literature regarding the prevalence of NCDs. Figure 1 discusses the percentages of having NCDs by different types of occupations. According to the graph, NCDs are predominant among the two groups. One is top-level professionals in managerial occupations engaging in hard-working schedules and long working hours. The literature review also found a higher likelihood of having NCDs among top-level professionals with higher income and wealth. The World Health Organization (2002) also mentions that non-communicable diseases are increasing among wealthy people.

Twenty-four percent of managerial professions have non-communicable diseases in Sri Lanka while 17.27 percent of agricultural workers and 15.21 percent of elementary workers occupy the second and third places respectively regarding the prevalence of NCDs. The lowest percentage was recorded among clerical workers who are working for standard working hours and suffered lesser physical hardships.

Figure 1: Impact of employment for causing non-communicable diseases
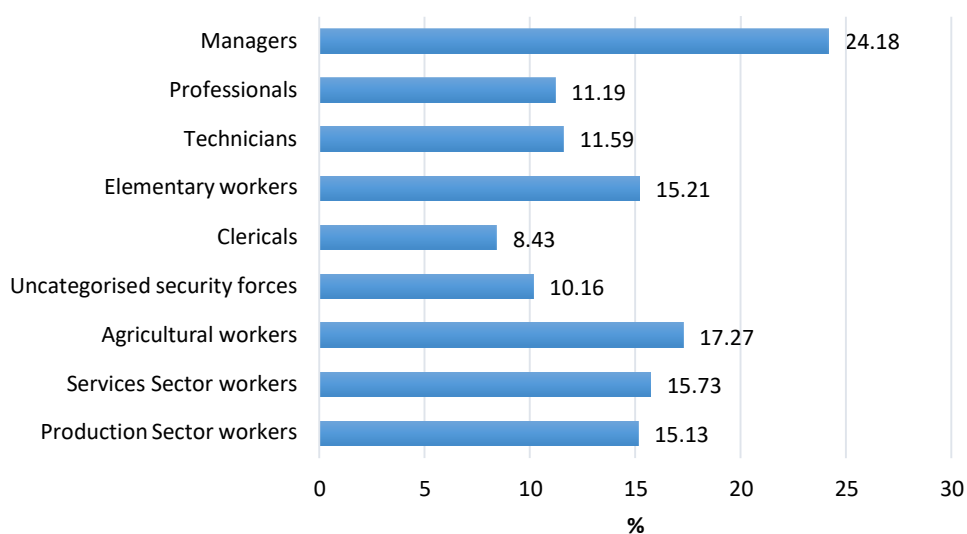
Source: Researcher developed using HIES 2016 micro-data

Three logistics regression models are derived to identify key socio-economic and demographic determinants of NCDs among employed persons in general, and for two specific diseases, including diabetes and blood pressure. A descriptive statistic of the sample is presented in Table 1 for all the dependent and independent variables used for the regression model. Sixteen percent of the samples were affected by non-communicable diseases and the majority of the samples were represented by males (65%) and rural residents (79%).

Table 1: Relevant detailed statistics to study the factors affecting non-communicable diseases

Variables	Proportion/ Mean	Standard Deviation
Presence of communicable diseases	0.164	0.370
Having High blood pressure	0.035	0.184
Having Diabetes(D)	0.039	0.192
Urban(D)	0.157	0.363
Rural(D)	0.792	0.405
Estate(D)	0.051	0.220
Age	42.901	13.500
Age Square	2024.228	1218.600
Unmarried(D)	0.171	0.376
Married(D)	0.829	0.376
Sinhala(D)	0.741	0.438
Sri Lankan Tamil(D)	0.141	0.348
Indian Tami(D)	0.043	0.202
Muslim(D)	0.071	0.257

Other(D)	0.004	0.060
Male (D)	0.657	0.474
Female(D)	0.343	0.474
Not attended school(D)	0.022	0.146
Primary education(D)	0.149	0.356
Secondary education(D)	0.775	0.417
Tertiary education (D)	0.053	0.224
Managers (D)	0.077	0.267
Professional (D)	0.063	0.242
Technologists(D)	0.069	0.254
Clerks(D)	0.037	0.189
Labourers (D)	0.196	0.396
Services sector (D)	0.092	0.289
Agricultural workers (D)	0.184	0.387
Production sector workers (D)	0.257	0.436

Source: Researcher's calculation using HIES 2016 micro-data

Table 2: Logit Regression for factors affecting non-communicable diseases of employed persons

Variables	Coefficient	Marginal Effect	SD	Z	P>Z
Residential sector					
Rural sector (D_1)	-0.208	-0.025	0.006	-4.530	0.000
Estate sector(D_2)	-0.443	-0.054	0.015	-3.750	0.000
Age(X_1)	0.164	0.020	0.001	16.410	0.000
Age square(X_2)	-0.001	0.000	0.000	-9.990	0.000
Marital status					
Married (D_3)	0.048	0.006	0.009	0.680	0.496
Ethnicity					
Sri Lankan Tamil (D4)	0.026	0.003	0.006	0.510	0.607
Indian Tamil (D_5)	0.235	0.029	0.014	2.020	0.044
Muslim (D_6)	0.082	0.010	0.008	1.240	0.216
Other (D_7)	0.321	0.039	0.030	1.330	0.183
Gender					
Female (D_8)	0.227	0.028	0.004	6.550	0.000
Education level					
No schooling (D_9)	0.070	0.009	0.012	0.700	0.482
Primary education (D_{10})	0.020	0.002	0.005	0.450	0.650
Occupation					
Technician (D_{11})	-0.140	-0.017	0.010	-1.770	0.077
Clerical (D_{12})	-0.451	-0.055	0.014	-3.870	0.000
Elementary workers (D_{13})	-0.235	-0.029	0.007	-4.230	0.000
Services sector employee (D_{14})	-0.028	-0.003	0.008	-0.410	0.678
Agricultural workers (D_{15})	-0.096	-0.012	0.006	-1.820	0.069
Production workers (D_{16})	-0.034	-0.004	0.006	-0.680	0.497
Constant	-6.904		0.244	-28.300	0.000

Source: Researcher's calculation using HIES 2016 micro-data

Significance level 10%

Note: Base category, being unmarried, Sinhala, male, living in the urban sector, having secondary or tertiary education, being a managerial or professional employee

According to Table 2, being a person from the rural sector and being a person from the estates decrease the probabilities of having non-communicable diseases in comparison to the base category, including the urban sector. That can be mainly affected by unhealthy food consumption patterns, (using instant and junk foods), environmental pollution leading to breathing and other health issues, lack of hard work or physical activities, and higher rates of mental stress.

Good dietary patterns in the rural sector when compared to the urban sector, in other words not becoming used to instant dietary patterns, limiting the consumption of artificial foods, mostly engaging in their livelihoods by using their physical labour can be stated as the reasons for the lower risks in non-communicable diseases in the rural sector. The lifestyle of rural residents is away from the monotonous patterns and hence they are free from poisonous gases that emerge with urbanisation, leading to lesser possibilities for the occurrence of non-communicable diseases. Due to the above reasons, non-communicable diseases are lower among people living in rural areas. This was further proved by Tawa et. al. (2011) with their findings on the factors associated with NCDS as the changing lifestyles of people due to globalization and urbanisation. The World Health Organization (2011) also highlighted that urbanisation causes to convert of traditional health practices into unhealthy practices. Revathi and Johnson (2019) also confirmed the importance of this living sector in general, regarding the risks of non-communicable diseases.

The age status of an individual was considered as the main factor for the occurrence of non-communicable diseases. Age increases the likelihood of having non-communicable diseases at a decreasing rate and this finding was aligned with the general biological deprivation of people with the age. Spontaneous physical weaknesses and changes in mental status with ageing also affect this. This is confirmed by the research done by Van Minh et al., (2008), Kasturiratne et al., (2009), and Ahmed et al., (2009). Tawa et. al. (2011) have also found that chronic illnesses are the highest category among the rural elderly population in Vietnam. Further,

it stated that age positively affects chronic and non-communicable diseases due to various complications with ageing (Ahmed et al., 2009).

The probability of Indian Tamils having non-communicable diseases was relatively higher than the base category, including Sinhalese. One of the key reasons for this is the differences in their dietary (alcohol, meat and oil consumption) and cultural patterns when compared to the Sinhalese. Research carried out by Teh et al. (2014) has revealed that the chances for non-communicable diseases like diabetes, blood pressure, cholesterol, etc. differ according to the various ethnicities living in Malaysia, aligned with the findings of the current study.

In gender aspects, it shows through the Logit results that being female causes to increase the possibilities of non-communicable diseases than men. Obesity after childbearing and unhealthy food patterns could affect this, as previously proved by researchers such as Mwangi et al. (2020), who identified the high prevalence of obesity among middle-aged persons, and higher obesity among females.

Regarding the occupational characteristics of people, those employed with physical hardships have a lower probability of getting non-communicable diseases compared with the base category, including managerial and professional workers.

Managerial and professional persons engage in white-collar jobs burn lower amounts of carbohydrates and fats as they are seated for a longer number of hours during their heavy working schedules. Similarly, they face comparatively high mental stresses, leading them to become victims of non-communicable diseases. Especially, those with occupations with physical hardships, including elementary workers and agricultural workers, show a considerably low rate for the presence of non-communicable diseases than the base category in Sri Lanka. A study in Hong Kong too reported the high prevalence of diabetes in the transport sector and among air traffic controllers and highlighted a high percentage of deaths due to heart ailments among transport sector workers, the low levels of physical activities, irregular work schedules, and the high mental stress in these professions being the reasons for this (Ng, 1988).

Table 3 Logit Regression for factors affecting diabetes of employed persons

Variables	Coefficient	ME	SE	Z	P>Z
Residential Sector					
Rural sector (D_1)	-0.566	-0.020	0.003	-7.430	0.000
Estate sector (D_2)	-1.042	-0.037	0.011	-3.240	0.001
Age (X_1)	0.298	0.011	0.001	12.560	0.000
Age square(X_2)	-0.002	0.000	7.850	-9.970	0.000
Marital status					
Married (D_3)	0.777	0.028	0.007	3.930	0.000
Ethnicity					
Sri Lankan Tamil (D_4)	-0.178	-0.006	0.004	-1.770	0.076
Indian Tamil (D_5)	-0.123	-0.004	0.011	-0.400	0.690
Muslim & Others(D_6)	0.123	0.004	0.004	1.120	0.263
Gender					

Female (D_7)	-0.030	-0.001	0.002	-0.450	0.655
Education level					
No schooling (D_8)	-0.700	-0.025	0.009	-2.890	0.004
Primary education (D_9)	-0.540	-0.019	0.003	-5.820	0.000
Occupation					
Technician (D_{10})	0.023	0.001	0.005	0.180	0.859
Clericals (D_{11})	-0.573	-0.020	0.008	-2.610	0.009
Elementary workers (D_{12})	-0.572	-0.020	0.004	-5.420	0.000
Services sector employee (D_{13})	-0.095	-0.003	0.004	-0.840	0.400
Agricultural workers (D_{14})	-0.634	-0.023	0.004	-6.380	0.000
Production workers (D_{15})	-0.206	-0.007	0.003	-2.390	0.017
Constant	-12.030		0.589	-20.430	0.000

Source: Researcher developed using HIES 2016 micro-data

Significance level10%

Note: Base category: being unmarried, Sinhala, male, living in the urban sector, having secondary or tertiary education, being a managerial or professional employee

According to Table 3, the probability of diabetes reduces by 2% for rural residents and 3% for estate residents compared to the base category, including urban residents. Lifestyles and food patterns in the urban sector are highly sensitive to diabetes in Sri Lanka. Therefore, it is clear that the living sector affects the occurrence of diabetes. According to Tawa et al. (2011), the spread of non-communicable diseases may increase with the changing lifestyles of the people due to globalisation and urbanisation.

According to the results, diabetes will increase with age at a decreasing rate, showing high sensitivity of the disease for the elder people. As revealed by Kuperstein et al. (2001) there is a positive inter-relation between age and diabetes and the findings of this study are also aligned to that.

Being married also increases the probability of having diabetes in comparison to the base category. Mental stresses due to family commitments and the biological effects and obesity due to childbearing for women could also affect these higher rates.

Sri Lankan Tamils show a negative relationship with diabetes than the base category, including Sinhalese. Healthy food styles, hard work, and lower meat consumption could also affect this nature.

When considering the education levels, having primary education or non-schooling decreases the likelihood of having diabetes compared to the base category, including secondary or tertiary educated people. Higher educated people engage in white-collar jobs with lower physical hardships and are limited to office work. Those with no schooling and the primary educated group have less likelihood of being victims of diabetes as most of them are working in elementary occupations, including wage labour, and as domestic workers.

Further, when considering the job compared to the base category, it is evident that diabetes is lower among those who are clericals, elementary workers, workers in the agricultural sector, and the production sector. Managerial and professional persons who engage in white-collar jobs show the highest prevalence of diabetes than those in the above groups of employees, thus showing the usual reasons for following unhealthy dietary patterns, environmental pollution, and lack of physical exercise.

Table 4: Logit Regression for factors affecting blood pressure of employed persons

Variables	Coefficient	ME	SD	Z	P>Z
Residential Sector					
Rural sector (D_1)	-0.247	-0.008	0.003	-2.760	0.006
Estate sector (D_2)	-0.196	-0.006	0.008	-0.820	0.412
Age(X_1)	0.256	0.008	0.001	10.570	0.000
Age Square (X_2)	-0.002	0.000	7.101	-7.510	0.000
Marital status					
Married (D_3)	0.340	0.011	0.006	1.960	0.050
Ethnicity					
Sri Lankan Tamil (D_4)	0.108	0.004	0.003	1.080	0.281
Indian Tamil (D_5)	0.381	0.012	0.008	1.600	0.110
Muslim & Others (D_6)	0.291	0.010	0.004	2.370	0.018
Gender					
Female (D_7)	0.499	0.016	0.002	7.430	0.000

Education level					
No schooling (D_8)	-0.274	-0.009	0.006	-1.540	0.124
Primary education (D_9)	-0.172	0.006	0.003	-2.090	0.036
Occupation					
Technicians& Clericals(D_{10})	-0.075	-0.002	0.005	-0.520	0.605
Elementary workers (D_{11})	-0.260	-0.008	0.004	-2.390	0.017
Agricultural workers (D_{12})	0.014	0.000	0.003	0.140	0.886
Production workers (D_{13})	0.014	0.000	0.003	0.140	0.888
Services sector employee (D_{14})	-0.012	0.000	0.004	-0.100	0.924
Constant	-12.040		0.618	-19.500	0.000

Source: Researcher developed using HIES 2016 micro-data

Significance level10%

Note: Base category: being unmarried, Sinhala, male, living in the urban sector, having secondary or tertiary education, being a managerial or professional employee

The key factors associated with the prevalence of high blood pressure are residential sectors, age, ethnic groups, education, and occupational categories aligned with the common non-communicable disease model.

Based on the results in Table 4, there are no impacts of high blood pressure on those living in the estate sector, while the rural sector shows significant negative impacts than the urban base category. The common findings of the positive relationship between the prevalence of high blood pressure and age are established even through this status, and this increment is at a decreasing rate as usual.

When examining the effects of marital status on blood pressure, the probabilities for blood pressure in a married person increase by 1.1% than in an unmarried person. This could be affected by the physical and mental hardships and family responsibilities after marriage.

It was also found that ethnicity affected the occurrence of blood pressure in Sri Lanka. The results obtained made it clear that compared to the Sinhalese, the risks of blood pressure were higher among the Muslims and others. Accordingly, the Logit marginal impact coefficient related to Muslims and others is 0.01. This means, when the other factors affecting blood pressure are constant, in comparison to the base category, being a Muslim and others increases the probability for blood pressure by 1%. The differences in the dietary patterns among the various ethnicities and the differences caused by cultural impacts are the main factors that affect this.

When considering gender, according to the Logit marginal impact, the women's coefficient is 0.0163. That means the prevalence of high blood pressure is higher among women in comparison to men.

Further, it can be realised from the above results that in comparison to persons with tertiary or secondary education levels, the risks for high blood pressure are lower among persons with lower education levels and high among the higher educated base category. Being workaholics, long work hours, and having physical mental hardships for long periods could affect this.

Among occupation categories, it is evident that blood pressure is lower among elementary workers. This is in contrast to the managerial and professional persons who are engaged in white-collar jobs and who face comparatively higher mental pressures, thus resulting in a higher probability of high blood pressure among them, mainly due to irregular work schedules and higher occupational-specific mental stresses which are symptoms of high mental stress among them (Ng, 1988). Pereira et al., (1998) found that chronic high blood pressure and coronary heart diseases were high among men and women in jobs with a higher prevalence of mental and social stresses in Finland, while Biswas et al. (2019) found that the prevalence of high blood pressure and overweight/obesity is considerably high among people with higher education, those living in the urban sector, being non-manual workers and enjoying wealthy socio-economic backgrounds.

Therefore, different socio-economic, demographic, and spatial factors impact the prevalence of non-communicable diseases, as expected by the hypothesis of the current study. The next section explains the important contributions and policy recommendations for the study.

CONCLUSION AND POLICY RECOMMENDATIONS

This study explores the socio-economic demographic and spatial factors associated with non-communicable diseases of employed persons in Sri Lanka, with a special focus on two key NCDs, including diabetes and high blood pressure. The study used household income and expenditure survey data (2016) conducted by the Department of Census and Statistics in Sri Lanka. Three Logit regression models were estimated to identify the socio-economic determinants of non-communicable diseases of employed persons in general, for diabetes and high blood pressure separately. According to the findings of the study, under the overall factors for the occurrence of non-communicable diseases, age, being female, and being an Indian Tamil person positively affect the occurrence of non-communicable diseases; while the factors, including being rural or estate residents, age square, being clerical workers and elementary workers, negatively affect the occurrence of non-communicable diseases.

The prevalence of diabetes mainly affected the residential sector (rural/estate), age, age squared, being no schooling, being a person with primary education, being clerical workers, elementary workers, agricultural workers, and being production workers with physical hardships. Age and being married have significantly positive relationships while being a rural resident, estate resident, being a Sri Lankan Tamil, having no schooling or having primary education and some

occupation categories (clerical, elementary workers, agricultural workers, production workers) have negative relationships with the prevalence of diabetes of employed persons.

Meanwhile, the study identified the important factors associated with the occurrence of blood pressure of a person and that was negatively affected by the residential sector (in the rural sector), with age squared, being a person with primary education, being elementary workers. Age, being a female, being a married person, being a Muslim, or other people positively affect the occurrence of the blood pressure among employed persons.

The policy suggestions were made based on the results and discussion of the current study as follows:

As identified by the study, the prevalence of NCDs among urban employed persons was identified as a key finding and the policies, while pathways for physical exercises, safeguarding the quality of natural air, and establishing greenery and gardens should be provided by relevant authorities including the Urban Development Authority to promote good health among urban residents. Developing exercising facilities within workplaces and increasing the availability of restaurants for nutritious foods, especially for working women, managerial and professional employees are other important policy insights in this aspect. Since the elderly population of Sri Lanka is expected to increase by 2030, a systematic public insurance scheme should be launched through the Ministry to introduce an insurance scheme and a health allowance for the elderly, etc. to minimise the rising health costs due to non-communicable diseases. Age causes an increase in NCDs like diabetes and high blood pressure, according to the findings of the current study. Proper facilities must be assured for the the employed persons who suffer from non-communicable diseases and special facilities should be provided for them to obtain the necessary medicinal drugs by the working place.

To ensure the prevention and control of non-communicable diseases, necessary advice and facilities for holding monthly health clinics and free health examinations should be provided through the Ministry of Health to all state institutions, organizations, and workplaces in Sri Lanka. The youth should be involved in programmes conducted by the Ministry of Health to control the use of liquor and tobacco. Suitable policies should be formulated and implemented to further promote the healthy diet (using carbonic fertilisers in the agricultural sector), while the Ministry of Agriculture and the Ministry of Health should launch joint mechanisms to supply adequate quantities of nutritious foods and also to distribute them among the urban employed population.

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