SOCIO-ECONOMIC IMPLICATIONS OF DIABETES ON HOUSEHOLD EXPENDITURE IN PUNJAB

Thesis Submitted for the Award of the Degree of

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in
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By

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PUNJAB
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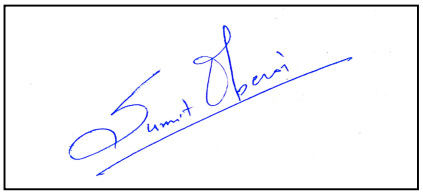
Declaration

I, Sumit Oberoi, hereby declare that the work presented herein is done originally by me and has not been published or submitted elsewhere for the requirement of a degree programme.

Any literature, data or work done by others cited in this dissertation has been given due acknowledgement and is listed in the reference section.



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Certificate

This is to certify that the thesis titled "**Socio-Economic Implications of Diabetes on Household Expenditure in Punjab**" carried out by Mr. Sumit Oberoi, Ph.D. research scholar at Lovely Professional University, under my guidance and supervision. This thesis is being submitted by him in the partial fulfilment of the requirements for the award of the Doctor of Philosophy in Economics from Lovely Professional University.

His thesis represents his original work and is worthy of consideration for the award of the degree of Doctor of Philosophy.

Dr. Pooja Kansra
Professor & Head of Department
Date: 27th May, 2022

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नास्ति विद्यासमो बन्धुर्नास्ति विद्यासमः सुहृत् ।।
नास्ति विद्यासमं वित्तं नास्ति विद्यासमं सुखम् ॥

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S. NO.	DESCRIPTION	ABBREVIATION
1.	Coronary Artery Disease	CAD
2.	Catastrophic Healthcare Expenditure	CHE
3.	Cost of Diabetes	COD
4.	Cost of Illness	COI
5.	Disability Adjusted Life Year	DALY
6.	Enumeration Block	EB
7.	Fibro-Calculous Pancreatic Diabetes	FCPD
8.	Gestational Diabetes Mellitus	GDM
9.	General Practitioner	GP
10.	Gross Domestic Product	GDP
11.	Indian Council of Medical Research	ICMR
12.	International Diabetes Federation	IDF
13.	Logistic Regression	LR
14.	Low and Middle-Income Countries	LMIC
15.	Mean Positive Overshoot	MPO
16.	Ministry of Health and Family Welfare	MoHFW
17.	Non-Communicable Disease	NCD
18.	Non-Governmental Organizations	NGO
19.	Odds Ratio	OR
20.	Out-of-pocket	OOP
21.	Primary Health Care	PHC
22.	Primary Sampling Unit	PSU
23.	Peripheral Vascular Complication	PVC
24.	Quality Adjusted Life Year	QALY
25.	Standard Deviation	SD
26.	Socio-Economic Status	SES
27.	Simple Random Sampling	SRS
28.	Secondary Sample Unit	SSU
29.	Transient Ischemic Attack	TIA
30.	Tropical Calcific-Pancreatitis	TCP
31.	World Health Organization	WHO

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ABSTRACT

The mechanism of determining diabetes is multitudinous and multi-factorial, with biological, physical, behavioural and socio-economical determinants as imperative ones (Shrivastva et al., 2016). Globally, diabetes is acknowledged with the status of public health priority. Being a metabolic syndrome, diabetes accounts for prolonged and multifarious repercussions such as progression of microvascular and macrovascular complications, loss of quality life, health deterioration and increasing economic burden (Nath et al., 2020). Diabetes affects people at their productive years, reduces people's life expectancy and financially impoverishes households (Zimmet et al., 2001).

The global assessment of adults living with diabetes was 463 million in 2019 (20-79 years), which is expected to be 700 million by the year 2045 (International Diabetes Federation, 2019). Diabetes alone caused healthcare expenditure of US$760 billion in 2019 and 79 percent of the diagnosed individuals are natives of low and middle-income economies. The healthcare systems in such economies are not endowed to handle the escalating menace of diabetes (International Diabetes Federation, 2019). An enormous amount of US$294.5 billion is spent by the United States of America in a year on diabetic patients and its associated complications followed by the Republic of China (Peter and Lipska, 2016). It was estimated that 8.4 percent of the total health spending in the Southeast Asian region is only spent on treatment and medicare of diabetes. India is the epicenter of diabetes and constitutes 87.8 percent of diabetic patients in the Southeast Asian region (Nath et al., 2020). Consequently, epidemiological changes in diabetes have an enormous economic burden on India. Healthcare expenditure at the country-level on diabetes after revising purchasing power in India was US$31 billion in 2017, thereby pushing India at fourth position trailed by the USA, Republic of China and Germany.

Understanding the provision, utilization of healthcare services and determinants of catastrophic healthcare expenditure is a difficult task, especially when the healthcare sector is diverse. Thus, chronic nature and the rise in the epidemic of diabetes have persistent consequences on the economy and health status. Therefore, managing diabetes and its comorbidities is a massive challenge in Punjab due to several issues such as the dearth of systematic and empirical analysis to understand the economic burden, healthcare utilization and coping strategies of diabetes employed by households

in Punjab. Therefore, the main aim of the present study is to examine the "*Socio-economic Implications of Diabetes on Household Expenditure in Punjab*".

Objectives of the Study

1. To study the awareness about diabetes risk factors and prevention strategies among households;
2. To identify the socio-economic determinants of diabetes among households;
3. To estimate the cost of diabetes among households;
4. To study the coping strategies employed by households to deal with economic cost of diabetes;
5. To identify the determinants of catastrophic healthcare expenditure of diabetes among households.

Research Design

The present study is a descriptive, cross-sectional study conducted in the north Indian state of Punjab. Data was collected from the respondents of both rural and urban areas through a self-structured questionnaire adapted from "*WHO STEPwise approach to surveillance*".

The study used "*multi-stage area sampling*" technique and in the primary phase, Punjab was geographically clustered in three different regions such as Doaba, Majha and Malwa. In the subsequent phase, 50 percent of the districts were selected from each of the geographical clusters based on high and low per-capita income levels. Amritsar and Gurdaspur districts were selected from the Majha region. Districts such as Jalandhar and S.B.S were selected from the Doaba region. Lastly, six districts were selected from the Malwa region, such as Ludhiana, Ferozpur, S.A.S Nagar, Mansa, Muktsar and Ropnagar.

Further from each selected district, both rural and urban areas were selected. A three-stage design was employed in rural and urban areas of Punjab. In the first stage, one town/city was selected based on the highest number of hospitals from urban area. In the second stage, 10 percent of the wards were selected from each selected city/town randomly and one enumeration block (EB) from each sampled ward. Lastly, households were randomly selected within each enumeration block (EB) using simple random sampling without replacement approach.

For rural area, a three-stage procedure was followed. In the primary phase, one development block was selected based on the highest number of primary healthcare centers (PHC). In the subsequent stage, two villages were selected from a development block. Finally, households were selected randomly within each village using simple random sampling without replacement approach.

The data analysis was done with the help of Chi-square, Mann-Whitney U test, Kruskal Wallis test, mean, median, headcount, overshoot, mean positive overshoot (MPO) and logistic regression. Awareness about diabetes and its association with socio-demographic variables in Punjab was examined with the help of percentages and chi-square. The "Mann-Whiney U" and "Kruskal Wallis tests" are used to examine the awareness about diabetes risk factors and prevention strategies by socio-demographic variables in Punjab. The socio-economic determinants of diabetes in both urban and rural Punjab were identified by using logistic regression. The profile of the study respondents was analyzed using percentages. Healthcare utilization, cost and coping strategies of diabetes were examined at the inpatient and outpatient levels. The cost of diabetes was estimated on the basis of the healthcare facility utilized, type of treatment, accessibility to the healthcare facility, reason for the choice of health facility, outpatient and inpatient costs of diabetes. The analysis of cost estimation and coping strategies was done by using mean, median, percentage, Mann-Whiney U and Kruskal Wallis test. Lastly, headcount, overshoot and mean positive overshoot (MPO) were used to estimate the incidence and intensity of catastrophic health expenditure. The key determinants of catastrophic health expenditure of diabetes were identified using logistic regression.

Findings of the Study

Analysis of the awareness about diabetes risk factors and prevention strategies among households revealed that the majority of respondents in Punjab had a moderate awareness regarding what diabetes actually is? and there exists a lack of knowledge regarding different types of diabetes. Out of different sources of awareness, doctors were the main source from where diabetics learn most about diabetes. It was found that higher awareness about diabetes was significantly associated with the region, marital status, history of diabetes, age, education, work status and income of the respondents in Punjab. The majority of diabetics perceived risk factors such as lack of exercise, obesity, smoking, history of diabetes and less consumption of fruits and vegetables

increases diabetes in Punjab. Moreover, prevention strategies such as stopping oneself from alcohol consumption, regular exercise, smoking cessation, proper health education and regular monitoring of blood glucose were observed to be the top behavioral and intervention strategies in Punjab. The results of the "*Mann-Whitney U*" and "*Kruskal-Wallis test*" exhibits a significant difference in the level of awareness about diabetes risk factors was witnessed based on region, age, work status, education and income in Punjab.

The socio-economic determinants are perceived as the foremost predictors of the incidence of diabetes. Profile of the diabetics exhibits that out of 720 respondents in Punjab, 67 percent were from the urban area and 33 percent were from the rural area. It was found that 50 percent of the respondents were from the 41-60 years of age group followed by 60 years and above, 21-40 years and up to 20 years. A large number of respondents were businessmen followed by homemakers, salaried, retired, students and others respectively in Punjab. It was found that 53 percent of respondents were from joint family and 54 percent of respondents had a history of diabetes in the family. Moreover, 30 percent of the diabetics in the family were mothers followed by siblings (28 percent), father (23 percent), both parents (14 percent) and children (5 percent). The results of logistic regression found that age, marital status, education, work status, income, history of diabetes and complications were the key socio-economic determinants of urban Punjab. Whereas age, marital status, education, work status, income and history of diabetes in the family were identified as the key socio-economic determinant of diabetes in rural Punjab. The results revealed that with a rise in the level of education, the probability of incidence of diabetes reduces significantly in both rural and urban Punjab. Similarly, incidence of diabetes increases with the rise in complications.

Healthcare utilization, cost and coping strategies of diabetes were estimated at outpatient and inpatient care in Punjab. The analysis exhibits that a large proportion of diabetic respondents utilized private hospitals and private clinic facilities for the treatment of diabetes and its associated complications in Punjab. It was found that respondents with a high level of income incurred three times higher costs of diabetes as compared to respondents with income less than ₹15000. Similarly, respondents below 20 years of age witnessed 1.5 times higher outpatient costs as compared to old age

respondents. It was observed that expenditure on medicines reports the highest proportion of cost followed by diagnostic expenditure, consultation fee, transportation cost, wage loss of a patient and wage loss of accompanying person. However, complications such as eyes problem (retinopathy), heart disease (CAD), blockage in blood vessels (PVD) and tooth infections (periodontitis) substantially predict the higher direct and indirect cost of diabetes. For inpatient care, diabetic respondents with old age and comorbidities incurred 2.5 times higher cost of treatment as compared to young respondents in Punjab. "*Buying part of medicines to cope with diabetes*" and "*intra-household labor substitution to compensate for any labor loss*" were the most prominent behaviour-based coping strategies adopted by diabetic patients in Punjab. The results of the analysis revealed that under asset-based coping strategies, 95 percent of the diabetic respondents preferred utilizing "*mobilizing the available cash in hand*" and "*using past savings to meet the healthcare expenses of diabetes*." Lastly, analysis highlighted that a very small proportion of respondents utilized assistance -based coping strategies.

With the rise of epidemiological conditions, cost of treating and managing diabetes is increasing. Therefore, out-of-pocket payments (OOP) by households leads to catastrophic healthcare expenditure. An attempt was made to identify the determinants of catastrophic healthcare expenditure of diabetes among households in Punjab. The key determinants of catastrophic healthcare expenditure of diabetic respondents were identified by logistic regression. At 5 percent threshold level region, gender, age 21-40 years, others work status, income ₹15,000- ₹30,000 and complication witnessed significant association with catastrophic healthcare expenditure. Similarly, at 10 percent threshold level region, 60 years and above age, homemaker, income ₹15000-₹30000, ₹30000-₹45000, income ₹45000-₹60000 and complications found to be associated with catastrophic healthcare expenditure. Lastly, at 20 percent threshold level region, gender, homemaker, income ₹15000- ₹30000, income ₹30000- ₹45000 and complications witnessed a significant association with catastrophic healthcare expenditure.

Conclusion

Awareness regarding diabetes mellitus, risk factors, prevention strategies and costs helps to design innovative awareness programs and government campaigns to educate individuals about the consequences of sedentary lifestyle, changing epidemiology of diabetes and lifestyle modifications. Thus, there is a dire need to create awareness about diabetes and its complications through mass media campaigns such as the distribution of pamphlets, advertisements in magazines, newspapers, television, radio, etc. Awareness programmes should be designed at offices, public meetings, religious gatherings, schools, colleges and especially in women's organisations. Considering the economic burden of diabetes in Punjab, it is imperative to strengthen the government healthcare infrastructure to detect the early onset of diabetes and provide uniform healthcare facilities. It was observed that expenditure on medicine reports the highest cost proportion; therefore, medicines should be made available at subsidized rates through '*Jan Aushadhi Kendra*.' The result of the study directs that respondents with macrovascular complications and respondents below 20 years of age incurred high out-of-pocket expenditure. Therefore, outpatient costs should be reimbursed under the '*Ayushman Bharat-Sarbat Sehat Bima Yojana*'. The findings of the study highlighted that a very small proportion of respondents utilize assistance-based coping strategies. Thus, early detection of diabetes mellitus among high-risk individuals and effective management of identified patients should be prioritized to reduce the catastrophic health expenditure.

CHAPTER I
INTRODUCTION

1.1 Background of Diabetes

"*Diabetes is a metabolic syndrome that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces.*"

- International Diabetes Federation (2019)

Diabetes mellitus is described as the "*too great emptying of urine*", finds its first reference in the ancient Egyptian text named "Hey-Ra" dating back to 1552 B.C. (MacCracken et al., 1997). According to Lakhtakia (2013, p. 368), "*Indian physicians named the disease as 'Madhumeha' because ants were attracted to the urine*". Sushruta and the prominent Indian surgeon Charaka identified type-1 and type-2 diabetes back at 400-500 A.D. Acknowledged for more than 3 millennia, the first recorded detailed description about diabetes was available in the first century (150 A.D.) by renowned Greek physician "Aretaeus" of Cappadocia a province of Roman empire.

Another distinguished Persian philosopher and physician Avicenna (980-1037) in his famous text "*Canon of Medicine*" mentioned about the abnormal symptoms such as anomalous appetite and discussed about term 'gangrene' (Dobson, 1776). The Latin word "Mellitus" (means honey) was first used and devised by Sir. John Rollo, a British surgeon in 1798. Therefore, physicians from 1700-1800s developed understanding about diabetes and possible dietary alterations to prevent from diabetes. Modern physician Frederick Banting from Canada, was the pioneer in treating diabetes with insulin. In 1922, Frederick Banting and his team succeeded in treating diabetic patients with insulin for which they were awarded with "*Nobel Prize in Medicine*".

1.2 Global Epidemiology of Diabetes

Globally, diabetes is conceded as a major chronic disease that doesn't consider any ethnic background and monetary levels. Diabetes touches individuals in the beginning of their productive age, impoverishes households and reduces the life expectancy (International Diabetes Federation, 2017). Diabetes mellitus is an epidemic ailment that doesn't consider any boundaries and social class (Unnikrishnan *et al.*, 2016). The menace of diabetes drains the national healthcare budget, decreases productivity and causes catastrophic healthcare expenditure for the most vulnerable households

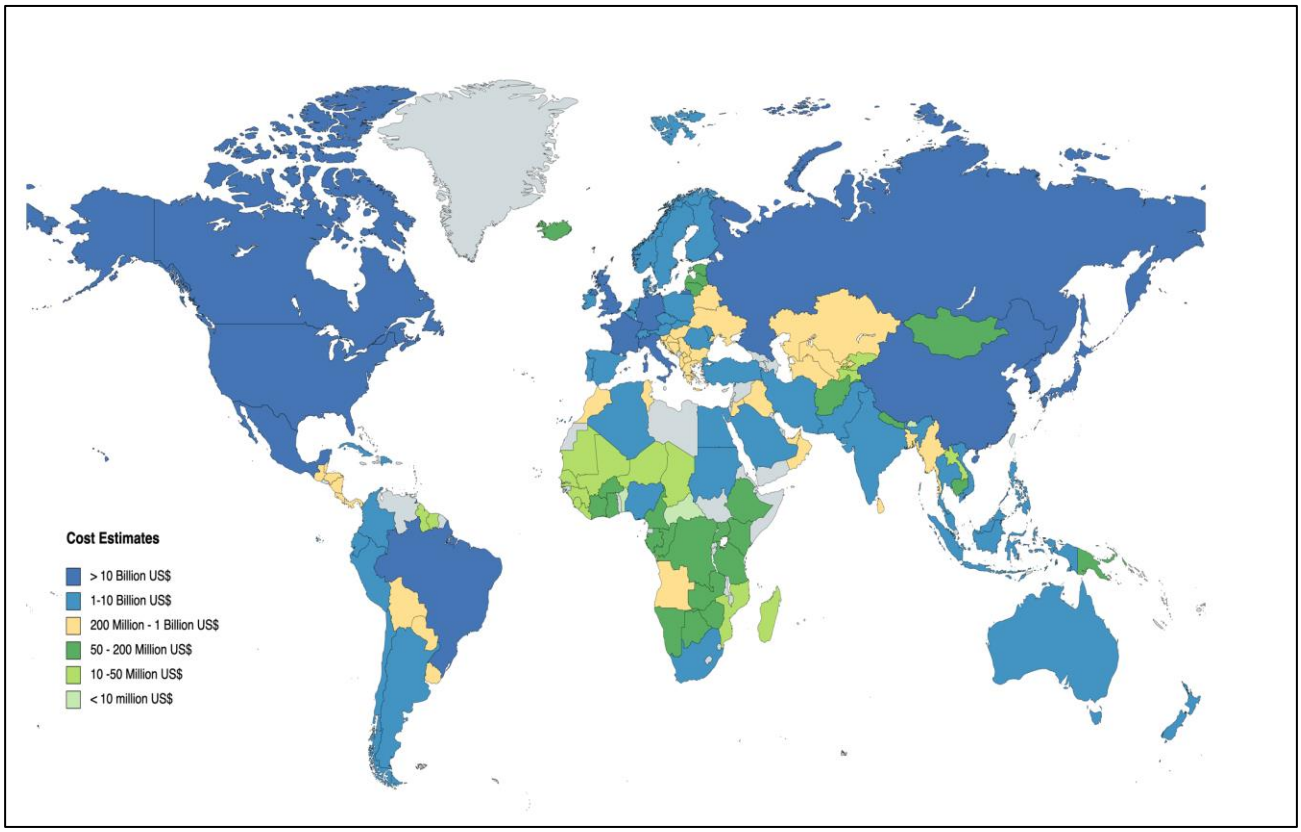
(Jonsson, 1998).

Diabetes is the obtrusive universal health emergency in both developed as well as developing nations and has been titled as '*Public Health Priority*' (Zimmet *et al.,* 2001). In 2000, the global estimate of diabetes prevalence was 151 million for adults of age group 20-79 years. The estimates showed an exponential rise in adults from 285 million in 2009 to 463 million by 2019 (International Diabetes Federation, 2019). Globally, diabetes mellitus is considered as one of the leading cause of morbidity and mortality. According to Pradeepa and Mohan (2021), mortality caused by diabetes accounted to be 1.6 million globally and it was the eighth leading cause of mortality among both males and females. Therefore, diabetes has emerged as a major cause of mortality in individuals younger than 60 years.

Diabetes also accounts for 2-3 percent of the total healthcare budget in every country (Jonsson,1998). Global health spending to diagnose, prevent and treat diabetes mellitus and its associated complications was somewhat US$ 232 billion for 2007. In 2013, the global healthcare cost was US$ 548 billion and by 2035 the cost was expected to increase US$627 billion (World Health Organization, 2016). According to International Diabetes Federation (2019), "*The rise in this expenditure was USD 727 billion in 2017 for adults aged 20–79 years. In 2019, total diabetes-related health expenditure will reach USD 760 billion. This represents a 4.5% increase on the 2017 estimate*".

Contemplating the fact, the epidemiological alteration of diabetes mellitus has a gargantuan economic menace (Oberoi and Kansra, 2020). Diabetes mellitus constitutes a gigantic economic burden globally. Asian economies struggle the highest economic burden of diabetes because roughly 80 percent of diabetes cases happen to occur in Asian economies (Ramachandran *et al.*, 2012). Based on country level cost estimates, countries such as America (US$ 294 billion), China (109 US$ billion) and Brazil (US$ 109 billion) experience the highest diabetes-related healthcare expenditure (Figure 1.1).

Figure: 1.2 Diabetes-Related Healthcare Expenditure (US$) in 2019



Source: Author compilation based on data adapted from the IDF, Atlas-9.

1.3 Epidemiology of Diabetes in India

According to the International Diabetes Federation (2019), "*India is the epicentre of diabetes mellitus and it was found that in 2019 India has the second-largest populace of 77 million diabetic patients, after China. And the figure is expected to be just double 134 million by 2045*". Considering the fact, the epidemiologic transition of diabetes has a colossal economic burden (Cho *et al.,* 2018). Over the past three decades, specifically, since economic reforms of 1991 lifestyle modification of the average Indian citizen has undergone a comprehensive transformation (Ramachandran, 2007).

An exorbitant rise has been witnessed in India's per capita income from $381 in 1990 to $1,670 by 2016, during the same time frame patients with diabetes also augmented by 123 percent (Sanghera, 2018). The estimated country-level healthcare expenditure on diabetes mellitus in India after amending purchasing power difference was 31 billion US dollars in 2017, pushing India at fourth-place globally after the United States of America, China and Germany. Looking at the economic burden, in

India diabetes alone exhausts 5 to 25 percent share of an average Indian household earning (Yesudian *et al.,* 2014; Kansra 2018).

Despite the economic turnaround in India, public health spending remains to be lowest in the world. Current healthcare spending in India is merely 1.4 percent of the GDP, of which the budget for treating, preventing and controlling diabetes mellitus is a small portion (World Health Organization, 2016). Thus, in the absence of government support households meet their medical expenditures from their own pockets. The excessive out-of-pocket (OOP) expenditure has mounting monetary burden on the economically underprivileged and deprived segment of the population (Ramachandra *et al.,* 2007). Out-of-pocket (OOP) spending constitutes to be somewhat 70 percent of total health spending (Tripathy et al., 2018). Thus, utilizing healthcare amenities in India for the most part is provided by private healthcare system.

The traces of cost-of-diabetes literature was first observed in a Bangalore based study in 1999, the direct and indirect annual cost was reported to be ₹15460 and ₹3572 (Rayappa et al., 1999). Numerous population-based studies from 2000 till 2009 assessed median yearly direct cost to be ₹9053, ranging from ₹7070 to ₹14000 and median yearly indirect cost was ₹4681, ranging from ₹2435 to ₹12756 (Shobhana et al., 2002; Grover et al., 2005 and Ramachandran et al., 2007). A swift augmentation in the cost-of-diabetes (COD) was witnessed from 2010 till 2020, which estimated median yearly direct cost to be more than twice accounting to be ₹21082, ranging from ₹4282 to ₹76779 and median yearly indirect cost was ₹7443, ranging from ₹1198 to ₹30670 (Oberoi and Kansra, 2020). The annual median direct & indirect overall cost-of-diabetes reported in the current study is ₹34100 and ₹4200.

According to International Diabetic Federation (2019), expenditure on diabetes in India at per person level was assessed to be ₹6900 (US$92), significantly less than reported by various available literature and also than the existing study. Therefore, it's completely pertinent having regard to the fact that South Asian population especially Indians got more affected by diabetes and its comorbidities a decade earlier, engendering to "*quality-adjusted life-year*" (QALY) and long treatment duration (Misra et al., 2017; Misra et al., 2019).

1.4 Types of Diabetes Mellitus

The classification and diagnosis of diabetes mellitus is a complex process and has been subject of much discussion and debate over several decades. Diabetes has been majorly classified as Type-I, Type-II, Gestational Diabetes Mellitus (GDM) and Fibro-calculous pancreatic diabetes (FCDP) (International Diabetes Federation, 2017). Diabetes results from a genetic tendency and from lifestyle modifications, particularly those of the western lifestyle characterised by a high calorie diet and low physical activity (Mohan *et al.,* 2008).

1.4.1 Type-I Diabetes

According to Todd (2010, pp. 457), "*Type-I diabetes mellitus is commonly believed to be triggered by obliteration of insulin generating pancreatic βeta cells*". Usually, Type-I diabetes is deemed as condition in teenagers and juveniles, but such opinion has altered over the period of time and age as symptomatic onset is not a risk factor. According to Atkinson *et al.* (2014, pp. 69), "*Polydipsia, polyphagia and polyuria in accompany with excess glucose level persist as a symbol in kids, juveniles and to somewhat in adults. A spontaneous want for exogenous insulin is a trait of Type-I diabetes mellitus*". Physical, psychological & socio-economic burden of Type-I diabetes is challenging for reckon. Thus, attaining normoglycaemia is an imperative curative objective for Type-I diabetic patients to avoid further complications.

1.4.2 Type-II Diabetes

Type-II diabetes commonly knowns as non-insulin dependent conditions, develops because of metabolic syndrome (Williams *et al.,* 2002). Type-II diabetes is delineated as derisory beta-cells response to insulin resistance accompanied by aging, physical inactivity and obesity (McCarthy, 2010). Type-II diabetes accounts for mortality and morbidity because of adverse effects on coronary arteries, hyperinsulinemia and complications *viz.* retinopathy and nephropathy. Anyone could be diagnosed with Type-II diabetes, even at adolescent and young age. Moreover, Type-II diabetes usually happen to occur amongst the middle-aged and elderly people. A sudden upsurge is witnessed in the count of adults and youngsters diagnosed with Type-II diabetes which is associated with various risk factors *viz.* sedentary lifestyle, obesity, lack of regular exercise regimen, rapid urbanization etc.

1.4.3 Gestational Diabetes

According to American Diabetes Association (2016, pp. S13), "*Gestational diabetes (GD) is described as glucose intolerance with the beginning or initial identification in pregnancy*". Soon after the parturition, glucose level is reinstated to non-pregnancy status, but women's earlier diagnosed with gestational diabetes are susceptible of developing type-2 diabetes in the forthcoming years (Bellamy *et al.*, 2009). Gestational diabetes is ought to be commence at the very first prenatal visit. Pregnant women with biological and behavioral risk factors (obesity, sedentary lifestyle, family history and glycosuria) are at a higher risk of gestational diabetes and should undergo glucose tests to avoid future complications (American Diabetes Association, 2016).

1.4.4 Fibro-Calculous Pancreatic Diabetes (FCPD)

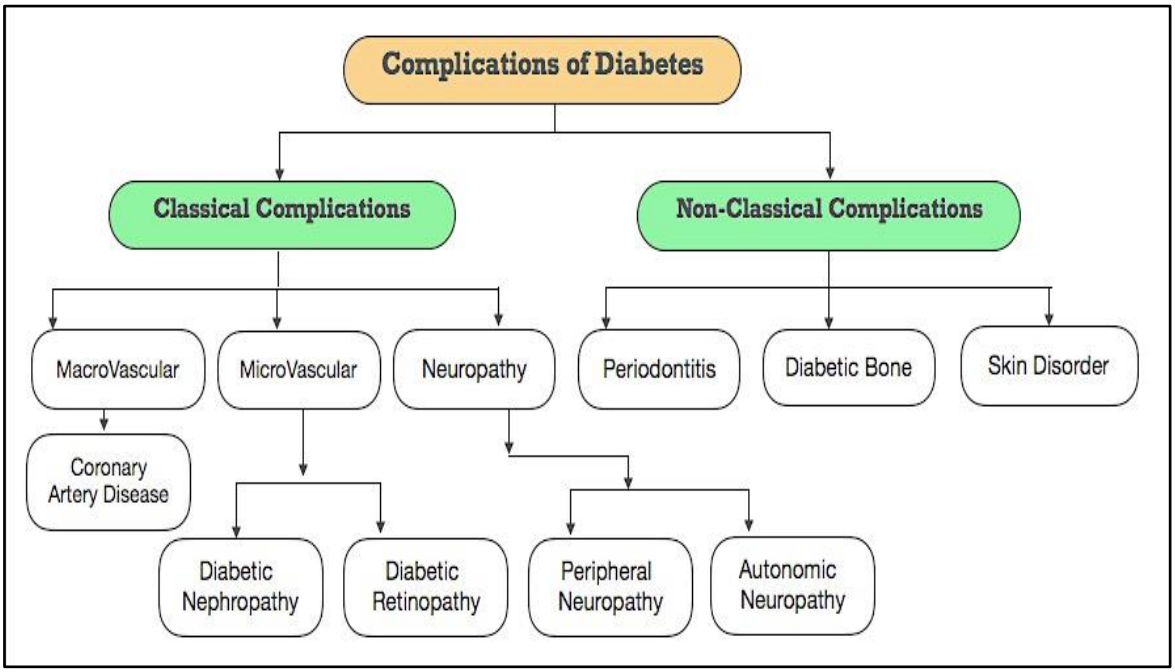
Mohan *et al.* (1998, pp. 153)[2], "*Fibro-calculous pancreatic diabetes (FCPD) is a unique form of diabetes secondary to non- alcoholic, chronic, calcific pancreatitis seen in tropical, developing countries of the world".* Numerous labels have been suggested such as tropical calcific-pancreatitis (TCP), tropical pancreatitis, pancreatic diabetes mellitus, nutritional pancreatic diabetes, pancreatic syndrome, etc. Individuals diagnosed with fibro-calculous pancreatic diabetes (FCPD) experience frequent abdominal ache, oily stools and pancreatic calculi (Unnikrishnan et al., 2016). People with fibro-calculous pancreatic diabetes are highly disposed to developing microvascular complications as patients with Type-2 diabetes.

1.5 Complications of Diabetes Mellitus

"*Diabetes mellitus is associated with a large number of serious and chronic complications, which act as a major cause of hospitalization, morbidity and premature mortality in diabetic patients*" (Kansra and Oberoi, 2021). Diabetes is commonly associated with chronic complications both classical and non-classical origin (Lotfy et al., 2017). Classical complications of diabetes mellitus are further categorized into macrovascular, microvascular and neuropathy comorbidities. Macrovascular complications comprises of "*Coronary Artery Disease*" (CAD). Heart disease among diabetic patients is commonly associated with hyperlipidemias and high blood pressure which is one of the leading cause of fatality among diabetic patients (Kumpatla et al., 2013; Lotfy et al., 2017). Microvascular complications of diabetes are primarily linked

to the weakening of vascular perviousness which distresses tissues and biological structure of body such as the kidneys, retina, nerves, etc. Microvascular complications are catalogued into two orderings such as diabetic nephropathy and diabetic retinopathy (Williams et al., 2002; Mokini and Chiarelli, 2006; Chatterjee et al., 2011). Non-classical complications of diabetes are also taken into consideration such as periodontal disease, diabetic bone diseases and skin disorders (Preshaw et al., 2012; Wu et al., 2015).

Figure: 1.5 Complication Profile of Diabetes



Source: Author compilation based on Lofty et al. (2017).

1.6 Conceptual Framework on Healthcare Utilization and Economic Burden of Diabetes

Figure 1.5 shows the conceptual framework on healthcare utilization and economic enquiry of diabetes. The framework is categorized into four major sections incidence of diabetes, healthcare utilization, cost estimation and coping mechanism.

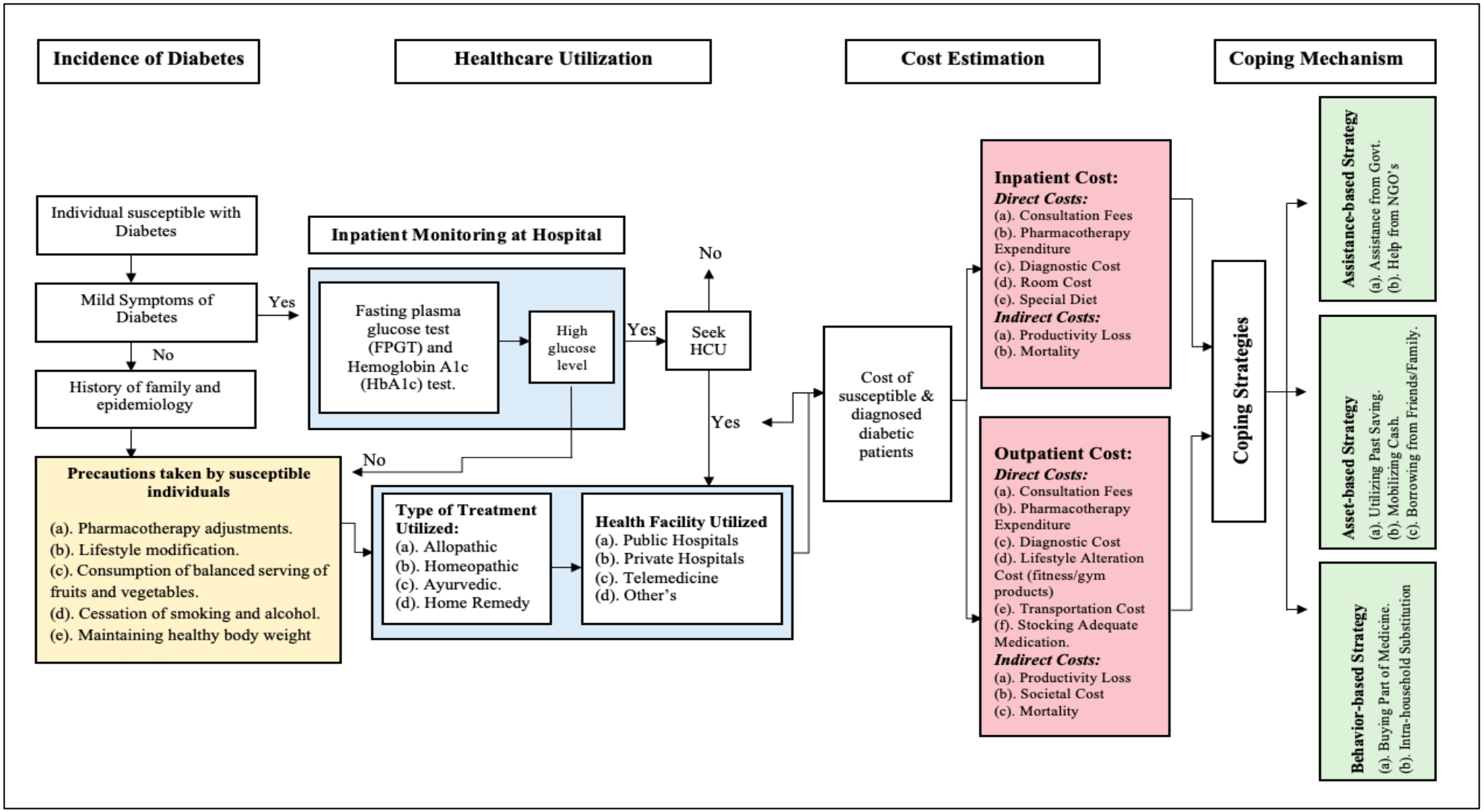
The present framework on healthcare utilization and economic analysis describes the different channels through which diabetes mellitus is diagnosed, treated and tentative strategies adopted to cope with the economic menace of diabetes by individuals/households. Under the incidence of diabetes section, individuals susceptible

to diabetes with mild symptoms and history of family were more vulnerable to diagnose with diabetes mellitus.

Individuals with mild symptoms having high fasting plasma glucose test (FPGT) and Hemoglobin A1c (HbA1c) test seek for healthcare utilization. Individuals diagnosed or susceptible to diabetes seek for different type of treatments viz. allopathic, homeopathic, ayurvedic and home remedies. Diabetic patients prefer different healthcare facilities such as public hospitals, private hospitals, telemedicine, etc. based on accessibility, availability and affordability. Healthcare utilization and treatment of diabetes exert an enormous economic burden both at individual/household levels.

The conceptual framework explains the cost estimation at both inpatient and outpatient level. Under inpatient and outpatient care both direct and indirect costs are considered for estimation. Individuals who utilize healthcare services tolerate direct costs such as consultation fee, pharmacotherapy expenditure, diagnostic cost, room cost, etc. Similarly, such patients also tolerate the burden of indirect costs such as wage loss, societal cost and mortality. Lastly, the economic repercussion of chronic illness demand households to practice various coping mechanisms to survive the high cost of illness. Having acknowledged the numerous costs of diabetes, this section of the conceptual framework exhibits the ways through which households finance these costs, to better comprehend the possible longstanding consequences.

Figure: 1.6 Conceptual Framework on Healthcare Utilization and Economic Burden of Diabetes



Source: Author's work based on literature review.

1.7 Research Objectives

1. To study the awareness about diabetes risk factors and prevention strategies among households;
2. To identify the socio-economic determinants of diabetes among households;
3. To estimate the cost of diabetes among households;
4. To study the coping strategies employed by households to deal with economic cost of diabetes;
5. To identify the determinants of catastrophic healthcare expenditure of diabetes among households.

1.8 Need of the Study

India has emerged to become the '*Diabetes Capital*' of the world after China, with an estimated 65 million patients aged 20 years and above (Guariguata et al., 2014). The number of diabetic patients in India is expected to rise to 134 million by 2045 (Pradeepa and Mohan, 2021). A Pan-India survey conducted by the Indian Council of Medical Research on the economic burden of diabetes exhibited that wealthy states had a higher incidence of diabetes. Kerela registered the highest mortality due to diabetes mellitus among all Indian states followed by Punjab with 44 and Karnataka with 42 morbidities, higher than the national average of 23 deaths.

Punjab is amongst the richest state of India and deemed to be the country's diabetes capital (Tandon, A. 2018). Punjab is the second-highest carrier state of diabetes after Kerala and the national front-runner in obesity, dyslipidemia and hypertension (Tripathy et al., 2017; Sanghera, T., 2018). According to the Indian Council of Medical Research, Punjab is the most obese and hypertensive state on account of its prosperity and consumption pattern. Punjab had the highest prevalence of both generalized and abdominal obesity at 40.5 percent and 57.2 percent, respectively. Four in every ten individuals in Punjab reported hypertension which was the highest in India. According to the Ministry of Health and Family Welfare (MoHFW) (2017), diabetes mellitus was ranked at 21st position in 1990 as the leading cause of DALYs in Punjab (Disability Adjusted Life Years) with a share of 1.3 percent and in 2016 diabetes mellitus accelerated to 4th position as a leading cause of DALYs with a share of 3.9 percent.

Though there have been numerous studies done on various aspects of diabetes mellitus globally and within India (Brandle et al., 2003; Ettaro et al., 2004; Zhang et

al., 2010; Yesudian et al., 2014; Chandra et al., 2014; Thakur et al., 2016; Tripathy et al., 2017), but there is a dearth of literature which attempts to understand the economic impact, healthcare utilization and coping strategies of diabetes on the households in Punjab. Thus, this study aims to examine the "Socio-economic Implications of Diabetes on Household Expenditure in Punjab".

1.9 Study Structure

The present study is structured into eight chapters. Chapter I provides a brief introduction of diabetes. Chapter II presents comprehensive review of literature on diabetes and its dimensions such as healthcare utilization, cost, complications, coping strategies, risk factors and prevention strategies. Chapter III highlights the research methodology, research instruments, statistical tools for data analysis and limitations. Chapter IV discusses the level of awareness towards diabetes, it's associated risk factors and prevention strategies among the households. The socio-economic characteristics and determinants of diabetes are described in Chapter V. Chapter VI examines and compares the healthcare utilization, cost and coping strategies of diabetes in Punjab. Chapter VII examines the incidence and intensity of out-of-pocket payments and identifies the key determinants of catastrophic healthcare expenditure in Punjab. Summary, conclusion and policy implications are discussed in the Chapter VIII.

Chapter-II

LITERATURE REVIEW

The chapter highlights prior studies on diabetes and its related dimensions. In the particular chapter a comprehensive review of literature has been carried out at both national and international level to emphasize on the various issues associated with the present study. The literature draws attention towards the research gaps and provides insight to the researchers and academicians on several dimensions. The literature is reviewed on various aspects *viz.* cost of diabetes, complications of diabetes, healthcare utilization, coping strategies, catastrophic health expenditure (CHE), socio-economic determinants, risk factors and prevention strategies of diabetes.

2.1. Cost of Diabetes

According to Rice et al. (1985), "*The economic costs-of-illness continue to play an important role in decision-making regarding the allocation of resources in the healthcare sector. It represents the monetary burden on society of illness and premature death*". Numerous policymakers, academicians and health planners believe cost estimation of disease as a major prerequisite for making decisions, setting up of the priorities and assessing the health budget (Hodgson and Meiners, 1982). According to Changik (2014), "*Cost of illness (COI), known as burden of disease (BOD), is a definition that encompasses various aspects of the disease impact on the health outcomes in a country, specific regions, communities, and even individuals*". The categorization of the cost of diabetes varies from incidence of disease to the morbidity along with the financial aspects. Therefore, the precise understanding of cost of illness is fundamental for either healthcare policy formulation or achieving policy efficiency.

Economic burden of diabetes has led to numerous studies on cost *viz.* (Gerald et al., 1989; Leese, 1995; Jonsson, 1998; Songer and Ettaro, 1998; Barcelo, 2003; Hogan, 2003; Chodick et al., 2005; Ramachandran, 2007; Kapur, 2007; Tharkar *et al.,* 2010; Shivaprakash *et al.,* 2012; Chandra *et al.,* 2014; Acharya *et al.,* 2016; Eshwari *et al.,* 2018, Kansra, 2018; Nath *et al.,* 2020; Oberoi and Kansra, 2020; Kristina *et al.,* 2021; Olickal *et al.,* 2021; Sharma *et al.,* 2021). According to Jonsson (1998), "*diabetes mellitus alone accounts for 2-3 percent of the total healthcare budget in every country*". Further, Zhang *et al.* (2010) estimated the cost of diabetes to be $ 1,200 billion globally

to diagnose, treat and prevent both type-1 and type-2 patients. The cost exerted by diabetes can be categorised into three different groups: direct cost, indirect cost and intangible cost (Pagano *et al.,* 1999; Sobocki *et al.,* 2007). Direct cost includes both direct healthcare cost (diagnosis, treatment, care and prevention) and direct non-healthcare cost (transport, housekeeping, social service and legal cost) (Hogan *et al.,* 2003; American Diabetes Association, 2013). Indirect cost includes cost for absenteeism, loss of productivity and disability (Herwaldt *et al.,* 2006; Glynn *et al.,* 2011; American Diabetes Association, 2013). Lastly, intangible cost embrace cost for social isolation and dependence, low socio-economic status, mental health and behavioural disorder and loss of quality of life (Beran, 1999; Sobocki *et al.,* 2007; Rodwin *et al.,* 2013).

Songer and Ettaro (1998) conducted a meta-analysis to comprehend how and to what extent cost of illness studies on diabetes has been used by researchers in the United States. The study discussed the items that deserve reflection in the assessment of both direct and indirect cost. Results inferred from various studies on the cost of diabetes stated that indirect cost accounts for more than half of the total cost of diabetes mellitus as compared to direct cost (Ettaro *et al.*, 2004; Gonzalez *et al.*, 2009; Kumpatla *et al.*, 2013). Contrary studies by (Chatterjee *et al.,* 2011; American Diabetes Association, 2013; Chandra *et al.,* 2014) concluded that contribution of the average annual direct cost of diabetes accounts for higher percentage share in the total cost of diabetes as compared to indirect cost. Further studies concluded that both direct cost and indirect cost exhibits equal and high economic burden on diabetes patients (Barcelo *et al.*, 2003 and Hogan *et al.*, 2003).

Selby *et al.* (1997), estimated per person household expenditure (US$3,494) for patients with diabetes was 2.4 times more in comparison with patients without diabetes. According to Hogan *et al.* (2003), the per capita medical expenditure in the United States was US$13243 for patients with diabetes and US$2560 for patients without diabetes in 2002. Similarly, Gonzalez *et al.* (2009) in their study concluded that annual direct cost per diabetic patient to be US$288 and the indirect cost was US$559 in Colombia. According to Chatterjee et al. (2011), average per diabetic patients cost of illness was US$ 881.48 which accounted to be 21 percent of per capita GDP of Thailand. According to King et al. (1998), "*a 170 percent increase from 84 to 228*

million patients with diabetes mellitus only in developing nations. *Hence, by the year 2025 more than 75 percent of people with diabetes will reside in the developing countries with higher economic burden than developed economies*". Jonsonn (1998) concludes that diabetes is more prevalent in the developing economies with the rise in a number of disability-adjusted life year (DALYs) lost from 1940-2010 with high economic cost. According to Abdulkadri et al. (2009) diabetes mellitus posed a greater economic burden in developing country Trinidad and Tobago when absolute cost was considered. In the Indian context, the total cost-of-illness (COI) for diabetes both with and without complications is increasing swiftly (Chandra et al., 2014; Acharya et al., 2016).

2.1.1 Cost of Diabetes in India

"*Economic burden of diabetes mellitus has led to numerous studies on cost-of-illness. The cost exerted by diabetes can be categorised into three groups: direct cost, indirect cost and intangible cost*" (Oberoi and Kansra, 2020). Direct cost includes both direct healthcare cost (diagnosis, treatment, care and prevention) and direct non-healthcare cost (transport, housekeeping, social service and legal cost) (Nath *et al.,* 2020; Sharma *et al.,* 2021; Olickal *et al.,* 2021; Kristina *et al.*, 2021). Indirect cost includes cost for absenteeism, loss of productivity and disability (Herwaldt *et al.,* 2006; Glynn *et al.,* 2011; American Diabetes Association, 2013; Oberoi and Kansra, 2020; Kristina *et al.,* 2021; Nath *et al.,* 2020). Lastly, intangible cost embrace cost for social isolation and dependence, low socio-economic status, mental health and behavioural disorder and loss of quality of life (Beran, 1999; Sobocki *et al.,* 2007; Rodwin *et al.,* 2013). All twenty-one reviewed studies put forward data and statistics to evaluate per capita cost of individual/household at zone level and rest eleven studies highlighted the cost of diabetes at national level. To have a clear insight on cost, the reviewed articles have been categorized into four different zones *viz.* north zone, west zone, south zone and north-east zone (Table 2.1.1).

Under north zone, 8 studies were included to calculate both direct and indirect cost of diabetes at individual/household level (Figure 2.1.1). The median direct cost of diabetes estimated to be ₹18,890/- per annum, ranging from ₹999/- to ₹1,09,344/- (Grover *et al.,* 2005; Kumar *et al.,* 2008; Joshi *et al.,* 2013; Kumar & Mukherjee, 2014; Katam *et al.,* 2016; Kansra, 2018; Singla *et al.,* 2019). The most commonly measured

costing item under direct cost were expenditure on medicines (7 studies), diagnostic expenses (2 studies), transportation cost (1 study), hospitalization (2 studies) and consultation fee (3 studies). The median indirect cost of diabetes for north zone was evaluated to be ₹18,146/- per annum, ranging from ₹4642/- to ₹98,808/- (Grover et al., 2005; Kumar and Mukherjee, 2014; Thakur et al., 2017; Kansra, 2018). For all indirect cost studies, costing items *viz.* wage loss and leisure time forgone was used majorly.

South zone includes 11 studies, majorly from Karnataka state (6 studies), followed by Tamil Nadu (4 studies) and Andhra Pradesh (1 study). The median direct cost was assessed to be ₹10,585/- per annum (Figure 1), ranging from ₹377/- to ₹21,258/- per annum (Shobhana *et al.,* 2000; Shobhana *et al.,* 2002; Kapur, 2007; Sachidananda *et al.,* 2010; Shivaprakash *et al.,* 2012; Kumpatla *et al.,* 2013; Acharya *et al.,* 2016; Eshwari *et al.,* 2018). Direct costing items *viz.* medicine cost (9 studies) consultation fees (4 studies) and hospitalization (3 studies) were used in the reviewed article. The median indirect cost of diabetes was ₹1198/- per annum, ranging from ₹462/- to ₹3,572/- per annum with major costing items such as monitoring cost (1 study), absenteeism (3 studies) and impairment (1 study) (Rayappa *et al.,* 1999; Akari *et al.,* 2013; Acharya *et al.,* 2016; Sharma *et al.,* 2016; Eshwari *et al.,* 2018).

Under north-east and west zone only one study was observed for each, to evaluate the direct and indirect cost of diabetes at individual/household level (Chandra *et al.,* 2014; Khongrangjem *et al.,* 2018). The median direct cost of diabetes for north-east was evaluated to be ₹45,792/- per annum and ₹8,822/- per annum was observed for west zone (Figure 1). Commonly estimated costing items were surgical procedures, expenditure on drugs/medicines, clinical fees, etc. The median indirect cost estimated for north-east zone was ₹18,707/- per annum and ₹3,949/- per annum was analysed for west zone. Indirect costing items identified for both reviewed studies was loss of wage, spending's on health class, travelling expenditure and spending's on diet control.

Lastly, 11 studies were incorporated to estimate the cost of diabetes for India as whole at individual/household level (Bjork, 2000; Bjork, 2003; Ramachandran, 2007; Ramachandran *et al,* 2007; Tharkar *et al.,* 2009; Tharkar *et al.,* 2010; Rao et al, 2011; Cavanagh *et al.* 2012; Viswanathan and Rao, 2013; Satyavani *et al.,* 2014; Tripathy and Prasad, 2018). The median direct cost of diabetes for India as whole was ₹9,996/- per

annum, ranging from ₹4,724/- to ₹25,391/- per annum. Also the median indirect cost of diabetes at individual/household level was estimated to be ₹5,237/- per annum, ranging from ₹2,435/- to ₹12,756/- annually (Figure 2.1.1).

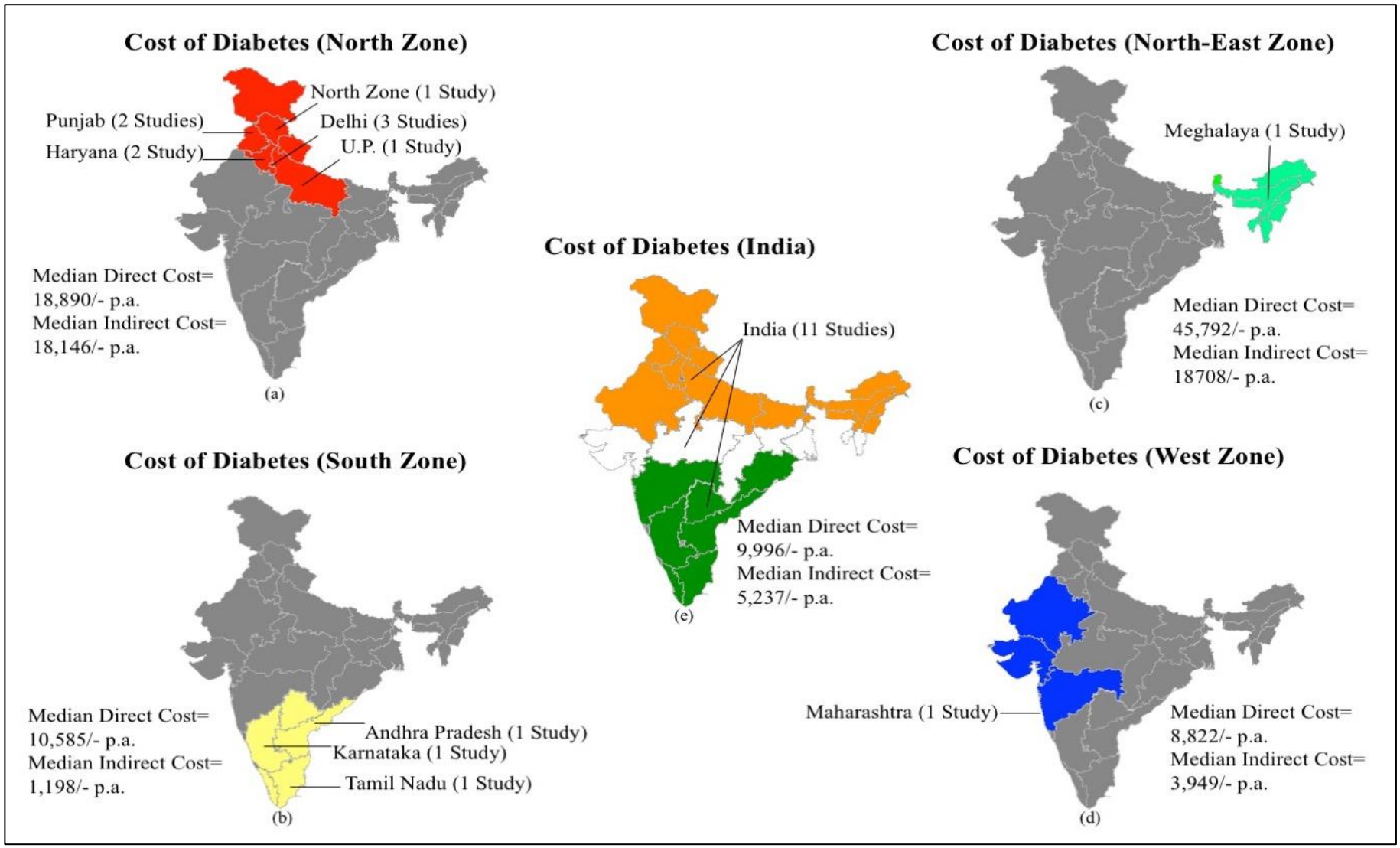
2.2. Cost of Complications of Diabetes

Diabetes mellitus is associated with a large number of serious and chronic complications, which act as a major cause of hospitalization, morbidity and premature mortality in diabetic patients (Williams *et al.,* 2002; Fowler, 2008). Diabetes mellitus is commonly associated with chronic complications both of macrovascular and microvascular origin (Fowler, 2008; Susan *et al.,* 2010; Kumpatla *et al.,* 2013; Unnikrishnan *et al.,* 2016; Lotfy *et al.,* 2017). Microvascular complications of diabetes mellitus include retinopathy, autonomic neuropathy, peripheral neuropathy and nephropathy (Williams *et al.,* 2002; Mokini and Chiarelli, 2006; Chatterjee *et al.,* 2011; Unnikrishnan *et al.,* 2016; Lotfy *et al.,* 2017). Macro-vascular complication of diabetes mellitus broadly includes coronary and peripheral arterial disease (Simpson *et al.,* 2003; Schmitt *et al.,* 2004; Kumpatla *et al.,* 2013). However, in other studies, non-classical complications of diabetes are also taken into consideration such as periodontal disease, diabetic bone diseases and skin disorders (Rakic *et al.,* 2006; Oumeish, 2008; Preshaw *et al.,* 2012; Wu *et al.,* 2015).

According to Susan et al., (2010), "*global health spending to treat and prevent diabetes and its complications was US$ 232 billion in 2007 and expected to exceed US$ 302 billion by 2025*". Diabetes complications have a significant impact on the cost of treating both type-1 and type-2 diabetes mellitus (Egede *et al.,* 2002; Williams *et al.,* 2002; Brandle *et al.,* 2003; Mody *et al.,* 2007; Zhang *et al.,* 2010). Cost of diabetes increased by 3-4 folds for the patients diagnosed with microvascular and macrovascular comorbidities, as compared to those without any complications of diabetes (Kumpatla *et al.,* 2013).

Previous studies on diabetes complication assessed macrovascular complication as the major cost component, accounting for more than half of cumulative cost of illness (Haffner *et al.,* 1998; Caro *et al.,* 2002; Brandle *et al.,* 2003; Simpson *et al.,* 2003;

Figure: 2.1.1. Cost Estimates of India and Zone-Wise Cost Profile



Source: Author's compilation.

Schmitt *et al.*, 2004; Ray *et al.*, 2005; Mody *et al.*, 2007; Ward *et al.*, 2014; Acharya *et al.*, 2016). Microvascular complications such as nephropathy, neuropathy and retinopathy impose a higher cumulative cost (Chatterjee *et al.*, 2011; Lotfy *et al.*, 2017). Brandle *et al.* (2003), estimated median annual cost for type-2 diabetes patients was US$1700 for men and US$ 2100 for woman and complications further increased the cost by 10-30 percent. Studies in Indian context estimated the median annual cost of illness for diabetes care without any complication was ₹ 22,455 per patient and with complication was ₹ 30,633 per patient (Acharya et al., 2016). A study by Unnikrishnan et al. (2016) found that on average Indian diabetes patient spends ₹ 4,492 a year to treat the diabetes mellitus in 2013.

2.2.1. Cost of Complications of Diabetes in India

Diabetes mellitus is associated with a large number of serious and chronic complications, which act as a major cause of hospitalization, morbidity and premature mortality in diabetic patients (Sachidananda et al., 2010; Akari et al., 2013; Kumpatla et al., 2013; Acharya et al., 2016; Nath et al., 2020; Sharma et al., 2021; Olickal et al., 2021; Kristina et al., 2021). Diabetes mellitus is commonly associated with chronic complications both of macrovascular and microvascular origin (Kumpatla et al., 2013; Unnikrishnan et al., 2016). Microvascular complications of diabetes mellitus include retinopathy, autonomic neuropathy, peripheral neuropathy and nephropathy (Satyavani et al., 2014; Unnikrishnan et al., 2016; Lotfy et al., 2017). Macro-vascular complication of diabetes mellitus broadly includes coronary and peripheral arterial disease (Akari et al., 2013; Kumpatla et al., 2013).

Of the total reviewed studies, only 10 studies estimated the cost of complications associated with diabetes. Couple of studies on diabetes assessed the cost of illness to be 1.4 times higher for individuals with complications as exhibited in Table 3 (Tharkar et al., 2009; Acharya et al., 2016). A similar study by Sachidananda et al. (2010), concluded that cost of diabetes to be 1.8 times higher for complicated non-hospitalized patients and 2.4 times higher for complicated hospitalized patients. Kapur (2007), inferred that individuals with three or more comorbidities encounter 48 percent more cost of care, amounting to be ₹10593/- annually.

According to Cavanagh et al. (2012), the study found India to be most expensive country for a patient with a complex diabetic foot ulcer, where 68.8 months of income

Table: 2.1.1 Cost Profile of the Reviewed Studies on India

Author	Publication Year	Cost of Individual/Household (Without Complications)	Cost of Individual/Household (With Complications)
Acharya *et al.*	2016	Total direct cost without complication was ₹21, 258/-p.a. Total indirect cost without complication was ₹1,198/-p.a.	Total direct cost with complication ₹28,888/- p.a. Total indirect cost with complication ₹1,746/- p.a. Cost of Illness (COI) with complication was 1.4 times higher.
Akari *et al.*	2013	The average total direct medical and non-medical cost was 15,588/- p.a. and The average total indirect cost was ₹ 1,079/- p.a.	The average cost with diabetic complications was ₹6,633/- p.a. for macro-vascular complications and ₹4,798/- p.a. for microvascular complications
Bjork *et al.*	2000	Estimated annual direct cost was ₹ 7070/- individual and indirect cost was ₹ 12,756/- including productivity and income loss through illness	----
Bjork *et al.*	2003	Mean total cost of diabetes in India accounts to ₹7159/- p.a. Mean direct cost of diabetes was ₹4724/- and Indirect cost *viz.* hospitalization was 2435/- p.a. (*Some regional differences in patterns of expenditure exist, with patients in the west of India likely to spend 26% more on laboratory fees, check-ups and medicines than any other region*.)	----
Cavanagh *et al.*	2012	----	Results of the study found India to be most expensive country for a patient with a complex diabetic foot ulcer, where 68.8 months of income was required to pay for treatment. The average direct and indirect monthly cost was ₹5258 (63096/- annually).
Chandra *et al.*	2014	Mean annual direct cost of treatment was ₹8822/- and 52% of amount is spent on drugs and medicines. Mean annual indirect cost of treatment was ₹3949/- of which 91.3% was wage loss.	----
Eshwari *et al.*	2018	Total cost for diabetes management was ₹5041/- p.a. of which ₹4282/- was direct cost for the treatment of diabetes and ₹462/- was spent on indirect cost.	Total cost for treatment of diabetes with comorbidities was ₹9133/- p.a. Direct cost with complications was ₹8185/- p.a. and Indirect cost amounts to be ₹508/- p.a.
Grover *et al.*	2005	Total annual cost of care for diabetes was ₹14508/-. The biggest proportion was made up of direct cost of ₹9865/-p.a. and rest ₹4642/- p.a. cost burden was adding up by indirect cost.	----
Joshi *et al.*	2013	Majority of the respondents spend ₹ 999/- p.a. on direct cost of care for diabetes.	----

Kansra	2018	Mean direct cost of diabetes for consultation, lab investigation, medicines etc. was ₹9112/- monthly. Whereas, indirect cost for outpatient care was ₹1166/- monthly and indirect cost for inpatient care was ₹7068 per month.	----
Kapur	2007	Total average yearly direct cost was observed to be ₹7158/-. However, the mean direct cost for all patients with diabetes was ₹4724/-p.a.	Whereas, individuals with three or more comorbidities encountered 48 percent more cost of care. Amounting to be ₹10593/- annually.
Katam *et al.*	2016	The average total direct cost per patient annually was amounted to be ₹27915/-. The highest portion of direct cost was spent on insulin and glucose test strips (40%).	----
Khongrangjem *et al.*	2018	The total median cost of illness per month was ₹5375/-. Total cost was made up of ₹3816/- direct cost and ₹1559/- indirect cost.	----
Kumar *et al.*	2008	The total mean evaluation of annual direct spending on ambulatory diabetes care was ₹6000/-.	----
Kumar and Mukherjee	2014	The total direct expenditure incurred on diabetes was ₹76779/- p.a. and total indirect expenditure was ₹30670/- p.a.	----
Kumpatla *et al.*	2013	The total direct cost estimates without any complication was observed to be ₹4493/-.	Total cost of expenditure with complication was ₹15,280/-. (*cost for patients with foot complication was ₹19,020/-, also average cost for renal patients was ₹12,690/- followed by 13,135/- for cardiovascular disease.)*
Ramachandran	2007	Average inpatient and outpatient cost of diabetes is ₹7505/- p.a. and ₹3310/- p.a.	----
Ramachandran *et al.*	2007	Total median Direct expenditure on health care was ₹8130/- p.a.	----
Rao *et al.*	2011	Mean cost per hospitalizations was ₹5925/- p.a. for diabetes.	----
Rayappa *et al.*	1999	Direct annual cost (incl. hospital, test, monitoring etc.) was ₹15460/- and Indirect annual cost was ₹3572/-.	----
Sachidanandaa *et al.*	2010	Annually medical cost spent on diabetes was ₹10584.7/-.	The annual medicine (direct) cost spent by complicated non-hospitalized ₹19326.91/- and ₹25960.2/- by complicated hospitalized patients

Satyavani *et al.*	2014	----	Monthly diabetic patients with chronic kidney disease spend ₹12,664/- on treatment.
Sharma *et al.*	2016	Direct annual cost was maximum for private clinics ₹19,552/- and Indirect cost was ₹2462/-.	----
Shivaprakash *et al.*	2012	Average cost per visit (direct cost) was ₹377/- in 2010 in comparison to ₹ 363/- in 2005.	Average cost per visit (direct cost) for patients with complications was ₹ 464/- in 2010.
Shobhana *et al.*	2000	Total direct cost (incl. drugs, tests, consultation, hospital, surgery, transport) was ₹4,510/- half yearly.	
Shobhana *et al.*	2002	₹13,980/- was spent annually on direct costs of diabetes by the patients.	----
Singla *et al.*	2019	Total direct cost (drugs and medicine) for diabetes patients was ₹3,241/- p.m.	----
Thakur *et al.*	2017	The Mean annual direct expenditure for diabetes care was ₹9,832/- and indirect cost was ₹5,622/-.	----
Tharkar *et al.*	2009	Total direct cost for hospitalization was ₹14000/- p.a.	Total direct cost for hospitalization with comorbidities was ₹19000/- p.a.
Tharkar *et al.*	2010	The median annual direct cost associated with diabetes care was ₹25,391/- and indirect cost was ₹4970/-, respectively.	----
Tripathy and Prasad	2018	The annual median out-of-pocket household expenditure because of hospitalization due to diabetes was ₹9996.20/-.	----
Viswanathan and Rao	2013	The annual direct and indirect cost to treat diabetes was ₹16,756 and ₹ 5504/-	----

Source: Author's compilation established on reviewed articles

was required to pay for treatment. Three reviewed studies incorporated in the study estimated the cost of individual/household with both macrovascular and microvascular complications (Akari et al., 2013; Kumpatla et al., 2013; Satyavani et al., 2014). Of these 3 reviewed articles, couple of them primarily concentrates on the cost of illness prompted by renal (kidney) complication (Kumpatla et al., 2013; Satyavani et al., 2014). Lastly, Eshwari et al. (2018), estimated the Total cost for treatment of diabetes with comorbidities was ₹9133/- annually. Direct cost with complications was ₹8185/- per annum and Indirect cost amounts to be ₹508/- annually.

2.3. Healthcare Utilization of Diabetes

Understanding the provision, utilization of healthcare services and its determinants is a difficult task, especially when the healthcare sector is heterogeneous in nature. Healthcare utilization is classified into three broad categories such as (a) Curative care (Inpatient and Outpatient care) (b) Preventive care (c) Promotive care i.e. disease control, education and promotion of health (Sarkar, 2002). Most of the studies on diabetes mellitus had taken into consideration the curative care dimension of healthcare utilization (Kangas *et al.,* 1996; Greenough *et al.,* 2001; Sarkar, 2002; Huang *et al.,* 2011; Joshi *et al.,* 2013; Grupp *et al.,* 2016; Maiya *et al.,* 2020; Umakanth, 2020; Wang *et al.,* 2021).

According to Mody *et al.* (2007) "*patients with type-2 diabetes mellitus have higher healthcare utilization cost as compared to those without diabetes mellitus*". Healthcare utilization services such as emergency visits, hospital and nursing home admissions etc. accounts for higher utilization cost per annum in the United States for treating chronic diseases (Huang *et al.,* 2011). In a similar study by Kumptala *et al.* (2013) healthcare utilization services accounts for a higher percentage share of the total cost of illness for treating, preventing and controlling diabetes related complications in South-Asian economies. According to Grupp *et al.* (2016) inferred that healthcare utilization services such as outpatient physician, hospitalization and rehabilitative care accounts for more than half of the total cost of illness.

Presence of different diabetes related complications and comorbidities have an independent effect on the larger utilization of healthcare services (Russell, 2004). Large number of comorbidities among diabetic patients results in extensive use of medical healthcare services such as general practitioner care, specialist care, hospitalization and

hospital care (Struijs *et al.,* 2006). The extent of healthcare utilization services viz. hospitalization by diabetes patient with comorbidity is significantly higher as compared to the non-comorbidity patients (Hutter *et al.,* 2009; Subramaniam *et al.,* 2009). Diabetic patient with multiple complications, on average spends a large proportion of their annual income on healthcare services such as inpatient service, hospital admissions and treatment (Kumptala *et al.,* 2013).

Higher dependence on private hospitals for healthcare service such as outpatient visit has been observed among the residents with high-income levels (Sundar, 1995; Sudha *et al., 2003*; Russell, 2004). According to Ghanim (2004) identified the factors such as income, education and health insurance that prompts diabetic patients to use private clinics, regardless of free public health care centers. According to Zhou et al. (2013) utilization of both outpatient and inpatient services in private clinics was pro-rich both in rural and urban China. In India for general illness (GI) around 70 to 80 percent of the respondent's lookout for healthcare services in hospitals, with the vast majority of patients visiting either private or NGO facilities (Mitchell *et al.,* 2011; Joshi *et al.,* 2013).

2.4. Coping Strategies of Diabetes

Households use various coping strategies to survive the economic repercussion of chronic illness (Bomberg *et al.,* 2017; Funuyet-Salas *et al.,* 2020; Murakami *et al.,* 2020; Widayati *et al.,* 2021). Available cash and savings act as an instant coping response to finance cost of illness. Previous studies exhibited that this could be possible only for a small section of households (Wilkes *et al.,* 1997; Gross *et al.,* 1999; Russell, 2004; Chuma *et al.,* 2007; Arnold *et al.,* 2016). Other studies on coping strategies emphasize the use of home remedies, postponement of medical appointments and the reduction of food consumption as major strategy to survive economic burden of illness (Mutyambizi, 2002; Henry *et al.,* 2010; Dhanaraj, 2016). Coping strategy for spontaneous response to finance the cost of illness is done through the sale of assets by households (Wilkes *et al.,* 1997; Damme *et al.,* 2004; Gotsadze, 2005; Leive and Xu, 2008). Sale of productive assets such as land, farming equipment, livestock and house forms an additional source of income for households to manage the cost of disease. (Binnendijk *et al.,* 2011; Shahrawat and Rao, 2011; Quintussi *et al.,* 2015).

The most common reaction for coping with the direct and indirect cost of illness is through borrowing from friends and family, moneylenders and informal loans from employers and neighbors (Gotsadze, 2005; Munga and Gideon, 2009; Nguyen *et al.*, 2012; Arnold *et al.*, 2016). Financing strategies and related mechanisms for coping with the cost of illness through loans and borrowings could have an adverse consequence on households (McIntyre *et al.*, 2005). Other coping strategies for dealing with the cost of ailment includes diversification of income and selling household labour helps in managing health expenditure (Xu *et al.*, 2003).

According to Sauerborn *et al.* (1996) intra-household labour substitution and hiring external labour act as major coping strategies to compensate for labour loss and cost of illness. Intra-household labour substitution constitutes intangible cost, particularly when children discontinue school to take on the work activities (Dhanaraj, 2016). Mostly, developed economies have advanced community groups and social institutes such as community insurance and tax-funded health systems that have high relevance in coping with the cost of illness (Xu *et al.*, 2003). According to murakami et al., (2020), "*adaptive emotion-focused coping supports glycaemic control in type 2 diabetes patients who do not use insulin*".

2.5. Catastrophic Healthcare Expenditure of Diabetes

According to World Health Organization (2000), "*The primary function of the healthcare system is to improve population health and to safeguard households from financial catastrophe expenditure*". Out-of-pocket (OOP) payments by households for healthcare services such as inpatient and outpatient services lead to catastrophic health expenditures (CHE), pushing households toward impoverishment (Bredenkamp and Gragnolati, 2011; Ghosh, 2011; Li *et al.*, 2012; Kastor and Mohanty, 2018; Jing *et al.*, 2019; Leng *et al.*, 2019; Ahmet *et al.*, 2021). Globally, 150 million households experience catastrophic healthcare expenditure (CHE) and approximately 100 million households are on the verge of being impoverished by health expenses (World Health Organization, 2011). Many low and middle-income countries (LMIC) such as India, Bangladesh, Greece, Israel, Jamaica, Nigeria, Thailand etc. experience extreme out-of-pocket expenditures, thereby, pushing households toward asset reduction, mounting debts, consumption depletion and financial risk (Xu *et al.*, 2007; Binnendijk *et al.*, 2011; Ghosh, 2011; Rahman *et al.*, 2013; Jing *et al.*, 2019; Ahmet *et al.*, 2021).

According to Aregbeshola and Khan (2017), "*Catastrophic healthcare expenditure (CHE) is a measure to safeguard financial burdens incurred by households who pay through out-of-pocket (OOP) for health services that are exorbitant*". Catastrophic healthcare expenditure (CHE) is a situation where households make out-of-pocket expenditures for healthcare services exceeding a threshold level of their income (Xu et *al.,* 2003; Xu *et al.,* 2007; Gotsadze *et al.,* 2009; Smith *et al.,* 2012; Kronenberg and Barros, 2014; Aregbeshola and Khan, 2017). Different thresholds levels have been used in various studies to assess catastrophic expenditure in different countries (Xu et al., 2003). Some studies used 10, 20 and 30 percent threshold level of total household expenditure (Xu *et al.,* 2003; Wagstaff & Doorslaer, 2003; Su *et al.,* 2006; Sene and Cisse, 2015). Whereas, others studies used 40 percent threshold level of non-food consumption expenditure (Xu *et al.,* 2003; Aregbeshola and Khan, 2017).

Numerous studies identified determinants of catastrophic healthcare expenditure both in developed and under-developed economies (Xu *et al.,* 2007; Yardim *et al.,* 2010; Smith *et al.,* 2012; Li *et al.,* 2012; Gwatidzo and Williams, 2017). Lower education level, elderly household members, household size and the dearth of health insurance are the major determinants associated with catastrophic healthcare expenditure (Yardim *et al.,* 2010; Smith *et al.,* 2012). Aregbeshola and Khan (2017) examined the determinants of catastrophic expenditure in Nigeria and inferred that elderly age, gender, regional location, education and economic status were amongst the most significant determinants of catastrophic healthcare expenditure (CHE). Households with low economic status placed under poorer wealth quintile acts as a significant determinant of catastrophic healthcare expenditure (Su *et al.,* 2006; Yardim *et al.,* 2010; Li *et al.,* 2012; Gwatidzo and Williams, 2017).

According to Gwatidzo and Williams (2017) almost 7 percent people with diabetes mellitus experience catastrophic healthcare expenditure (CHE) because of high medication cost in India. Brinda *et al.* (2015) inferred that people living in rural areas with low income level incurred more of catastrophic healthcare expenditure in India. Mondal *et al.* (2010) identified the prevalence of chronic morbidity, inpatient care, household size and medical expenditure for illness as the significant determinants of catastrophic healthcare expenditure (CHE) in India. Pal (2012) found age, caste and education as the key determinants of catastrophic healthcare expenditure (CHE). It was

inferred that households from backward social groups incurred higher catastrophic expenditure as compared to households with other social groups in India. Lifestyle modification and economic status were significant determinants of diabetes mellitus and catastrophic healthcare expenditure (Gwatidzo and Williams, 2017).

2.6. Socio-Economic Determinants of Diabetes

There are several socio-economic factors which affects the health status of individuals and society such as caste, inheritance, income, education level and association with neighbors and family. Amalgamation of all these determinants could be referred as socio-economic determinants (Rayappa *et al.,* 1999; Evans *et al.,* 2000; Ramachandra, 2007; Parihar, 2016).

Studies on socio-economic determinants considered, social cohesion and cohabiting with individual from same social status (caste) to be significant determinants (Pickett and Pearl, 2001; Rios *et al.,* 2011; Broberg *et al.,* 2018). Socio-economic determinants have traditionally been classified as education, income and employment (Ramachandran, 2007; Agardh *et al.,* 2011; Braveman *et al.,* 2011; Corsi and Subramanian, 2012). Kapur (2001) examined education level, family income and demographic characteristics viz. age, location, marital status etc. to be the significant socio-economic determinants of diabetes. It was also inferred that illiterates and jobless, especially those living in semi-urban areas are more prone to diabetes. Shamshirgaran *et al.* (2013) concluded that diabetes was prevalent among individuals who were retired or unemployed, less educated and had low income level as significant socio-economic determinants.

Lifestyle modification and economic status were the significant determinants of diabetes mellitus (Gwatidzo and Williams, 2017). Numerous studies highlighted the change in lifestyle pattern (rapid dietary change and low involvement in physical activities) because of urbanization as a substantial socio-economic determinant of diabetes (Ramachandran, 2007; Corsi and Subramanian, 2012; Shrivastava *et al.,* 2016; Lockwood *et al.,* 2018). Association of socio-economic determinants viz. educational, demographic characteristics and occupational status with diabetes mellitus prevalence was assessed among the urban individuals with a middle socio-economic status (SES) and age-adjusted occurrence of diabetes mellitus was found to be more prevalent in urban society (Misra *et al.,* 2011; Corsi and Subramanian, 2012). An emerging trend of

reflecting property value as proxy for socio-economic determinant was considered in health research to link property value to assess prevalence of chronic disease, obesity and diet etc. (Fone *et al.,* 2006; Drewnowski *et al.,* 2015; Lockwood *et al.,* 2018).

2.7. Risk Factors of Diabetes

According to Kansra and Oberoi (2021, p. 60), "*Assessing the awareness and perception about diabetes is a pivotal step towards eliciting the diabetes-related risk factors*". The level of awareness and perception regarding diabetes prevention strategy extremely depends upon the socio-economic and behavioral factors (Sims et al., 2011).

The diabetes mellitus is associated with common risk factors viz. junk diet, physical inactivity, use of tobacco, alcohol consumption, obesity, hyperglycemia, high blood pressure and hyperglycemia (Ezzati *et al.,* 2002; World Health Organization, 2002; Li *et al.,* 2008; Steinbrecher *et al.,* 2012; Wu *et al.,* 2015; Thakur *et al.,* 2016; Ahmed *et al.,* 2018; Kansra and Oberoi, 2021). Thus, knowledge and awareness regarding diabetes risk factors is important for the prevention of diabetes (Zaman *et al.,* 2016). Literature available on risk factors of diabetes was associated with a wide range of behavioral risk factors, physical risk factors and biological risk factors (Aryal *et al.,* 2015; Oommen *et al.,* 2016; Thakur *et al.,* 2016, Kansra and Oberoi, 2021).

Behavioral risk factors viz. tobacco use, low servings of fruits and vegetables, harmful use of alcohol, low physical activity are the known contributors of diabetes mellitus (Ezzati *et al.,* 2002; Bauer *et al.,* 2014; Regmi *et al.,* 2016). According to Wu et al. (2015), "*the significant variations in the behavioral risk factors among China, Ghana, Mexico, India, Russia and South Africa. The study concluded, prevalence of daily tobacco use was highest in India, alcohol use was the highest in China (6.3 percent) and lowest in India (0.2 percent) and lastly, prevalence of physical inactivity was highest in South Africa (59.7 percent)*". In a similar study by Zaman *et al*. (2016) estimated that prevalence of behavioral risk factors for major NCDs among men and women of Bangladesh and inferred that 54 percent of the sample population used tobacco in some or the other form, less than 1 percent consumed alcohol being Muslim nation, more than 92 percent don't consume adequate fruit and vegetables and approximately 35 percent of the respondents had low level of physical activity.

Numerous studies have discussed physical risk factors viz. overweight, obesity, abdominal obesity and blood pressure as significant risk factors for diabetes (Chan et

al., 1994; Petit et al., 2001; Steinbrecher et al., 2012; Thakur et al., 2016; Ahmed et al., 2018). Oommen et al. (2016) mentioned that in urban Tamil Nadu individuals with overweight constitutes to be 54 percent of the sample population and 29 percent individuals had hypertension w.r.t. 31 and 17 percent respondents with overweight and hypertension, in the rural Tamil Nadu. A similar study by Aryal et al. (2015) assessed the physical risk factors which lead to NCDs rise in Nepal and concluded that around 21 percent of the respondents were obese, higher prevalence of blood pressure and blood glucose, one-fourth of respondents had elevated total cholesterol and less than 1 percent of the respondents were found to be free of all NCDs risk factors.

A blend of both dry and wet chemistry techniques are utilized to measure biological profile of patients and associated risk factors (Thakur et al., 2014). Biological risk factors viz. Hyperglycemia (>110mg/dl), Hypertriglyceridemia (>150mg/dl), Hypercholesterolemia (>190mg/ dl), Haemostatic Abnormalities and High salt intake level (>5gm/day) are general risk factors for diabetes (Kaur *et al.,* 2012; Bauer *et al.,* 2014; Devi *et al.,* 2014; Katsiki *et al.,* 2017). In a similar study by Thakur et al. (2016) assessed the profile of risk factors for NCDs in Punjab and concluded that incidence of biological risk factors of diabetes such as Hyperglycemia, Hypertriglyceridemia and Hypercholesterolemia was observed to be 14.3 percent, 21.6 percent and 16.1 percent respectively amongst both urban and rural respondents of Punjab (India). According to Katsiki et al. (2017) biological risk factors such as insulin resistance, obesity, hypertension, dyslipidaemia, fatty liver disease as well as haemostatic abnormalities intensify the occurrence of type-2 diabetes mellitus. Lastly, according to Kansra and Oberoi (2021), "*The overall awareness level was found to be 83%, but perception and comprehension regarding risk factors are at a nascent stage. There is need for innovative awareness programs and government campaigns on the consequences of lifestyle modification, sedentary lifestyle, and altering epidemiology of diabetes*".

2.8. Prevention Strategies of Diabetes

In light of the rising rate of diabetes mellitus globally, it is imperative for clinical and public health communities to concentrate on risk factors of diabetes mellitus. Hence, in most developing countries extensive implementation of both interventions and strategies for the control and management of diabetes is must (Regmi *et al.,* 2016). Intervention policies by government *viz.* levying taxes on commodities such as tobacco,

sweetened drinks, alcohol and unhealthy diet could reduce the incidence of type-2 diabetes by more than 50 percent among individuals impaired with disease (Gillies *et al.*, 2007).

Focused health educational syllabus and restricting access to alcohol and tobacco products near schools and college premises could be helpful in promoting general awareness (Tuomilehto *et al.*, 2001; Branca *et al.*, 2007; World Health Organization, 2010). Lastly, interventions viz. nutrition labelling, in-scripting health messages, pictorial labelling on cigarettes by government could prevent people from diabetes mellitus and other chronic NCDs (World Health Organization, 2002; Cecchini *et al.*, 2010; Regmi *et al.*, 2016).

The strategies and interventions to prevent and control diabetes mellitus under primary health care setting in Southeast Asian and African region are (i) primary prevention: post-ponement of the diabetes condition (ii) secondary prevention: avoidance of complications amongst those who already have diabetes and (iii) tertiary prevention strategy: limiting physical disability and preventing complication progression. According to Bauer et al. (2014) to meet the burden of chronic illness, the United States "*Centre for Disease Control and Prevention*" considered four type of prevention strategies such as (i) Epidemiology and surveillance: to monitor trends and inform programmes (ii) Environmental approaches: to promote health and healthy behaviors (iii) Health system interventions: to improve use of clinical and other preventive services (iv) community and clinically based prevention strategies.

Majority of previous studies support that diabetes mellitus could be prevented by modifications in the lifestyle patterns (Tuomilehto *et al.*, 2001; Albright and Gregg, 2012; Dasgupta, 2013; Ley *et al.*, 2014; Merlotti *et al.*, 2014; Katsiki *et al.*, 2017). The Finnish diabetes prevention study observed a notable reduction of 43 percent in diabetes mellitus incidence after the implementation of lifestyle interventions (Lindstrom *et al.*, 2006). In a similar study conducted by Li *et al.* (2008), "*lifestyle intervention group had a 51 percent lesser incidence of diabetes mellitus for the particular intervention year and a 43 percent lower prevalence of diabetes over the period of 20 years in China*". Albright and Gregg (2012) concluded that organized lifestyle intervention viz. food nutrition, physical activity and behaviour change strategies results in the lower prevalence and prevention of diabetes.

Crandall et al. (2008) examined that laparoscopic surgery and pharmacologic interventions helps in either preventing or delaying the prevalence of type-2 diabetes. According to Dixon et al. (2005), "*laparoscopic gastric banding in patients with diabetes mellitus resulted in reduction of diabetes mellitus by 64 percent among sample patients and major improvements in glycemic control*". American Diabetes Association (2018) assessed whether intensive lifestyle interventions have a long-term effect on diabetes prevention and concluded that lifestyle interventions (diet and exercise), technology assistance (mobile applications, social networks), pharmacologic interventions (metformin therapy, beta-cell stimulating drugs) and education and support interventions helps to prevent the burgeoning of diabetes mellitus.

Prevention is an enormously complex practice which acts as a protective function, letting individuals/households use resources to catch-up with unanticipated traumas in life. When confronted with ordeals, patients with diabetes practice a wide range of strategies to tackle resultants. According to Kansra and Oberoi (2021, p. 62), "*a large number of respondents perceived eating balanced meals with dietary fibers helpful in preventing diabetes, followed by reduction of total and saturated fat intake, lifestyle modification, controlling cholesterol, blood glucose monitoring, maintaining body weight and a regular exercise regimen were the utmost important prevention strategies*".

CHAPTER III

RESEARCH METHODOLOGY

A comprehensive understanding of the research methods and data analysis is a pre-requisite for research design. Therefore, research design provides the framework for the collection and analysis of data. This chapter lucidly explains the research methodology used to provide a detailed description of study population, sample design, sample size and statistical tools for data analysis. The present chapter is divided into three sections. Section I of the chapter discusses the research design and provides details regarding research topic, objectives, hypotheses, sample design and sample size estimation. Section II focuses upon research instrument, validity and reliability. Section III provide a detailed description of statistical tools for data analysis.

SECTION I

3.1. RESEARCH DESIGN

A cross-sectional study is conducted in the north Indian state of Punjab, where data is collected from the respondents of both rural and urban areas, through a self-structured questionnaire adapted from the "*WHO STEPwise approach to surveillance*".

3.1.1. Research Topic

"Socio-Economic Implications of Diabetes on Household Expenditure in Punjab"

3.1.2. Objectives of the Study

1. To study the awareness about diabetes risk factors and prevention strategies among households;
2. To identify the socio-economic determinants of diabetes among households;
3. To estimate the cost of diabetes among households;
4. To study the coping strategies employed by households to deal with economic cost of diabetes;
5. To identify the determinants of catastrophic healthcare expenditure of diabetes among households.

3.1.3. Hypothesis

Based on literature review, to study the objectives following hypothesis have been framed:

1. Hypothesis framed to study the awareness about diabetes risk factors and prevention strategies among households are:

Ho_1: There exists no significant association between socio-economic characteristics and awareness of diabetes risk factors among households in Punjab.

Ho_2: There exists no significant association between socio-economic characteristics and awareness of diabetes prevention strategies among households in Punjab.

Ho_3: There exists no significant association between socio-economic characteristics and awareness of diabetes risk factors among urban-rural households in Punjab.

Ho_4: There exists no significant association between socio-economic characteristics and awareness of diabetes risk factors among urban-rural households in Punjab.

2. Hypothesis framed to estimate the cost of diabetes among households:

Ho_1: There exists no significant difference in Outpatient cost based on socio-economic characteristics among households in Punjab.

Ho_2: There exists no significant difference in Inpatient cost based on socio-economic characteristics among households in Punjab.

Ho_3: There exists no significant difference in Outpatient cost based on socio-economic characteristics among urban-rural households in Punjab.

Ho_4: There exists no significant difference in Inpatient cost based on socio-economic characteristics among urban-rural households in Punjab.

3. Hypothesis framed to identify the determinants of catastrophic healthcare expenditure of diabetes among households.

Ho_1: There is no significant relationship between socio-economic characteristics and the risk of incurring catastrophic health expenditure among households in Punjab.

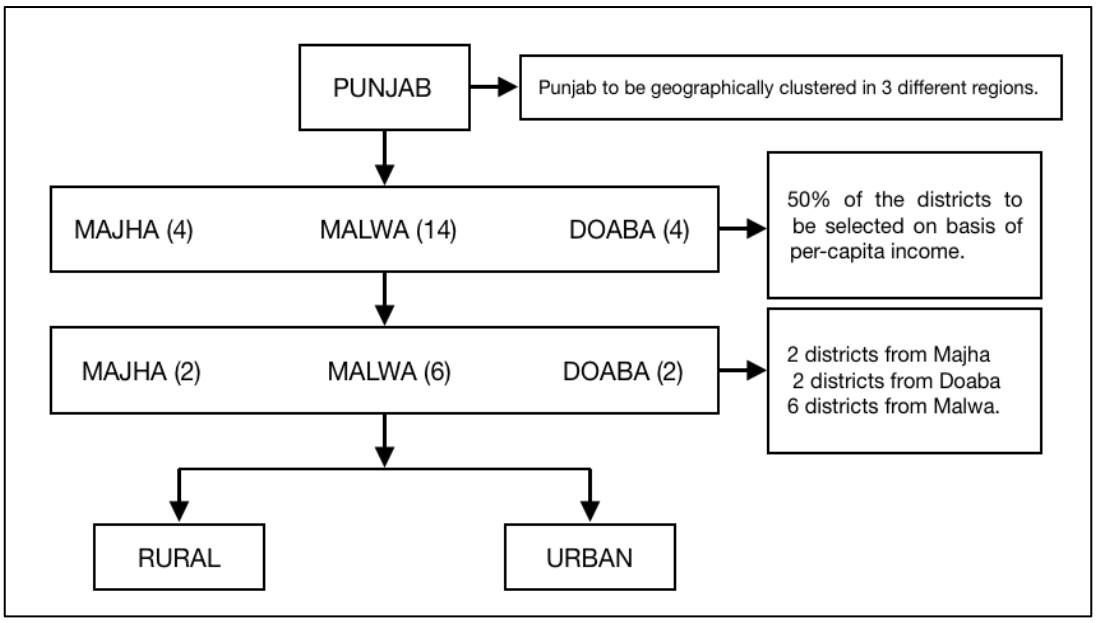
Ho_2: There is no significant relationship between socio-economic characteristics and the risk of incurring catastrophic health expenditure among urban households in Punjab.

Ho_3: There is no significant relationship between socio-economic characteristics and the risk of incurring catastrophic health expenditure among rural households in Punjab.

3.1.4. Sample Design

The present study involves the multi-stage area sampling technique. The first phase of the sampling technique involves the geographical clustering of Punjab in 3 regions namely Majha, Doaba and Malwa. In the second phase, 50 percent of districts will be selected from each of the geographical clusters on the basis of high and low per-capita income (Anjana et al., 2017). Amritsar and Gurdaspur districts will be selected from the Majha region. Similarly, districts viz. Jalandhar and S.B.S will be selected from Doaba and lastly, from Malwa region 6 districts will be selected viz. Ludhiana, Ferozpur, S.A.S Nagar, Mansa, Muktsar and Ropnagar.

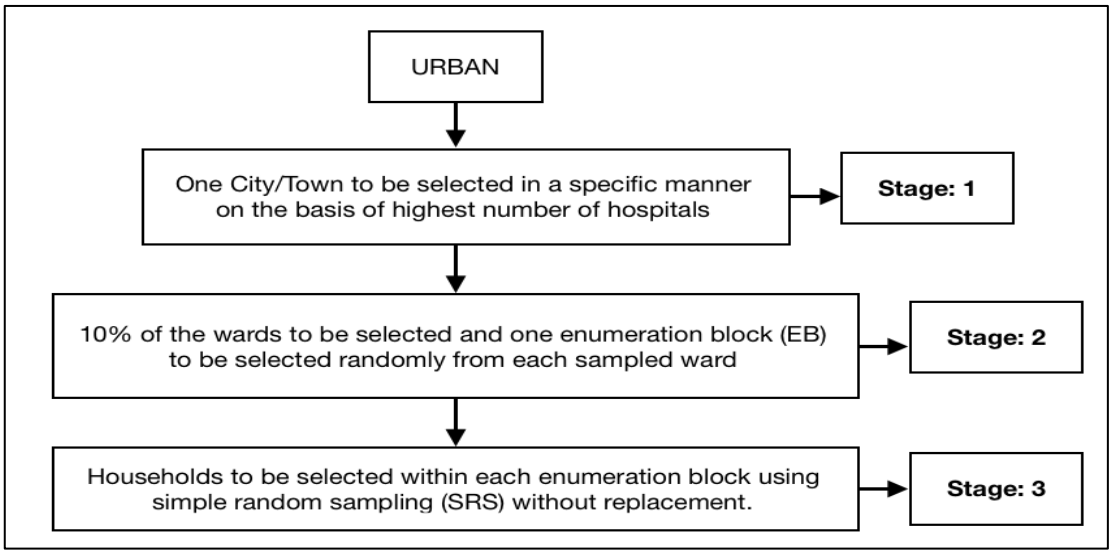
Figure: 3.1 Study Sampling Strategy



Source: Author Compilation

Further from each selected district, both rural and urban areas were considered. A three-stage design was employed in rural and urban areas of Punjab. In the initial phase, one town/city was selected based on the highest number of hospitals from urban area. In the subsequent stage, 10 percent of the wards were selected from each selected city/town randomly and one enumeration block (EB) from each sampled ward. Lastly, households were randomly selected within each enumeration block (EB) using simple random sampling without replacement approach.

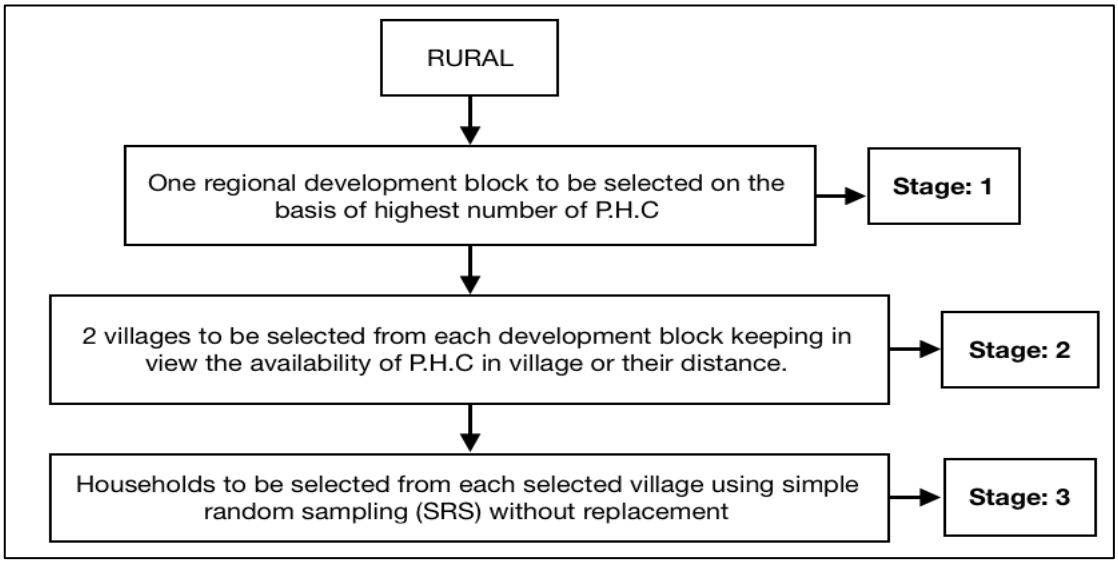
Figure: 3.2 Phases of the Sampling Design in Urban Punjab



Source: Authors compilation.

For rural area a three-stage approach was also employed. In the primary stage, one development block will be selected in a specific manner on the basis of highest number of primary healthcare center (PHC). In the second stage, two villages will be selected from a development block. The villages selected keeping in view the availability of P.H.C in the village or their distance from the Primary Health Centre (PHC). Finally, in the last stage households were selected randomly within each village using the simple random sampling without replacement approach (Kapur,2012).

Figure: 3.3 Phases of the Sampling Design in Rural Punjab



Source: Authors compilation.

A total of 60 Primary Sampling Units (PSUs) will be taken, there will be 20 villages and 40 enumeration blocks from the urban locality. From each selected primary sample units (PSU), 12 households secondary sample units (SSU) will be selected using random sampling technique without replacement technique (Thakur *et al.,* 2016; Tripathy *et al.,* 2016).

3.1.5. Estimation of Sample Size:

The sample size is calculated from both urban and rural area grounded on the prior estimates of incidence of physical inactivity as around 50 percent (Anjana et al., 2011; Thakur et al., 2016) 95 percent of confidence interval and the recommended margin error of 5 percent (0.05) used as per STEPS manual approach. According to World Health Organisation (2005), "*Total sample size estimate attained is adjusted for the design effect (1.5). Using these values, a sample size of 576 was derived which was adequate to provide state wide results by age groups (20-65+), gender and residence*". Lastly, assuming a response rate of 80 percent sample size raised to 720 for the present study. The sample size of 720 households are calculated on the basis of prevalence percent of risk factor using the sample size calculation formula (Krejcie and Morgan, 1970; World Health Organisation, 2005).

$$n = Z^2 (p) (1-p) / e^2$$

Where, 'n'= Sample size and 'Z'= Z statistic for level of confidence. For the level of confidence of 95%, the conventional 'Z 'value is 1.96. p= estimated prevalence of the risk factor and e= margin error.

SECTION II

3.2. RESEARCH INSTRUMENT

For measuring the social-economic implications of diabetes self-structured questionnaire has been used for the present study. The questionnaire is divided into seven different sections. Section 1 highlights the household identification. The basic characteristics of the households are discussed in section 2. Further, Section 3 and 4 of the questionnaire measures the awareness regarding diabetes risk factors and prevention strategies. Section 5 focusses upon the associated complications of diabetes, followed by section 6 discusses the healthcare utilization and cost of diabetes. Lastly, Section 7 of the questionnaire accentuates the coping strategies employed by households to cope with the expenditure of diabetes for which the Likert scale is used.

3.2.1 Content Validity:

"*Content validity refers to the extent to which the items on a measure assess the same content or how well the content material was sampled in the measure*" (Rubio et al., 2003). In a similar study by Kimberlin and Winterstein (2008), content validity helps in addressing how correctly the items advanced to operationalize a construct delivers a satisfactory and illustrative sample of items which can measure the construct of interest. Since there are no arithmetical and statistical tests to infer whether a questionnaire sufficiently covers all content areas, this generally counts upon the judgment of professionals in that field. Content validity is the judgmental procedure in which an attempt is made to determine whether our questionnaire includes those behaviors that are relevant to the domain (Dar and Mishra, 2019).

According to Kumar and Sadeeq (2020), "*Content validity is assessed by trusting on the proficiency of the experts who are having a thorough knowledge about the domain or construct under study*". These subject experts are requested to provide their feedback regarding the matter, ambiguity and language. For particular study majority of experts recommended the use of medical terminology to be minimum, language to be simple and few construct items were deleted after the insightful suggestions of the experts. Therefore, with the incorporation of the recommendations as suggested by the experts the language of the research instrument is simple, clear, effective and understandable by the study respondents.

3.2.3. Pilot Testing

According to Bashir (2016, pp. 71), "*Pilot testing is done to check the internal consistency of the statements by analyzing the Cronbach's Alpha*". A pilot study was performed in the districts of Punjab and 140 self-structured questionnaires were distributed amongst the individuals. People already diagnosed or suffering from diabetes mellitus were surveyed for the particular study and the respondents for pilot testing were from different-different backgrounds. Respondents observed no problem in understanding and answering to the questionnaire. On an average, it took around 15-20 minutes for each respondent to register the response.

3.2.4. Reliability

Reliability is defined as the property by which steady and consistent outcomes are accomplished when the measurement of something is repeated. In a study by Nargundkar (2008), "*reliability is explained as the uniformity in the results when the measurement is repeated time after time. In a simple language, when a questionnaire put to use on a similar population advances alike results is said to be reliable*".

According to Farooq (2017, pp. 81), "*The most widely used method to measure reliability is the Cronbach's alpha which ranges from 0-1 and can be used to measure the reliability of dichotomous scale, Likert scale, nominal and ordinal scale*". In a study by Nunnally (1978), to determine the validity of the research instrument, the threshold value of "Cronbach Alpha" should not be less than 0.70. The higher alpha value highlights higher reliability of the measure and the alpha score less than 0.70 is regarded as unreliable. The results have been presented in table 3.2.4.

The value of "Cronbach's alpha" for risk factors, coping strategies and prevention strategies constructs was above 0.70, as presented in table 3.2.4, thereby certifying the reliability of all the constructs. The Cronbach's alpha value of coping strategies measure was observed to be 0.764. The Cronbach's alpha value for risk factor scale was 0.703 but one item RF13 "consuming too much sugar items causes diabetes" was also deleted and the reliability was improved to 0.725. The reliability of prevention strategies measure was initially observed to be 0.720, which was above the threshold level. Item PS12 was removed to enhance the reliability to 0.745. Therefore, all the scales were established to be reliable.

Table 3.2.4: Reliability of Coping Strategies, Risk Factors and Prevention Strategies Scale.

Construct	Item Code	Corrected Items Correlation	Alpha Values if Items Deleted	Cronbach's Alpha	Items Label
Coping Strategies	CS1	0.288	0.759	0.764	Consuming less of food items to meet healthcare expenditure on diabetes
	CS2	0.163	0.766		Buying part of medicines to cope with diabetes
	CS3	0.456	0.746		Reduced the number of visits to doctor
	CS4	0.416	0.747		Working overtime to meet the diabetes expenses
	CS5	0.37	0.753		Intra-household labor substitution to compensate for any labor loss
	CS6	0.514	0.742		Managing diabetes by working as bonded laborer
	CS7	0.208	0.763		Using past savings to meet the healthcare expenses of diabetes
	CS8	0.029	0.772		Mobilizing the available cash in hand
	CS9	0.543	0.739		Selling of productive assets to cope with diabetes
	CS10	0.516	0.736		Borrowing from friends to meet healthcare expenditure of diabetes
	CS11	0.576	0.738		Mortgage productive assets to cope with diabetes
	CS12	0.384	0.752		Seeking help from relatives to cope up with diabetes
	CS13	0.569	0.74		Taking loan from moneylenders to meet healthcare costs of diabetes
	CS14	0.545	0.732		Borrowing from neighbors
	CS15	0.153	0.784		Received assistance from Govt./ NGO's to manage diabetes
Risk Factors	RF1	0.221	0.698	0.725	With increase in age the incidence of diabetes increases
	RF2	0.162	0.705		Obesity Increases the occurrence of Diabetes
	RF3	0.479	0.664		Smoking highly contributes to diabetes
	RF4	0.339	0.684		Excess of alcohol consumption make people more prone to diabetes
	RF5	0.301	0.69		Rising prevalence of diabetes is primarily attributed to rapid urbanization
	RF6	0.405	0.678		Inappropriate lifestyle (sedentary) leads to the occurrence of diabetes

	RF7	0.404	0.676		Lack of regular exercise regimen increases the risk of diabetes
	RF8	0.316	0.687		Consumption of less than 5 servings of fruit and vegetable a day
	RF9	0.24	0.7		If I am diabetic, my family has higher tendency to be diabetic
	RF10	0.502	0.667		With high level of bad cholesterol incidence of diabetes rises
	RF11	0.3	0.689		Hypertension increases the prevalence of diabetes mellitus
	RF12	0.425	0.673		The usual cause of diabetes is insulin resistance in the body
	RF13	0.385	0.678		Lack of sleep increases the risk of diabetes mellitus
Prevention Strategies	PS1	0.577	0.665	0.720	Regular monitoring of blood glucose can prevent diabetes
	PS2	0.474	0.692		Regular exercise helps in reducing the vulnerability of diabetes mellitus
	PS3	0.425	0.693		Individuals with diabetes should avoid alcohol
	PS4	0.353	0.703		Cessation of smoking and tobacco abuse helps to prevent diabetes
	PS5	0.451	0.692		Eating a balanced dietary fibre helps to prevent diabetes
	PS6	0.306	0.708		Reduction of total and saturated fat intake helps in diabetes prevention
	PS7	0.382	0.697		Maintaining healthy body weight reduces the risk of diabetes mellitus
	PS8	0.266	0.713		Controlling cholesterol makes people less prone to diabetes
	PS9	0.398	0.695		Monitoring hypertension could result in diabetes prevention
	PS10	0.389	0.697		Use of insulin as a lifesaving agent reduces long term complications
	PS11	0.321	0.708		Proper health education helps to prevent diabetes

Source: Authors calculation based on primary data.

SECTION III

3.3 STATISTICAL TOOLS FOR DATA ANALYSIS

3.3.1 Mean

Mean ($\overline{X}$) is a fundamental concept of statistics and mathematics. In statistics, it is a measure of central tendency of a probability distribution. "*Mean is estimated by taking the sum of all observations in a data set divided by the total number of observations in a given data set*" (Kumar and Sadeeq, 2020).

$$\overline{X} = \frac{\sum X}{N}$$

Where

$\sum X$ = Summation of all observations.
N = Number of observations.

3.3.2 Median

The median in general is described as the middle value arranged in a sorted, descending or ascending, list of numbers. Occasionally median can be more descriptive for a data set than the mean value. "*For odd number of observation, the middle number is the median value and if there is an even number of observations, the median is the mean of the two middle values*" (Kumar, 2016).

$$\text{Median} = \frac{(N\ +\ 1)}{2}$$

Where

N = Total number of observations.

3.3.3 Mann-Whitney U Test

The test is commonly called as "*Mann-Whitney-Wilcoxon test*" or "*Wilcoxon rank-sum test*". It helps in determining, whether two independent samples are from the same population. According to MacFarland and Yates (2016, p. 103), "*The Mann–Whitney Test is quite powerful and by no means should it be considered anything but equivalent to Student's t-Test for Independent Samples in terms of utility*".

$$U = n1n2 + \frac{n2\,(n2+1)}{2} - \sum_{i=n1+1}^{n2} Ri$$

Where
U = Mann-Whitney Test
n_1 = Size of Sample1
n_2 = Size of Sample 2
R_i = Rank of sample size

3.3.4. Kruskal Wallis Test

In 1952, "William Kruskal" and "W. A. Wallis" proposed a nonparametric technique of testing whether the samples (more than two) are originated from the same population is termed as "Kruskal-Wallis test" or "One-way ANOVA on ranks". Kruskal-Wallis test expands the "*Mann-Whitney U test*" to more than two samples. Since, this test is a nonparametric technique, it doesn't presume a distribution to be normal of the residuals.

$$H = \frac{12}{N(N+1)} \sum \frac{Ri^2}{ni} - 3(N + 1)$$

Where
N = Total number.
n_i = Number in i^{th} group.
R_i = Summation of ranks in i^{th} group.

3.3.5. Chi-Square

"*Chi-square ($\chi 2$) statistic is a technique which measures the difference between the observed and expected frequencies of the outcomes of a set of events*" (Kumptala et al., 2913). Chi-square is performed to check whether two variables are associated to each other or not. It is useful for studying the difference in categorical variables, particularly when study variables are nominal in nature (*viz.* Gender, Region, etc.).

$$\chi 2 = \sum \frac{(Oi - Ei)^2}{Ei}$$

O*i* = Observed frequency.
E*i* = Expected frequency.

3.3.6. Headcount

According to Ghosh (2011), "*The incidence of catastrophic health expenditure is measured using Headcount approach*". Headcount is defined as the percentage of households monthly out-of-pocket (OOP) expenditure, as ratio of monthly income of

household, for monthly outpatient expenditure, exceeding a specific catastrophic threshold level. Majority of studies accept and use 5% and10% as desired threshold level. But the present study calculated the headcount at 5%, 10%, 20% and 30% threshold levels for better insight.

$$\text{Headcount} = \frac{1}{n} \sum_{i=1}^{N} Ei$$

Where

E = Indicator equal to one, if Oi/Yi > z or else zero.

Pi = Out-of-pocket expenditure of household.

Yi = Income of household.

Z = Catastrophic threshold level.

N = Sample size.

3.3.7. Overshoot

Headcount method highlights the percentage share of out-of-pocket spending by household beyond the threshold level, but it doesn't highlight the intensity of expenditure household spent beyond the catastrophic threshold. According to Bhojani et al. (2012, p. 4), "*Overshoot measures the degree by which an average OOP expenditure (in entire sample) crossed the given catastrophic threshold*". The formula used for overshoot is,

$$\text{Overshoot} = \frac{1}{n} \sum_{i=1}^{N} Oi$$

Where

Oi = Ei((Pi/Yi)-Z).

3.3.8. Mean Positive Overshoot

According to Bhojani et al. (2012, p. 4), "*Mean positive overshoot (MPO) measures the degree by which the average out-of-pocket expenditure by households that have experienced catastrophe has exceeded the given threshold level*". The formula for mean positive overshoot is,

$$\text{MPO} = \frac{Overshoot}{Headcount}$$

Where

If household "*j*" experience catastrophic health expenditure, the household might have spent (MPO + Threshold level) percent of income on cost of illness.

3.3.9. Logistic Regression

This technique is performed when the dependent variable is nominal or categorical in nature. According to Field (2009), "*determines the impact of multiple independent variables presented simultaneously to predict membership of one or other of the two dependent variable categories*".

In logistic regression, a logistic transformation of the odds serves as the depending variable:

$$\text{Log (odds)} = \text{Logit (P)} = \ln\left(\frac{P}{1-P}\right) \quad \ldots\ldots 1$$

Taking above dependent variable and adding a regression equation for independent variables, logistic regression is:

$$\text{Logit (P)} = a + b1x1 + b2x2 + b3x3 \ldots\ldots bixi \quad \ldots\ldots 2$$

Equation

$$\text{P} = \frac{\exp(a+b1x1+b2x2+b3x3\ldots\ldots bixi)}{1+\exp(a+b1x1+b2x2+b3x3\ldots\ldots bixi)} \quad \ldots\ldots 3$$

Where,

P = Probability of a case is in a particular category.
exp = exponential function.
a = intercept of equation.
b = coefficient of the predictor variable.

SECTION IV

3.4. LIMITATIONS

3.4.1 Study Limitations

The results and conclusion of the present study cannot be applied generally, before considering the following limitations:

1. The present study is cross-sectional in nature; therefore, it makes use of cross-sectional data that doesn't measure the awareness level, cost estimates and coping strategies over a period of time. Hence, the cost estimates and awareness level may differ if a longitudinal study would have been conducted.
2. In the present study, districts were selected from each of the geographical cluster based on high and low per-capita income. Therefore, the findings of the study may vary if all 23 districts of Punjab were included.
3. The present study is restricted to the North Indian state of Punjab, therefore, the cultural, socio-economic and geographical differences may vary beyond this region and the results cannot be generalized as a whole.
4. Chandigarh being a union-territory was not included in any of the geographical cluster of Punjab. According to ICMR, Chandigarh records the highest 14.6 percent prevalence rate of diabetes, approximately twice the national count of 7.30 percent.
5. Women's with gestational diabetes mellitus (GDM) does not provide information because of social constraints and prohibitions.

CHAPTER IV

AWARENESS ABOUT DIABETES RISK FACTORS AND PREVENTION STRATEGIES AMONG HOUSEHOLDS IN PUNJAB

Assessing the awareness and perception about diabetes mellitus is a crucial step towards eliciting diabetes-related risk factors and prevention strategies (Muninarayana *et al.*, 2010; Page *et al.*, 2016; Kansra, 2018; Kansra and Oberoi, 2021). With the rising prevalence of diabetes and its related complications, awareness regarding risk factors could help in timely prevention and decrease in its prevalence. The level of awareness and perception about diabetes risk factors and prevention strategies majorly depends upon socio-demographic, economic and behavioral factors (Sim *et al.*, 2011; Merloti *et al.*, 2014; Wu *et al.*, 2015; Regmi *et al.*, 2016; Katsiki *et al.*, 2017; Ahmed *et al.*, 2018). Knowledge regarding diabetes, its associated risk factors and prevention strategies is beneficial for designing innovative awareness programs and government campaigns to educate people regarding the consequences of diabetes.

Therefore, the present chapter discusses the level of awareness of diabetic patients towards risk factors and prevention strategies prevalent among the households of Punjab. The chapter is divided into three different sections. Section I highlights the level of awareness and perception about diabetes amongst the diabetic patients of Punjab. Section II discusses the rural-urban comparison of awareness and perception about diabetes mellitus in Punjab. Lastly, Section III concludes the summary along with the policy implications.

SECTION I

4.1 AWARENESS ABOUT DIABETES MELLITUS IN PUNJAB

4.1.1 Awareness and Sources of Awareness about Diabetes Mellitus in Punjab

Table 4.1.1 of the study exhibits the awareness and sources of awareness about diabetes in Punjab. Out of 720 respondents, 49 percent respondents know about what diabetes actually is? Whereas, 51 percent respondents were unaware of diabetes. Though, a large proportion of respondents certainly know about diabetes as a chronic disease but awareness regarding different types of diabetes is very low. It was found that 71 percent respondents don't know about the type of diabetes they are diagnosed with and merely 23 percent of the respondents know about Type-2 diabetes. Majority of respondents know about diabetes from doctors (56 percent) followed by family (15 percent), friends (14 percent), internet (09 percent), books (3 percent), television (2 percent) and newspapers (1 percent).

Table: 4.1.1 Awareness and Sources of Awareness about Diabetes Mellitus in Punjab

Characteristics	(N= 720) (%)
Do you know what diabetes actually is?	
Yes	356 (49)
No	364 (51)
Do you know diabetes mellitus is a chronic disease?	
Yes	581 (81)
No	139 (19)
Type of diabetes you are diagnosed with?	
Type-1	46 (06)
Type-2	159 (23)
Gestational Diabetes Mellitus	02 (00)
Don't Know	513 (71)
From where you have learnt most about diabetes?*	
Doctors	506 (56)
Books	30 (03)
Newspaper	04 (01)
Television	17 (02)
Friends	123 (14)
Family	134 (15)
Internet	83 (09)

Source: Authors calculation established on primary data.
Note: *Multiple responses possible

4.1.2 Awareness about Diabetes and its Association with Socio-Demographic Variables in Punjab

Table 4.1.2 explains the level of awareness based on various socio-demographic variables in Punjab. Out of 356 aware diabetics, 24.7 percent of the respondents were from rural area and 75.3 percent of the respondents were from urban Punjab. It was witnessed that proportion of aware male respondents was 64.9 percent as compared to 35.1 percent of the female respondents.

It was found that 49.4 percent respondents of the age 41-60 years were most aware about diabetes followed by above 60 years (28.4 percent), 21-40 years (19.7 percent) and below 20 years (02.5 percent) respectively. It was further revealed that 83 percent of the aware diabetics were married and rest 17 percent respondents were single. The analysis revealed that 61 percent of the aware respondents agreed with the history of diabetes in the family and rest 39 percent respondents didn't had any history of diabetes in their family.

The level of awareness regarding diabetes was highest amongst the graduates and least amongst the illiterates. Work status revealed that 40.4 percent of the respondents were businessman followed by homemakers, salaried employees, retired, students and others. It was found that respondents with monthly income of ₹15,000- ₹30,000 were most aware of diabetes and respondents with less than ₹15,000 monthly incomes were least aware.

Table 4.1.2 exhibits the association of awareness about diabetes mellitus with socio-demographic variables using Chi-square *($\chi 2$).* The $\chi 2$ test value of 23.514 (p = 0.000) revealed a significant association between level of awareness about diabetes mellitus and region of the respondent. Further, no significant association was witnessed between awareness about diabetes and gender of the respondents (p= 0.092). Age revealed a significant association with the level of awareness about diabetes in Punjab with a $\chi 2$ test value of 32.430 (p= 0.000). Similarly, marital status of the respondents highlighted a significant association with the level of awareness (p= .006).

It was found that history of diabetes revealed a significant association with the level of awareness about diabetes with a $\chi 2$ test value of 16.435 (p= 0.000). Chi-square value of 3.1555 (p= 0.076) explained no significant association between awareness about diabetes and family type of the respondent.

Table: 4.1.2 Awareness about Diabetes by Socio-Demographic Variables in Punjab

Socio-Demographic Variables	Awareness about Diabetes Mellitus		Grand Total
	Aware	Unaware	
Region			
Urban	268 (75.3)	212 (58.2)	480 (66.7)
Rural	88 (24.7)	152 (41.8)	240 (33.3)
Gender			
Male	231 (64.9)	214 (58.8)	445 (61.8)
Female	125 (35.1)	150 (41.2)	275 (38.2)
Age			
Upto 20 years	09 (02.5)	10 (02.7)	19 (02.6)
21- 40 years	70 (19.7)	23 (06.3)	93 (12.9)
41- 60 years	176 (49.4)	184 (50.5)	360 (50.0)
Above 60 years	101 (28.4)	147 (40.4)	248 (34.4)
Marital Status			
Single	60 (17)	36 (09.9)	96 (13.3)
Married	296 (83)	328 (90.1)	624 (86.7)
Education			
Illiterate	00 (00.0)	41 (11.3)	41 (05.7)
Primary	37 (24.7)	181 (41.8)	218 (33.3)
Secondary	100 (28.1)	123 (33.8)	223 (31.0)
Graduation	172 (48.3)	17 (04.7)	189 (26.3)
Post-Graduation	43 (12.1)	01 (00.3)	44 (06.1)
Others	04 (01.1)	01 (00.3)	05 (00.7)
Work Status			
Salaried	59 (16.6)	22 (06.0)	81 (11.3)
Business	144 (40.4)	130 (35.7)	274 (38.1)
Student	20 (05.6)	12 (03.3)	32 (04.4)
Homemaker	85 (23.9)	128 (35.2)	213 (29.6)
Retired	36 (10.1)	25 (06.9)	61 (08.5)

Others	12 (03.4)	47 (12.9)	59 (08.2)
Income			
Less than ₹15,000	22 (06.2)	85 (23.4)	107 (14.9)
₹ 15,000- ₹ 30,000	95 (26.7)	137 (37.6)	232 (32.2)
₹ 30,000- ₹ 45,000	93 (26.1)	76 (20.9)	169 (23.5)
₹ 45,000 - ₹ 60,000	64 (18.0)	40 (11.0)	104 (14.4)
₹ 60,000 and above	82 (23.0)	26 (07.1)	108 (15.0)
Family Type			
Nuclear	181 (50.8)	161 (44.2)	342 (47.5)
Joint	175 (49.2)	203 (55.8)	378 (52.5)
History of Diabetes			
Yes	217 (61.0)	167 (45.9)	384 (53.3)
No	139 (39.0)	197 (54.1)	336 (46.7)

Variables	**Chi-Square (Value)**	**p-Value**	**Phi**	**Cramer's V**
Region	23.514	.000	.181	-
Gender	02.834	.092	-	-
Age	32.430	.000	-	.212
Marital Status	07.533	.006	.102	
Education	307.448	.000	-	.653
Work Status	50.961	.000	-	.266
Income	80.904	.000	-	.335
Family Type	03.155	.076	-	-
History of Diabetes	16.435	.000	.151	-

Source: Authors calculation established on primary data.
Chi-square ($\chi 2$): significant at 5 percent

Income displayed a significant association with the level of awareness about diabetes with a $\chi 2$ test value of 80.904 (p = 0.000). Lastly, Chi-square ($\chi 2$) test value of 307.448 highlighted a significant association between awareness about diabetes and education.

4.1.3 Perception towards Diabetes Risk Factors in Punjab

Table 4.1.3. outlines the perception of respondents regarding numerous risk factors of diabetes mellitus. Risk factors were categorized into three different types such as biological risk factors, physical risk factors and behavioral risk factors. A large proportion of respondents strongly agreed that "*If I am diabetic, my family has higher tendency to be diabetic*" as the prime biological risk factor followed by "*Hypertension increases the prevalence of diabetes mellitus*" and "*With increase in age the incidence of diabetes mellitus increases*" as the most recognized diabetes risk factors.

It was found that "*Obesity increases the occurrence of diabetes*" and "*Lack of regular exercise regimen*" were the most recognized physical risk factor of diabetes, but a large proportion of 32 percent respondents did not recognized "*Sedentary lifestyle leads to the occurrence of diabetes*" as a primary physical risk factor of diabetes in Punjab.

Lastly, 28 percent of the respondents agreed "*Smoking highly contributes to diabetes*" and 26 percent respondents agreed "*Consumption of less servings of fruit and vegetable a day augment diabetes*" as the highest behavioral risk factor of diabetes. However, 51 percent of the respondents disagreed "*excess of alcohol consumption*" as a major behavioral risk factor of diabetes in Punjab.

Table: 4.1.3 Perception towards Diabetes Risk Factors in Punjab

n (%)

Risk Factors		*Strongly Agree*	*Agree*	*Neutral*	*Disagree*	*Strongly Disagree*
Biological Risk Factors	Hypertension increases the prevalence of diabetes mellitus	211 (30)	194 (27)	118 (16)	138 (19)	58 (08)
	With high level of bad cholesterol incidence of diabetes rises	10 (01)	71 (10)	129 (18)	331 (46)	169 (23)
	The usual cause of diabetes is insulin resistance in the body	94 (13)	91 (13)	173 (24)	265 (37)	96 (13)
	If I am diabetic, my family has higher tendency to be diabetic	250 (35)	155 (21)	74 (10)	180 (25)	60 (09)
	With increase in age the incidence of diabetes mellitus increases	143 (20)	220 (30)	162 (23)	163 (23)	31 (04)
Physical Risk Factors	Obesity increases the occurrence of diabetes mellitus	134 (19)	188 (26)	229(32)	141 (20)	27 (03)
	Lack of regular exercise regimen increases the risk of diabetes	132 (18)	225 (31)	142 (20)	163 (23)	57 (08)
	Rising prevalence of diabetes is primarily attributed to rapid urbanization	68 (09)	206 (29)	258 (36)	164 (23)	23 (03)
	Sedentary lifestyle leads to the occurrence of diabetes	95(13)	224 (31)	169 (24)	178 (25)	52 (07)
	Lack of sleep increases the risk of diabetes mellitus	88 (12)	195 (27)	213 (30)	153 (21)	69 (09)
Behavioral Risk Factors	Excess of alcohol consumption make people more prone to diabetes	146 (20)	200 (28)	102 (14)	216 (30)	55 (08)
	Consumption of less servings of fruit and vegetable a day augment diabetes	98 (13)	185 (26)	205 (29)	183 (25)	49 (07)
	Smoking highly contributes to diabetes	55 (08)	79 (11)	87 (12)	368 (51)	130 (18)

Source: Authors calculation established on primary data.

4.1.4 Awareness about Diabetes Risk Factors by Socio-Demographic Variables in Punjab

Table 4.1.4 highlighted the risk factors awareness score and its association with socio-demographic variables in Punjab. "*Mann-Whitney U*" and "*Kruskal-Wallis test*" was performed to study the awareness about diabetes risk factors based on awareness scores and mean rank values. The mean score of 438 aware respondents was 44.337 with a standard deviation of 4.522 (SD).

The results of the "*Mann-Whitney U test*" (p-value = 0.000) exhibits that awareness about diabetes risk factors was highest among urban respondents (mean rank = 234.29) as compared to rural respondents (mean rank= 172.99). Similarly, marital status also explained a significant difference in the level of awareness among married and single respondents (p = 0.046). It was found that there exists no significant difference between the level of awareness among male and female respondents (p= 0.724). It was observed that respondents with diabetes history were more aware of risk factors (mean rank = 232.84) as compared to respondents with no history of diabetes (Table 4.1.4)

Age highlighted a statistically significant difference in the level of awareness about diabetes risk factors (p = 0.024). Respondents with higher level of education were more aware of diabetes risk factors with mean rank values ranging from 105.86 to 339.20. Similarly, respondents with monthly income of ₹60,000 and above were most aware of diabetes risk factors. Lastly, salaried respondents were highly aware of diabetes risk factors (mean rank= 267.82) followed by retired (mean rank= 239.85), businessman (mean rank= 239.85), homemaker (mean rank= 206.73), student (mean rank= 155.18) and others (mean rank= 99.48).

Table: 4.1.4 Awareness about Diabetes Risk Factors by Socio-Demographic Variables in Punjab

Diabetes risk factor awareness scores		Max. Score 65	Mean Score 44.337	SD 4.522
Variables	**Mean Rank**	**Mann-Whitney U**	**Z- Value**	**p-Value**
Region				
Urban	235.29	12986.000	-4.497	0.000[a]
Rural	172.99			
Gender				
Male	217.95	21225.000	-.354	0.724[a]
Female	222.44			
Age				
Upto 20 years	119.30	-	-	0.024[b]
21-40 years	226.73			
41-60 years	231.53			
Above 60 years	197.41			
Marital Status				
Single	188.43	9087.500	-1.995	0.046[a]
Married	224.15			
Education				
Illiterate	105.86	-	-	.000[b]
Primary	166.00			
Secondary	182.33			
Graduate	249.83			
Post-Graduate	329.74			
Others	339.20			
Work Status				
Salaried	267.82	-	-	0.000[b]
Business	226.09			
Student	155.18			
Homemaker	206.73			
Retired	239.85			
Others	99.48			
Income				
Less than ₹15,000	168.33	-	-	0.000[b]
₹ 15,000- ₹ 30,000	193.39			
₹ 30,000- ₹ 45,000	214.18			
₹ 45,000 - ₹ 60,000	220.70			
₹ 60,000 and above	288.26			
Family Type				
Nuclear	221.45	23544.000	-.327	0.743[a]
Joint	217.50			
History of Diabetes				
Yes	232.84	19560.500	-2.702	0.007[a]
No	199.64			

Source: Authors calculation established on primary data.
Note: SD = Standard Deviation and (₹) Indian Rupee.
a Mann-Whitney U Test; b Kruskal-Wallis Test.
A p-Value < 0.05 is considered significant
Z-Value: Compares the average rank for each group with the overall average rank. A negative z-value indicates that a group's average rank is less than the overall average rank.

4.1.5 Perception towards Diabetes Prevention Strategies in Punjab

The perception of respondents regarding various prevention strategies of diabetes is presented in table 4.1.5. The prevention strategies were segmented into two groups as behavioral strategies and interventions. Under behavioral prevention strategies, 41 percent respondents strongly agreed that "*individuals with diabetes should avoid alcohol consumption*" as the primary behavioral prevention strategy followed by "*Regular exercise helps in reducing the vulnerability*" (33 percent) and "*Cessation of smoking and tobacco abuse helps to prevent diabetes*" (26 percent) as the most recognized prevention strategies of diabetes mellitus in Punjab. Behavioral prevention strategies such as "*Reduction of total and saturated fat intake helps in diabetes prevention*" and "*Controlling cholesterol makes people less prone to diabetes*" were the least recognized prevention strategies of diabetes with high disagree percentage share of 37 percent and 39 percent.

Intervention strategies such as "*Proper health education helps to prevent diabetes*" (36 percent) and "*Regular monitoring of blood glucose can prevent diabetes*" (25 percent) were the most recognized intervention strategies for which large percentage of respondents strongly agreed. Lastly, perception towards "*Monitoring hypertension could result in diabetes prevention*" intervention strategy was least recognized amongst diabetic patients of Punjab.

Table: 4.1.5 Perception towards Diabetes Prevention Strategies in Punjab

n (%)

Prevention Strategies		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Behavioral Strategies	Regular exercise helps in reducing the vulnerability of diabetes mellitus	210 (33)	222 (34)	123 (19)	63 (10)	28 (04)
	Individuals with diabetes should avoid alcohol	264 (41)	246 (38)	78 (12)	52 (08)	06 (01)
	Cessation of smoking and tobacco abuse helps to prevent diabetes	170 (26)	181 (28)	142 (22)	121 (19)	32 (05)
	Eating a balanced dietary fibre helps to prevent diabetes	152 (23)	203 (31)	160 (25)	108 (17)	23 (04)
	Reduction of total and saturated fat intake helps in diabetes prevention	56 (09)	109 (17)	143 (22)	273 (37)	67 (10)
	Maintaining healthy body weight reduces the risk of diabetes mellitus	93 (14)	163 (25)	224 (35)	119 (19)	47 (07)
	Controlling cholesterol makes people less prone to diabetes	35 (05)	85 (13)	146 (23)	251 (39)	129 (20)
Interventions	Use of insulin as a lifesaving agent reduces long term complications of diabetes	150 (23)	94 (15)	147 (22)	159 (25)	96 (15)
	Proper health education helps to prevent diabetes	235 (36)	249 (38)	68 (11)	61 (10)	33 (05)
	Monitoring hypertension could result in diabetes prevention	78 (12)	119 (18)	134 (21)	185 (29)	130 (20)
	Regular monitoring of blood glucose can prevent diabetes	165 (25)	218 (34)	121 (19)	99 (15)	44 (07)

Source: Authors calculation established on primary data.

4.1.6 Awareness about Diabetes Prevention Strategies by Socio-Demographic Variables in Punjab

Table 4.1.6 explains the awareness level regarding prevention strategies of diabetes and its association with socio-demographic variables in Punjab. Thus, "*Mann-Whitney U*" and "*Kruskal-Wallis*" tests were performed to study the awareness about diabetes prevention strategies among respondents at different socio-demographic level.

The results of "*Mann-Whitney U*" test revealed that urban respondents were more aware of diabetes prevention strategies (mean rank = 265.65) as compared to rural respondents (mean rank = 232.88). It was found that no statistically significant difference exists in the level of awareness regarding prevention strategies among male and female respondents (p = 0.703). Similarly, marital status showed no significant difference in the level of awareness regarding prevention strategies between married and single respondent (p = 0.247). Lastly, respondents with and without the history of diabetes revealed almost same level of awareness about prevention strategies of diabetes with their mean rank of 258.32 and 254.17.

Age exhibits a statistically significant difference in the level of awareness regarding prevention strategies of diabetes mellitus in Punjab using "*Kruskal-Wallis*" test (p= 0.044). Respondents of the age 21-40 years (mean rank = 294.61) were most aware followed by upto 20 years (mean rank = 284.43), 41-60 years (mean rank = 256.80) and 60 years and above (mean rank = 236.90). However, a statistically significant difference was also observed among educated and illiterate respondents (p-value= 0.000). Respondents with post-graduation (mean rank = 391.00) were highly aware of diabetes prevention strategies as compared to illiterate respondents (mean rank = 191.88).

The results of the analysis show that respondents with higher income level were most aware of prevention strategies and a statistically significant difference was observed with p-value = 0.000. Whereas, retired respondents with mean rank of 313.37 were highly aware of diabetes prevention strategies followed by salaried (mean rank= 300.48), student (mean rank= 262.94), homemaker (mean rank= 250.42), businessman (mean rank= 242.54) and others (mean rank= 162.60).

Table: 4.1.6 Awareness about Diabetes Prevention Strategies by Socio-Demographic Variables in Punjab

Diabetes prevention strategies awareness scores	Max. Score 55	Mean Score 38.578	SD 3.605
Variables	**Mean Rank**	**Mann-Whitney U**	**Z- Score**	***P*-Value**
Region				
Urban	265.65	23006.000	-2.257	0.024[a]
Rural	232.88			
Gender				
Male	254.62	29775.000	-.381	0.703[a]
Female	259.78			
Age				
Upto 20 years	284.43	-	-	0.044[b]
21-40 years	294.61			
41-60 years	256.80			
Above 60 years	236.90			
Marital Status				
Single	276.46	13058.500	-1.158	0.247[a]
Married	253.65			
Education				
Illiterate	191.88	-	-	0.000[b]
Primary	227.54			
Secondary	236.93			
Graduate	266.73			
Post-Graduate	391.00			
Others	198.00			
Work Status				
Salaried	300.48	-	-	0.000[b]
Business	242.54			
Student	262.94			
Homemaker	250.42			
Retired	313.37			
Others	162.60			
Income				
Less than ₹15,000	194.35	-	-	0.000[b]
₹ 15,000- ₹ 30,000	235.34			
₹ 30,000- ₹ 45,000	257.94			
₹ 45,000 - ₹ 60,000	282.19			
₹ 60,000 and above	304.02			
Family Type				
Nuclear	262.51	31206.500	-.870	0.384[a]
Joint	251.15			
History of Diabetes				
Yes	258.32	31733.000	-.316	0.752[a]
No	254.17			

Source: Authors calculation established on primary data.
Note: SD = Standard Deviation and (₹) Indian Rupee.
a Mann-Whitney U Test; b Kruskal-Wallis Test.
A p-Value of p-Value < 0.05 is considered significant
Z-Value: Compares the average rank for each group with the overall average rank. A negative z-value indicates that a group's average rank is less than the overall average rank.

SECTION II

4.2 RURAL-URBAN COMPARISON OF AWARENESS ABOUT DIABETES MELLITUS IN PUNJAB

4.2.1 Awareness and Sources of Awareness about Diabetes Mellitus in Rural and Urban Punjab

Table 4.2.1 shows the awareness and sources of awareness about diabetes mellitus in rural and urban Punjab. Out of 356 aware respondents, 55.8 percent respondents were from urban area and 36.6 percent respondents were from rural area. A large proportion of 81 percent respondents know about diabetes as a chronic disease. The awareness regarding different types of diabetes was found to be very low in both rural and urban area. Out of 720 respondents a large proportion of 87.2 percent of the rural respondents and 63.5 percent of the urban respondents don't know about the type of diabetes they are diagnosed with. Majority of urban respondents know about diabetes mostly from doctors (62 percent), family (15 percent) and friends (13 percent). Similarly, a large number of the rural respondents know about diabetes from doctors (69 percent), friends (12.5 percent) and family (10 percent). Newspaper was the least known source of awareness about diabetes to the respondents of both rural and urban Punjab.

Table: 4.2.1 Awareness and Sources of Awareness about Diabetes in Rural and Urban Punjab

Characteristics	Urban	Rural
Do you know what diabetes actually?		
Yes	268 (55.8)	88 (36.6)
No	212 (44.2)	152 (63.4)
Do you know diabetes mellitus is a chronic disease?		
Yes	416 (86.6)	166 (69.1)
No	64 (13.4)	74 (30.9)
Type of diabetes mellitus you are diagnosed with?		
Type-1	35 (07.2)	11 (04.5)
Type-2	140 (29.1)	19 (07.9)
Gestational Diabetes	01 (00.2)	01 (00.4)
Don't Know	304 (63.5)	209 (87.2)
From where you have learnt most about diabetes?*		
Doctors	479 (62)	239 (69)
Books	28 (03)	02 (0.5)
Newspaper	02 (00)	02 (0.5)
Television	14 (02)	02 (0.5)
Friends	83 (13)	40 (12.5)
Others	158 (20)	59 (17)

Source: Authors calculation established on primary data.
Note: *Multiple Responses.

4.2.2 Awareness about Diabetes and its Association with Socio-Demographic Variables in Rural and Urban Punjab.

Table 4.2.2 explains the level of awareness about diabetes based on various socio-demographic variables in rural and urban Punjab. The percentage share of aware male (69.3 percent) respondents was high in rural area as compared to urban area (63.4 percent). The results revealed that respondents of age 41-60 years were highly aware of diabetes and respondents of age upto 20 years were least aware of diabetes in both rural and urban area. Considering marital status, 85 percent of the urban married respondents were aware of diabetes as compared to 76.1 percent of the married rural respondents.

The results revealed that 44.8 percent of the aware urban respondents were businessman followed by homemaker (22.4 percent) and salaried (17.5 percent). Analogously, work status of the aware rural respondents highlighted homemakers (28.4 percent) were most cognizant of diabetes followed by businessman (27.3 percent) and salaried (13.6 percent). Urban respondents with monthly income of ₹60,000 and above (29.9 percent) were most aware of diabetes and rural respondents with monthly income of ₹15,000-₹30,000 had the highest level of awareness about diabetes. The percentage share of aware respondents under family type section was almost same in both rural and urban area. Finally, it was found that the level of awareness about diabetes was highest among urban residents having a history of diabetes in the family (61.6 percent).

The results of table 4.2.2 exhibits that there exist no significant association between gender and awareness of diabetes in both rural (p = 0.334) and urban area (p = 0.084). Similarly, family type also highlighted no significant association with awareness of diabetes in urban (p= 0.128) and rural (p= 0.304) Punjab. A statistically significant association between age and awareness of diabetes was witnessed in both urban ($\chi 2$= 28.373; p= 0.000) and rural area ($\chi 2$=11.145; p= 0.009).

It was witnessed that marital status highlights a statistically significant association with awareness of diabetes in both urban (p= 0.000) and rural area (p= 0.037). Chi-square ($\chi 2$) value of education in urban (198.158; p= 0.000) and rural area (100.566; p= 0.000) exhibits a significant association between awareness of diabetes and education i.e., higher educational background leads to a higher degree of awareness regarding diabetes. Similarly, income highlighted a statistically significant association

Table: 4.2.2 Awareness about Diabetes and its Association with Socio-Demographic Variables in Rural and Urban Punjab

Socio-Demographic Variables	Urban		Rural	
	Aware	Unaware	Aware	Unaware
Gender				
Male	170 (63.4)	118 (55.7)	61 (69.3)	96 (63.2)
Female	98 (36.6)	94 (44.3)	27 (30.7)	56 (36.8)
Age				
Upto 20 years	08 (03.0)	07 (03.3)	01 (01.1)	03 (02.0)
21-40 years	46 (17.2)	07 (03.3)	24 (27.3)	16 (10.5)
41-60 years	136 (50.7)	104 (49.1)	40 (45.5)	80 (52.6)
Above 60 years	78 (29.1)	94 (44.3)	23 (26.1)	53 (34.9)
Marital Status				
Single	39 (14.6)	16 (07.5)	21 (23.9)	20 (13.2)
Married	229 (85.4)	196 (92.5)	67 (76.1)	132 (86.8)
Education				
Illiterate	00 (00.0)	11 (05.2)	00 (00.0)	30 (19.7)
Primary	23 (08.6)	94 (44.3)	14 (15.9)	87 (57.2)
Secondary	61 (22.8)	91 (42.9)	39 (44.3)	32 (21.1)
Graduation	140 (52.2)	14 (06.6)	32 (36.4)	03 (02.0)
Post-Graduation	40 (14.9)	01 (00.5)	03 (03.4)	00 (00.0)
Others	04 (01.5)	01 (00.5)	-	-
Work Status				
Salaried	47 (17.5)	14 (06.7)	12 (13.6)	08 (05.3)
Business	120 (44.8)	91 (42.9)	24 (27.3)	39 (25.7)
Student	13 (04.9)	09 (04.2)	07 (08.0)	03 (02.0)
Homemaker	60 (22.4)	83 (39.2)	25 (28.4)	45 (29.6)
Retired	27 (10.1)	09 (04.2)	09 (10.2)	16 (10.5)
Others	01 (00.4)	06 (02.8)	11 (12.5)	41 (27.0)

Income				
Less than ₹15,000	10 (03.7)	37 (17.5)	12 (13.6)	48 (31.6)
₹ 15,000- ₹ 30,000	57 (21.3)	74 (34.9)	38 (43.2)	63 (41.4)
₹ 30,000- ₹ 45,000	63 (23.5)	50 (23.6)	30 (34.1)	26 (17.1)
₹ 45,000 - ₹ 60,000	58 (21.6)	28 (13.2)	06 (06.8)	12 (07.9)
₹ 60,000 and above	80 (29.9)	23 (10.8)	02 (02.3)	03 (02.0)
Family Type				
Nuclear	135 (50.4)	92 (43.4)	46 (52.3)	69 (45.4)
Joint	133 (49.6)	120 (56.6)	42 (47.7)	83 (54.6)
History of Diabetes				
Yes	165 (61.6)	90 (42.5)	52 (59.1)	77 (50.7)
No	103 (38.4)	122 (57.5)	36 (40.9)	75 (49.3)
Variables	**Chi-Square (*p* value)**	**Phi/Cramer's V**	**Chi-Square (*p* value)**	**Phi/Cramer's V**
Gender	02.979 (p= .084)	-	00.935 (p= .334)	-
Age	28.373 (p= .000)	.243	11.145 (p= .009)	.219
Marital Status	07.725 (p= .017)	.109	04.510 (p= .037)	.137
Education	198.159 (p= .000)	.643	100.566 (p= .000)	.647
Work Status	32.749 (p= .000)	.261	14.950 (p= .011)	.250
Income	55.442 (p= .000)	.340	14.218 (p= .007)	.343
Family Type	02.311 (p= .128)	-	01.056 (p= .304)	-
History of Diabetes	17.366 (p= .000)	.190	01.594 (p= .208)	-

Source: Authors calculation established on primary data.
Chi-Square ($\chi 2$): significant at 5 percent.

with awareness of diabetes in both urban ($\chi 2 = 55.442$; $p = 0.000$) and rural area ($\chi 2 = 14.218$; $p = 0.007$). Lastly, history of diabetes also revealed a statistically significant association with awareness of diabetes only in urban area ($p = 0.000$) but statistically insignificant association was witnessed in rural area ($p = 0.208$).

4.2.3 Perception towards Diabetes Risk Factors in Rural and Urban Punjab

Table 4.2.3 outlines the perception of urban and rural respondents towards various risk factors of diabetes. Risk factors were categorized in three different types. The first type comprises of biological risk factors, second type encompasses physical risk factors and third type was behavioral risk factors.

The results of the study exhibited that 31 percent of the rural respondents and 37 percent of the urban respondents perceived "*If I am diabetic, my family has higher tendency to be diabetic*" as the primary biological risk factor followed by "*Hypertension increases the prevalence of diabetes mellitus*" and "*With increase in age the incidence of diabetes mellitus increases*". It was found that 24 percent of the rural respondents and 23 percent of the urban respondents strongly disagreed "*With high level of bad cholesterol incidence of diabetes rises*" as the least recognized biological risk factor of diabetes.

Under physical risk factors, 61 percent of the urban respondents recognized "*Lack of regular exercise regimen*" as a key risk factor followed by "*Sedentary lifestyle leads to the occurrence of diabetes*" and "*Obesity increases the occurrence of diabetes mellitus*". Similarly, 40 percent of the rural respondents perceived "*Rising prevalence of diabetes is primarily attributed to rapid urbanization*" as the foremost physical risk factors of diabetes.

It was revealed that 19 percent of the rural respondents and 21 percent of the urban respondents strongly agreed to recognize "*Excess of alcohol consumption make people more prone to diabetes*" as primary behavioral risk factor of diabetes. Lastly, in both rural and urban Punjab, behavioral risk factors *such as* "*Consumption of less servings of fruit and vegetable a day*" and "*Smoking highly contributes to diabetes*" were least recognized diabetes risk factors.

Table: 4.2.3 Perception towards Diabetes Risk Factors in Rural and Urban Punjab

n (%)

Risk Factors		Urban					Rural				
		Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Biological Risk Factors	Hypertension increases the prevalence of diabetes mellitus	140 (29)	144 (30)	76 (16)	81 (17)	38 (08)	71 (30)	50 (21)	42 (17)	57 (24)	20 (08)
	With high level of bad cholesterol incidence of diabetes rises	14 (03)	56 (12)	85 (18)	212 (44)	112 (23)	05 (02)	15 (06)	44 (18)	119 (50)	57 (24)
	The usual cause of diabetes is insulin resistance in the body	84 (13)	71 (13)	110 (24)	154 (37)	60 (13)	10 (04)	20 (07)	63 (26)	111 (46)	36 (15)
	If I am diabetic, my family has higher tendency to be diabetic	176 (37)	111 (23)	56 (12)	95 (20)	42 (08)	75 (31)	44 (18)	18 (08)	85 (35)	18 (08)
	With increase in age the incidence of diabetes mellitus increases	87 (18)	158 (33)	114 (24)	106 (22)	14 (03)	56 (23)	62 (26)	48 (20)	57 (24)	17 (07)
Physical Risk Factors	Obesity increases the occurrence of diabetes mellitus	106 (22)	132 (28)	153 (32)	80 (16)	09 (02)	28 (12)	56 (23)	78 (32)	61 (25)	18 (8)
	Lack of regular exercise regimen increases the risk of diabetes	115 (24)	176 (37)	92 (19)	73 (15)	23 (05)	17 (07)	49 (20)	50 (20)	90 (38)	34 (14)
	Rising prevalence of diabetes is primarily attributed to rapid urbanization	45 (09)	132 (28)	187 (39)	98 (20)	17 (04)	23 (09)	74 (31)	71 (30)	66 (28)	06 (02)
	Sedentary lifestyle leads to the occurrence of diabetes	67 (14)	183 (38)	112 (23)	92 (19)	24 (06)	28 (12)	41 (17)	57 (24)	86 (35)	28 (12)
	Lack of sleep increases the risk of diabetes mellitus	62 (13)	130 (27)	152 (32)	96 (20)	39 (08)	26 (11)	64 (27)	61 (25)	57 (24)	30 (13)
Behavioral Risk Factors	Excess of alcohol consumption make people more prone to diabetes	102 (21)	126 (26)	60 (13)	157 (33)	35 (07)	45 (19)	74 (31)	42 (18)	59 (25)	20 (07)
	Consumption of less servings of fruit and vegetable a day augment diabetes	73 (15)	121 (25)	133 (28)	129 (27)	23 (5)	25 (10)	64 (27)	72 (30)	53 (22)	26 (11)
	Smoking highly contributes to diabetes	45 (09)	50 (10)	61 (13)	255 (54)	68 (14)	10 (04)	29 (12)	26 (11)	113 (47)	62 (26)

Source: Authors calculation established on primary data.

4.2.4 Awareness about Diabetes Risk Factors by Socio-Demographic Variables in Rural and Urban Punjab

Table 4.2.4 highlights rural-urban comparison of the awareness scores of diabetes risk factors and its association with socio-demographic variables in Punjab. Mann-Whitney U and Kruskal-Wallis tests were performed to study the awareness about diabetes risk factors and its association based on awareness scores and mean rank values.

The mean score of 44.507 was observed in urban area and 42.945 in rural area. The results of "*Mann-Whitney U*" test in urban (p= 0.358) and rural (p = 0.147) area revealed no statistical association between gender and awareness about diabetes risk factors. Similarly, no statistically significant association was witnessed between marital status and awareness about diabetes risk factors in urban (p = 0.589) and rural (p = 0.120) area. The analysis of "*Mann-Whitney U*" test show a statistically significant association between history of diabetes and awareness about diabetes risk factors among urban respondents (p= 0.002) but no significant association was witnessed among rural respondents (p= 0.403).

The results of "*Kruskal-Wallis*" test revealed no statistically significant association between age and awareness of diabetes risk factors in both rural (p = 0.435) and urban (p = 0.074) Punjab. Education observed a statistically significant association with the level of awareness about diabetes risk factors in both urban (p = 0.000) and rural (p = 0.031) area. Mean rank value of urban and rural respondents concludes that more educated respondents to be substantially aware of diabetes risk factors as compared to illiterates. Income witnessed a statistically significant association with awareness of diabetes risk factors in urban area (p= 0.002) but not in rural area (p = 0.109). The urban respondents with monthly income of ₹60,000 and above were most aware of diabetes risk factors (mean rank = 197.45) as compared to the respondents with monthly income less than ₹15,000 (mean rank = 134.54).

Table: 4.2.4 Awareness about Diabetes Risk Factors by Socio-Demographic Variables in Rural and Urban Punjab

Socio-Demographic Variables	Risk Factors Awareness in Urban				Risk Factors Awareness in Rural			
		Awareness Max. Score 65	Mean Score 44.507	SD 4.175		Awareness Max. Score 65	Mean Score 42.945	SD 4.284
	Mean Rank	Mann-Whitney U	Z- Score	*P*-Value	Mean Rank	Mann-Whitney U	Z- Score	*P*-Value
Gender								
Male	167.52	11443.000	-.919	0.358[a]	52.96	1122.000	-1.451	0.147[a]
Female	157.50				62.33			
Age								
Upto 20 years	166.10				-			
21-40 years	183.95	-	-	0.074[b]	52.58	-	-	0.435[b]
41-60 years	169.98				59.29			
Above 60 years	145.29				50.41			
Marital Status								
Single	172.00	4950.000	-0.540	0.589[a]	46.26	740.500	-1.555	0.120[a]
Married	163.01				58.27			
Education								
Illiterate	69.50				40.06			
Primary	122.65				56.63			
Secondary	125.48	-	-	0.000[b]	49.88	-	-	0.031[b]
Graduate	181.20				64.27			
Post-Graduate	235.79				99.00			
Others	231.90				-			
Work Status								
Salaried	211.75				48.12			
Business	159.05				60.53			
Student	145.77	-	-	0.000[b]	60.00	-	-	0.009[b]
Homemaker	145.60				62.86			
Retired	177.37				69.08			
Others	69.40				31.81			

Income								
Less than ₹15,000	134.54	-	-	0.002[b]	46.76	-	-	0.109[b]
₹ 15,000- ₹ 30,000	143.30				56.45			
₹ 30,000- ₹ 45,000	162.07				56.40			
₹ 45,000 - ₹ 60,000	158.23				58.95			
₹ 60,000 and above	197.45				110.50			
Family Type								
Nuclear	163.88	13340.000	-.023	0.981[a]	62.25	1131.500	-2.324	0.020[a]
Joint	164.12				48.09			
History of Diabetes								
Yes	177.60	10431.000	-3.076	0.002[a]	57.46	1270.000	-.386	0.403[a]
No	145.14				52.56			

Source: Authors calculation established on primary data.
Note: SD = Standard Deviation and (₹) Indian Rupee.
a Mann-Whitney U Test; b Kruskal-Wallis Test.
A p-Value < 0.05 is considered significant
Z-Value: Compares the average rank for each group with the overall average rank.
A negative z-value indicates that a group's average rank is less than the overall average rank.

4.2.5 Perception towards Diabetes Prevention Strategies in Rural and Urban Punjab

Table 4.2.5 summarizes the perception of rural and urban respondents towards various prevention strategies of diabetes. Prevention strategies were categorized as behavioral strategies and interventions.

Under behavioral prevention strategies it was found that 36 percent of the rural and 43 percent of the urban respondents perceived "*Individuals with diabetes should avoid alcohol*" as primary prevention strategy of diabetes. Whereas, 38 percent of the urban respondents and 28 percent rural respondents recognized "*Regular exercise helps in reducing the vulnerability of diabetes mellitus*" and "*Cessation of smoking and tobacco abuse helps to prevent diabetes*" as the second most perceived and recognized prevention strategy. Lastly, behavioral prevention strategy "*Controlling cholesterol makes people less prone to diabetes*" was least recognized strategy by 54 percent of the rural respondents and 61 percent urban respondents in Punjab.

Under intervention strategies the results highlighted that 30 percent of the rural respondents and 39 percent urban respondents perceived "*Proper health education helps to prevent diabetes*" as foremost prevention strategy followed by "*Regular monitoring of blood glucose can prevent diabetes*" as the second most recognised intervention strategies in both rural and urban area with high percentage share. Lastly, "*Monitoring hypertension could result in diabetes prevention*" was the least recognized intervention strategy both in rural and urban Punjab.

Table: 4.2.5 Perception towards Diabetes Prevention Strategies in Rural and Urban Punjab

n (%)

Prevention Strategies		Urban					Rural				
		Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Behavioral Strategies	Regular exercise helps in reducing the vulnerability of diabetes mellitus	160 (38)	169 (40)	55 (13)	25 (06)	15 (03)	50 (22)	53 (23)	68 (30)	38 (17)	13 (06)
	Individuals with diabetes should avoid alcohol	183 (43)	171 (40)	47 (12)	19 (04)	04 (01)	81 (36)	75 (34)	31 (14)	33 (14)	02 (01)
	Cessation of smoking and tobacco abuse helps to prevent diabetes	107 (25)	121 (29)	79 (19)	87 (21)	17 (04)	63 (28)	60 (27)	50 (22)	34 (15)	15 (07)
	Eating a balanced dietary fibre helps to prevent diabetes	109 (25)	147 (35)	106 (25)	52 (13)	10 (02)	43 (20)	56 (25)	54 (24)	56 (25)	13 (06)
	Reduction of total and saturated fat intake helps in diabetes prevention	30 (07)	69 (16)	102 (24)	189 (45)	34 (08)	24 (11)	40 (19)	41 (19)	84 (37)	33 (14)
	Maintaining healthy body weight reduces the risk of diabetes mellitus	81 (19)	125 (29)	129 (30)	71 (17)	18 (04)	12 (06)	38 (17)	95 (43)	48 (21)	29 (13)
	Controlling cholesterol makes people less prone to diabetes	25 (05)	53 (12)	88 (21)	169 (40)	89 (21)	10 (05)	32 (16)	58 (25)	82 (35)	40 (19)
Interventions	Use of insulin as a lifesaving agent reduces long term complications of diabetes	101 (24)	72 (17)	112 (26)	94 (22)	45 (11)	49 (24)	22 (17)	35 (26)	65 (22)	51 (11)
	Proper health education helps to prevent diabetes	167 (39)	171 (40)	35 (08)	41 (10)	10 (02)	68 (30)	78 (36)	33 (15)	20 (09)	23 (10)
	Monitoring hypertension could result in diabetes prevention	46 (11)	92 (22)	84 (20)	131 (31)	72 (16)	32 (14)	28 (13)	50 (22)	54 (24)	58 (25)
	Regular monitoring of blood glucose can prevent diabetes	103 (24)	157 (37)	80 (19)	58 (14)	26 (06)	62 (28)	61 (28)	41 (18)	41 (18)	17 (08)

Source: Authors calculation established on primary data.

4.2.6 Awareness about Diabetes Prevention Strategies by Socio-Demographic Variables in Rural and Urban Punjab

Table 4.2.6 shows the rural-urban comparison of the awareness scores of diabetes prevention strategies and its association with socio-demographic variables in Punjab. Both "*Mann-Whitney U*" and "*Kruskal-Wallis*" tests were performed to study the awareness about prevention strategies and its association based on awareness scores and mean rank values.

It was found that there exist no statistically significant association between gender and awareness about prevention strategies in rural (p = 0.859) and urban (p= 0.445) Punjab. Similarly, marital status observed no statistically significant association with awareness about prevention strategies in both rural (p= 0.491) and urban (p= 0.146) Punjab. The results of "*Mann-Whitney U*" test highlighted that there exists no significant difference between the level of awareness about diabetes prevention strategies and family type in rural (p= 0.143) and urban (p= 0.665) Punjab.

The analysis of "*Kruskal-Wallis*" test manifest a statistically significant association between age and level of awareness regarding prevention strategy in urban (p= 0.036) area. Table 4.2.6 revealed a statistically significant association between education and awareness of diabetes prevention strategies in urban (p= 0.000) area but education exhibited no significant association with awareness of prevention strategies in rural (p= 0.076) area. Similarly, it was found that income observed a significant association with awareness of diabetes prevention strategies in urban area (p= 0.000) but not in rural area (p= 0.071). Lastly, the results highlighted a significant association between work status and prevention strategies of diabetes was witnessed in both urban (p =.009) and rural (p =.010) Punjab.

Table: 4.2.6 Awareness about Diabetes Prevention Strategies and its Association with Socio-Demographic Variables in Rural and Urban Punjab

Socio-Demographic Variables	Prevention Strategies Awareness in Urban				Prevention Strategies Awareness in Rural			
	Awareness Max. Score 55		Mean Score 38.888	SD 3.347	Awareness Max. Score 55		Mean Score 38.174	SD 4.053
	Mean Rank	Mann-Whitney U	Z- Score	*P*-Value	Mean Rank	Mann-Whitney U	Z- Score	*P*-Value
Gender								
Male	181.78	15093.000	-.763	.445[a]	72.76	2304.000	-.178	.859[a]
Female	190.52				71.18			
Age								
Upto 20 years	-				60.25			
21-40 years	223.95	-	-	.036[b]	76.19	-	-	.851[b]
41-60 years	256.80				72.74			
Above 60 years	236.90				68.17			
Marital Status								
Single	208.38	5523.000	-1.454	.146[a]	77.16	1346.000	-.689	.491[a]
Married	182.24				70.91			
Education								
Illiterate	-				49.00			
Primary	171.82				69.58			
Secondary	158.35	-	-	.000[b]	74.71	-	-	.076[b]
Graduate	187.01				72.45			
Post-Graduate	271.70				128.17			
Others	131.60				-			
Work Status								
Salaried	217.17				82.06			
Business	168.41				72.20			
Student	-	-	-	.009[b]	52.94	-	-	.010[b]
Homemaker	183.83				70.97			
Retired	209.00				96.58			
Others	-				-			

Income								
Less than ₹15,000	146.61	-	-	.000[b]	62.05	-	-	.071[b]
₹ 15,000- ₹ 30,000	166.59				69.99			
₹ 30,000- ₹ 45,000	165.63				88.16			
₹ 45,000 - ₹ 60,000	210.04				61.70			
₹ 60,000 and above	213.84				96.75			
Family Type								
Nuclear	187.63	16427.000	-.433	.665[a]	76.87	2192.500	-1.463	.143[a]
Joint	182.82				66.78			
History of Diabetes								
Yes	188.45	15970.000	-.718	.473[a]	72.72	2479.000	-.228	.820[a]
No	180.44				71.14			

Source: Authors calculation established on primary data.

Note: SD = Standard Deviation and (₹) Indian Rupee.

a Mann-Whitney U Test; b Kruskal-Wallis Test.

A p-Value < 0.05 was considered significant.

Z-Value: Compares the average rank for each group with the overall average rank.

A negative z-value indicates that a group's average rank is less than the overall average rank.

SECTION III

4.3 SUMMARY AND CONCLUSION

Punjab is the second highest carrier state of diabetes mellitus after Kerela and has emerged as the national front runner in obesity, dyslipidemia and hypertension as the major risk factors of diabetes. Monitoring the awareness regarding diabetes risk factors and prevention strategies play's an imperative role.

It was found that out of 720 respondents, 49 percent respondents know about what diabetes actually is? Moreover, a large proportion of respondents know diabetes is a chronic metabolic syndrome. Cognizance regarding different types of diabetes was very low. It was observed that 71 percent of the respondents don't know about the type of diabetes they are diagnosed with. The main sources of awareness about diabetes was doctors (56 percent) followed by family (15 percent), friends (14 percent), internet (09 percent), books (3 percent), television (2 percent) and newspapers (1 percent).

Further analysis revealed that 75.3 percent respondents were from urban area and 24.7 percent respondents were from rural area. Similarly, proportion of the aware male respondents was 64.9 percent as compared to 35.1 percent of the female respondents. Age highlighted that respondents of age 41-60 years were most aware about diabetes followed by 60 years and above, 21-40 years and below 20 years respectively. Analysis revealed that 61 percent of the aware respondents agreed with the history of diabetes in the family.

The analysis revealed that the level of awareness was highest amongst the graduate respondents and least among illiterates. Work status of the aware respondents revealed that 40.4 percent respondents were businessman followed by homemakers, salaried, retired, students and others. Further it was revealed that 26.7 percent respondents were from ₹15,000- ₹30,000 income group were most aware of diabetes and 06.2 percent respondents from less than ₹15,000 income group were least aware of diabetes.

Results of Chi-Square ($\chi 2$) revealed that there exists a significant association between awareness about diabetes and region, age, marital status, income, education, work status and history of diabetes. However, it was found that gender and family type exhibits no significant association with the level of awareness about diabetes at 5 percent level of significance.

The perception of respondents towards diabetes risk factors in Punjab highlighted that a large proportion of respondents strongly agreed that "*If I am diabetic, my family has higher tendency to be diabetic*" as the foremost biological risk factor followed by "*Hypertension increases the prevalence of diabetes mellitus*" and "*With increase in age the incidence of diabetes mellitus increases*". Further it was found that "*Obesity increases the occurrence of diabetes*" and "*Lack of regular exercise regimen*" were the most recognized physical risk factor of diabetes. Lastly, 28 percent of the respondents agreed "*Smoking highly contributes to diabetes*" and 26 percent respondents agreed "*Consumption of less servings of fruit and vegetable a day augment diabetes*" as the highest behavioral risk factors of diabetes.

Mann-Whitney U and Kruskal-Wallis tests were performed to study the awareness about diabetes risk factors and its association with socio-demographic variables based on awareness scores and mean rank values. The results of "*Mann-Whitney U*" test found that awareness about diabetes risk factors was highest among urban respondents (mean rank= 234.29) as compared to rural respondents (mean rank= 172.99). Similarly, marital status also explicated a significant difference in the awareness level among married and single respondents. However, the analysis witnessed that there exists no statistically significant difference in the level of awareness among male and female respondents. Respondents with history of diabetes were more aware of risk factors (mean rank= 232.84) as compared to respondents with no history of diabetes.

Education-wise analysis shows that highly educated respondents were more aware of diabetes risk factors rather than illiterates. Age highlighted a statistically significant difference in the level of awareness about diabetes risk factors (p = 0.024). Similarly, respondents with monthly income of ₹60,000 and above were most aware of diabetes risk factors and a statistically significant difference was witnessed with p = 0.000. Lastly, salaried respondents were highly aware of diabetes risk factors followed by retired, businessman, homemaker, student and others.

Perception towards diabetes prevention strategies in Punjab highlighted that under behavioral prevention strategies 41 percent respondents perceived "*individuals with diabetes should avoid alcohol consumption*" as the main prevention strategy. Whereas, intervention strategies such as "*Proper health education helps to prevent diabetes*" (36

percent) and "*Regular monitoring of blood glucose can prevent diabetes*" (25 percent) were the most noticed intervention strategies.

Prevention strategies awareness score and its association with socio-demographic variables in Punjab was analyzed using Mann-Whitney and Kruskal-Wallis test. The results of Mann-Whitney U test highlighted that there exists a statistically significant difference between region and level of awareness about diabetes prevention strategies (p = 0.024). Moreover, it was found that awareness about diabetes prevention strategies was highest among urban respondents (mean rank = 265.65) as compared to the rural respondents (mean rank = 265.65). Similarly, the results of Kruskal-Wallis test show that there exists a statistically significant difference between the awareness about prevention strategies and socio-demographic variables such as age, education, work status and income.

Rural-urban comparison of awareness and perception about diabetes is a pivotal step towards eliciting the risk factors and prevention strategies in Punjab. Table 4.2.1 highlights the awareness and sources of awareness about diabetes in urban and rural Punjab. Out of 356 aware respondents a large proportion of the urban respondents were aware of diabetes and 36.6 percent of the rural respondents know about what diabetes actually is? Respondents from both rural and urban area were least aware of the type of diabetes they were diagnosed with, merely 7.9 percent of the respondents know about type-2 diabetes in rural Punjab. Out of various sources of awareness, doctors were the main source of awareness about diabetes for both rural and urban respondents.

The results of the table 4.2.2 exhibits that male respondents were more aware of diabetes as compared to female respondents in both rural and urban Punjab. It was found that respondents of age 41-60 years were most aware of diabetes in both rural and urban Punjab. Further, it was witnessed that respondents with income ₹60,000 and above were most aware of diabetes in urban Punjab, whereas, respondents with income ₹15,000-₹30,000 were most aware of diabetes in rural Punjab. Finally, the level of awareness about diabetes was witnessed to be highest among urban residents with the history of diabetes (61.6 percent).

Table 4.2.2 shows no significant association between awareness of diabetes and gender. Similarly, no significant association exists between family type and awareness of diabetes in urban ($\chi2$= 02.311; p= 0.128) and rural areas ($\chi2$= 01.056; p= 0.304). A

statistically significant association between awareness of diabetes and age, marital status, history of diabetes was witnessed in both urban and rural area with $p< 0.05$. Similarly, a statistically significant association between awareness of diabetes and education, income and work status was witnessed in urban and rural Punjab.

Perception of urban and rural respondents regarding various risk factors of diabetes was outlined in table 4.2.3. The results of the study exhibit that 31 percent of the rural respondents and 37 percent of the urban respondents perceived "*If I am diabetic, my family has higher tendency to be diabetic*" as the top biological risk factors followed by "*Hypertension increases the prevalence of diabetes mellitus*" and "*With increase in age the incidence of diabetes mellitus increases*". Under physical risk factors 61 percent urban respondents recognized "*Lack of regular exercise regimen*" as a primary risk factor and 40 percent rural respondents recognized "*Rising prevalence of diabetes is primarily attributed to rapid urbanization*" as the foremost physical risk factors of diabetes. Finally, 19 percent of the rural respondents and 21 percent of the urban respondents strongly agreed to recognize "*Excess of alcohol consumption make people more prone to diabetes*" as key behavioral risk factor.

Table 4.2.4 highlighted rural-urban comparison of the awareness scores of diabetes risk factors and its association with socio-demographic variables in Punjab. Results of "*Mann-Whitney U*" test revealed no statically significant difference between gender and awareness for diabetes risk factors in rural and urban Punjab. Similarly, no statistically significant difference was witnessed between marital status and awareness for risk factors in both rural and urban Punjab.

The analysis revealed that no statistically significant difference between age and awareness of diabetes risk factors in both rural and urban, Punjab. Mean rank values of urban and rural respondents concludes, more educated respondents to be substantially aware of risk factors as compared to illiterates (Table 4.2.4). The mean rank value of urban respondents with income ₹60,000 and above was highest as compared to rural respondents with income less than ₹15,000, thereby highlighting higher level of awareness for diabetes risk factors.

Perception of rural and urban respondents regarding various prevention strategies of diabetes was highlighted in table 4.2.5. Under behavioral prevention strategies, 36 percent of rural and 43 percent urban respondents strongly agreed "*Individuals with*

diabetes should avoid alcohol" as key prevention strategy of diabetes. It was found that behavioral prevention strategy "*Controlling cholesterol makes people less prone to diabetes*" was least recognized strategy by 54 percent rural respondents and 61 percent urban respondents in Punjab.

Under intervention strategies, 30 percent rural respondents and 39 percent urban respondents strongly agreed "*Proper health education helps to prevent diabetes*" as foremost prevention strategy followed by "*Regular monitoring of blood glucose can prevent diabetes*". Lastly, "*Monitoring hypertension could result in diabetes prevention*" was the least recognized intervention strategy in both urban and rural area.

Rural-urban comparison of the awareness scores of diabetes prevention strategies and its association with socio-demographic variables in Punjab was elucidated in table 4.2.6. Both "*Mann-Whitney U*" and "*Kruskal-Wallis*" tests were performed to study the awareness about prevention strategies and its association based on awareness scores and mean rank values. Results of "*Mann-Whitney U*" test in urban and rural area revealed no statistical association between gender and level of awareness for prevention strategies. The results of analysis revealed that there exists no significant association between marital status and awareness about prevention strategies in urban and rural area. Lastly, history of diabetes also highlighted no statistically significant association with awareness about prevention strategies in both rural and urban area.

Analysis of the study revealed that a statistically significant association between age and level of awareness regarding prevention strategy in urban area, but no statistically significant association was witnessed in rural area. Table 4.2.6 show significant association between education and awareness of diabetes prevention strategies in urban Punjab. Whereas, the results of "*Kruskal-Wallis*" test calls attention to a statistically significant association between work status and prevention strategies of diabetes both in urban and rural areas of Punjab.

The result of the present study shows that majority of respondents in Punjab had moderate awareness regarding what diabetes actually is? and there exists a lack of awareness regarding different types of diabetes. Out of different sources of awareness, doctors were the main source from where diabetics learn most about diabetes. Therefore, doctors should counsel their patients about diabetes, type of diabetes patient is diagnosed with, associated risk factors and prevention strategies during consultation

visits. Better awareness about diabetes mellitus was associated with region, marital status, history of diabetes, age, education, work status and income of the respondents in Punjab. The result of the analysis shows that lack of cognizance regarding awareness of diabetes mellitus, its risk factors and prevention strategies was prevalent among diabetic respondents residing in rural area, with no history of diabetes, low educational background and low income level. Therefore, there is an urgent need to create awareness about diabetes mellitus among diabetic respondents in Punjab.

However, moderate proportion of respondents knew about diabetes but they had numerous misconceptions and misapprehensions regarding diabetes such as eating sugar causes diabetes, moderate sleep increases sugar levels, etc. Thus, the need of the hour is to create awareness about diabetes mellitus through different sources such as advertisements in magazines, television, radio, etc. Moreover, awareness programmes should be designed at workplaces, public meetings, religious gatherings, educational institutions and exclusively in women's organisations regarding gestation diabetes mellitus (GDM). As diabetes mellitus is a lifestyle disease along with the above procedures alteration in dietary habits, physical activities and behaviour is must among diabetics of Punjab.

CHAPTER VI

HEALTHCARE UTILIZATION, COST AND COPING STRATEGIES OF DIABETES IN PUNJAB

Diabetes is a global health emergency that affects people at their productive age, impoverishes families and leads to fatality progression (Morrish et al., 2001; Kumpatla et al., 2013 and Unnikrishnan et al., 2016). Being metabolic syndrome diabetes mellitus accounts for prolonged and multifarious repercussions on peoples such as advancement in complications, loss of quality life and health deterioration (Nath et al., 2020). The economic burden of diabetes mellitus is predicted to increase as a consequence of rising environmental change, demographic transition, urbanization and lifestyle modifications (Zimmet et al., 2001 and International Diabetes Federation, 2015). With a rise in epidemiological conditions the cost of treating and managing diabetes is on upsurge. The cost of treating diabetes and its associated complications poses a huge economic burden both at individual and household levels (Cavanagh et al., 2012; Akari et al., 2013 and Eshwari et al., 2019). Therefore, chronic nature and rising epidemic of diabetes have adverse economic implications on asset exhaustion and indebtedness.

The present chapter estimates and compares the healthcare utilization, cost and coping strategies of diabetes among households in Punjab. The study aims to estimate the cost of treating diabetes, complications and its cost by socio-demographic variables. The chapter has been categorized into three different sections. Section I of the chapter estimates and compares the healthcare utilization, cost and coping strategies of diabetes among households in Punjab. Section II discusses the rural-urban comparison of the healthcare utilization, cost and coping strategies of diabetes in Punjab. Lastly, Section III highlights the summary and conclusion.

SECTION I

6.1 HEALTHCARE UTILIZATION AND COST FOR OUTPATIENT CARE AMONG HOUSEHOLDS IN PUNJAB

6.1.1 Healthcare Utilization of Diabetes for Outpatient Care in Punjab

Table 6.1.1 elucidates the healthcare utilization of diabetes for outpatient care in Punjab. It was found that a large proportion of respondents utilized allopathic type of treatment (72 percent) followed by home remedies (22 percent), ayurveda (5 percent) and homeopathy (1 percent). The results revealed that 42 percent of the diabetic respondents utilized private hospitals followed by private clinics (31 percent), government hospitals (20 percent), chemist (4 percent), others (2 percent) and homeopathy clinic (1 percent). The results showed that 78 percent of the respondents mentioned healthcare facilities was easily accessible. The mean distance covered to access healthcare facility was 9.49 kilometers.

Availability of specialized treatment (23 percent), proximity to home (17 percent) and doctor familiarity (15 percent) were the top three reasons for the choice of health facility utilized. However, no long queues (6 percent), trust/faith (4 percent) and free treatment (2 percent) were the least preferred reason for the choice of health facility utilized. Lastly, it was found that 39 percent of respondents visited healthcare facility quarterly followed by once in a month (31 percent), half-yearly (20 percent), others (7 percent) and annually (3 percent).

Table: 6.1.1 Healthcare Utilization of Diabetes for Outpatient Care in Punjab

Healthcare Utilization	N (%)
Do you take any kind of treatment for diabetes mellitus?	
Yes	720 (100)
No	-
Which treatment you have taken for outpatient care of diabetes mellitus?*	
Allopathic	712 (72)
Ayurveda	50 (05)
Homeopathy	09 (01)
Home Remedies	217 (22)
Unani	02 (00)
Which type of health facility have you visited for the treatment of diabetes mellitus?*	
Government Hospital	199 (20)
Private Hospital	413 (42)
Private Clinic	299 (31)
Homeopathy Clinic	08 (01)
Chemist	44 (04)
Faith Healer	00 (00)
Others	15 (02)
Visited facility was easily accessible?	
Yes	563 (78)
No	157 (22)
Distance covered to visit health facility?	
Average distance in kilometers	9.49 km
State the reasons for the choice of health facility utilized?*	
Availability of specialized treatment	574 (23)
Clean ambience	327 (13)
Doctor was familiar	381 (15)
Free treatment	02 (00)
Low cost treatment	359 (14)
Near to home	440 (17)
No long queues	158 (06)
No other option	193 (08)
Others	97 (04)
How frequently you visit the health facility to take treatment for diabetes?	
Once in a Month	223 (31)
Quarterly	280 (39)
Half-Yearly	146 (20)
Annually	24 (03)
Others (1-2 Week)	47 (07)

Source: Authors calculation established on primary data.
Note: * Multiple response possible

6.1.2 Outpatient Cost of Diabetes by Socio-Demographic Variables in Punjab

Outpatient cost of diabetes by socio-demographic characteristics was presented in table 6.1.2. It was found that rural respondents (₹2021 and ₹657) incurred less mean direct and indirect outpatient cost of diabetes as compared to urban respondents (₹3396 and ₹903). Further, it was observed that there exists a statistically significant difference in direct (p= 0.000) and indirect cost (p= 0.011) based on region. The mean direct and indirect outpatient cost of female respondents was highest as compared to male respondents. However, a statistically significant difference exists on the basis of gender for direct outpatient cost (0.009) as compared to indirect outpatient cost (p= 0.811).

The result of analysis exhibits that respondents of age below 20 years incurred the highest mean direct outpatient cost of ₹4342 (p= 0.009) followed by 21-40 years (₹3114), 41-60 years (₹2892) and 60 years and above (₹2830). Under indirect cost respondents of age 21-40 years (₹927) incurred the highest mean cost, but no significant difference in cost was witnessed with p = 0.234. Moreover, it was found that mean direct and indirect outpatient cost incurred by illiterates (₹1843 and ₹543) was lowest as compared to post-graduates (₹4458 and ₹1426). The result of "*Kruskal Wallis test*" shows that there exists a significant difference in direct outpatient cost on the basis of educational background (p= 0.000).

Students incurred the highest mean direct (₹3972) and indirect outpatient cost (₹1013) as compared to others, thus, highlighting a statistically significant difference on the basis of work status with p-value of 0.000 and 0.001 respectively. Respondents with monthly income of ₹60,000 and above incurred the highest direct (₹4649, p = 0.000) and indirect outpatients cost (₹1340, p = 0.000) as compared to respondents with monthly income less than ₹15,000. It was found that respondents under joint family type spent more on direct outpatient cost (₹3121) and nuclear family respondents spent more on indirect outpatient cost (₹843). Respondents with a history of diabetes (₹3078; p = 0.013) incurred high direct and indirect outpatient cost as compared to respondents with no history of diabetes (₹2778) in their family. Lastly, it was found that respondents with complications incurred high mean direct outpatient (₹3495; p = 0.000) and indirect outpatient cost (₹894, p = 0.004) in Punjab.

Table: 6.1.2. Outpatient Cost of Diabetes by Socio-Demographic Variables in Punjab

Socio-Demographic Variables	Direct Cost			Indirect Cost		
	Mean	Median (Range)	*p*-value	Mean	Median (Range)	*p*-value
Region						
Urban	₹3396*	2500 (20000-200)	.000	₹903*	750 (4000-200)	.011
Rural	₹2,021	1500 (8000-200)		₹657	600 (2500-200)	
Gender						
Male	₹2840	2500 (11200-200)	.009	₹800	[700 (3000-200)	.811
Female	₹3095*	2500 (20000-200)		₹853	[700 (4000-200)	
Age						
Below 20 years	₹4342**	2500 (11200-15200)	.009	₹892	800 (2500-300)	.234
21- 40 years	₹3114	3000 (11000-500)		₹927	700 (4000-250)	
41- 60 years	₹2892	2500 (20000-200)		₹848	700 (4000-200)	
Above 60 years	₹2830	2200 (10000-200)		₹690	600 (2500-200)	
Marital Status						
Single	₹2967	2800 (11200-450)	.359	₹806	700 (2500-200)	.221
Married	₹2933	2500 (20000-200)		₹821	700 (2500-200)	
Education						
Illiterate	₹1843	1500 (7500-300)	.000	₹543	450 (900-200)	.000
Primary	₹2232	1875 (11000-200)		₹667	600 (2500-200)	
Secondary	₹3024	2500 (20000-250)		₹722	600 (4000-200)	
Graduation	₹3495	3000 (11200-200)		₹954	[800 (3000-200)	
Post-Graduation	₹4458	4300 (9800-2000)		₹1426	1200 (4000-300)	
Others	₹4360**	4700 (5800-3000)		₹1400**	1200 (2500-600)	
Work Status						
Salaried	₹3446	3300 (9800-300)		₹1149	700 (4000-200)	

Business	₹2959	2500 (12000-200)	.000	₹713	700 (3000-200)	.001
Student	₹3972**	3663 (11200-1400)		₹1013**	800 (2500-300)	
Homemaker	₹2814	2250 (20000-300)		₹826	[700 (4000-200)	
Retired	₹3311	2700 (10000-500)		₹931	700 (2500-500)	
Others	₹1641	1300 (7000-200)		₹517	500 (1200-200)	
Income						
Less than ₹15,000	₹1497	1200 (8000-200)	.000	₹503	500 (1200-200)	.000
₹ 15,000- ₹ 30,000	₹2349	2150 (10000-200)		₹687	600 (2500-200)	
₹ 30,000- ₹ 45,000	₹3114	2900 (11200-350)		₹785	700 (4000-200)	
₹ 45,000 - ₹ 60,000	₹3646	3200 (20000-200)		₹855	800 (4000-200)	
₹ 60,000 and above	₹4649**	4300 (11000-9000)		₹1340 **	1000 (3000-200)	
Family Type						
Nuclear	₹2732	2400 (11200-200)	.065	₹843	700 (4000-200)	.489
Joint	₹3121	2500 (20000-200)		₹796	700 (4000-200)	
History of Diabetes						
Yes	₹3078*	2725 (20000-200)	.013	₹829	700 (4000-200)	.804
No	₹2778	2200 (12000-200)		₹803	700 (4000-200)	
Complications						
Yes	₹3495*	3000 (20000-300)	.000	₹894*	800 (4000-200)	.004
No	₹2336	2000 (11000-200)		₹705	600 (3000-200)	
Household Size						
Upto 3 Members	₹2908	2700 (10000-200)	.012	₹798	700 (2500-200)	.851
4-6 Members	₹2763	2450 (12000-200)		₹817	800 (4000-200)	
6 Members and above	₹3466**	2500 (20000-200)		₹829	800 (4000-200)	

Source: Authors calculation established on primary data.
Note: *Mann Whitney U test and **Kruskal Wallis test done for group comparison;
Significant at 5 percent.

6.1.3. Profile of Diabetic Respondents based on Complications in Punjab

Table 6.1.3 exhibits the profile of diabetic respondents based on complications in Punjab. The result of the study revealed that 91 percent respondents knew that diabetes can cause complications in other organs. It was found that 52 percent respondents were diagnosed with any of the complication due to diabetes. Moreover, it was observed that 61 percent of the respondents were diagnosed with microvascular complications and 39 percent with macrovascular complications.

The result of the analysis shows that out of 201 respondents with macrovascular complications, 48 percent of the respondents were diagnosed with heart disease (CAD) followed by a blockage in blood vessels (PVC) (40 percent), low sugar stroke (9 percent) and brain stroke (TIA) (2 percent). However, under microvascular complications it was found that 55 percent of the respondents suffer from eye sickness (retinopathy) followed by gum/tooth infection (periodontitis) (21 percent), blood vessel disease (vasculopathy) (12 percent), kidney-related disease (nephropathy) (06 percent) and foot ulcer and neuropathy (3 percent).

Table 6.1.3. Profile of Diabetic Respondents based on Complications in Punjab

Do you know that diabetes can cause complications in other organs?	**n (%)**
Yes	652 (91)
No	68 (09)
You suffer from any of the complication due to diabetes	**n (%)**
Yes	374 (52)
No	346 (48)
Macrovascular complications you have?*	**n (%)**
Heart Disease (Coronary Artery Disease)	97 (48)
Brain Stroke (Transient Ischemic Attack)	04 (02)
Low Sugar Stroke (Hypoglycemia)	19 (09)
Blockage in Blood Vessels (Peripheral Vascular Disease)	81 (40)
Microvascular Complications you have?*	**n (%)**
Foot Ulcer	10 (03)
Gum/Tooth Infection (Periodontitis Complication)	77 (21)
Eyes Sickness (Retinopathy)	205 (55)
Nerves Related Disease (Neuropathy)	10 (03)
Kidney Related Disease (Nephropathy)	24 (06)
Blood Vessel Disease (Vasculopathy)	45 (12)

Source: Authors calculation established on primary data.
*Multiple responses possible

6.1.4. Outpatient Cost of Treating Diabetes Complications in Punjab

The outpatient cost of treating diabetes complications was lucidly explained in table 6.1.4. The diabetic respondents were categorized into three different groups based on the prevalence of complications. The first group comprised of respondents without complications, second group encompassed of diabetic respondents with microvascular complications and third group included of diabetics with macrovascular complications.

The mean total direct cost (₹3717) of treating diabetes was highest among diabetic respondents with macrovascular complications as compared to microvascular (₹3240) and without complications (₹2336). Under total direct outpatient cost, expenditure on medicines accounts for the highest proportion in all groups followed by diagnostic expenditure, consultation fee and transportation cost. The mean total indirect outpatient cost under macrovascular complications (₹870) was marginally high as compared to microvascular complications (₹863).

The mean wage loss incurred by respondents with macrovascular complications (₹946) was highest as compared to respondents with microvascular complications (₹744) and no complication (₹703). Whereas, mean wage loss incurred by accompanying person was highest for diabetics with microvascular complications (₹944) followed by macrovascular complications (₹807) and no complication (₹696) in Punjab.

Table: 6.1.4 Outpatient Cost of Treating Diabetes Complications in Punjab

Cost Variables	Group-1 (Without Complications)		Group-2 (With Microvascular Complications)		Group-3 (With Macrovascular Complications)	
	Mean	***Median (Range)***	***Mean***	***Median (Range)***	***Mean***	***Median (Range)***
Consultation Fees	₹265	₹200 (800-10)	₹331	₹300 (1000-50)	₹367	₹300 (1000-50)
Expenditure on Medicines	₹1901	₹1800 (8000-100)	₹2486	₹2000 (8000-300)	₹2899	₹2500 (12000-300)
Diagnostic Expenditure	₹565	₹400 (2850-500)	₹702	₹550 (3000-80)	₹727	₹600 (4500-100)
Transportation	₹112	₹100 (700-300)	₹139	₹100 (1500-40)	₹214	₹150 (3000-50)
Total Direct Cost	***₹2336***	***₹2000 (11000-200)***	***₹3240***	***₹2950 (11200-300)***	***₹3717***	***₹3000 (20000-400)***
Wage loss incurred by diabetic patient	₹703	₹500 (3000-200)	₹744	₹650 (2500-200)	₹946	₹700 (3000-200)
Wage loss incurred by accompanying person	₹696	₹700 (3000-200)	₹944	₹700 (2500-200)	₹807	₹800 (4000-200)
Total Indirect Cost	***₹705***	***₹600 (3000-200)***	***₹863***	***₹700 (3000-200)***	***₹870***	***₹850 (4000-200)***

Source: Authors calculation established on primary data.

6.1.5. Healthcare Utilization of Diabetes for Inpatient Care in Punjab

Table 6.1.5 shows the healthcare utilization of diabetes for inpatient care in Punjab. Out of 720 respondents, 29 percent of the diabetic respondents utilized inpatient care in past 365 days. It was found that 78 percent respondents utilized private hospitals followed by government hospitals (19 percent) and private clinics (3 percent) for treatment of diabetes and its associated complications. Moreover, 71 percent respondents revealed that visited facility was easily accessible. The mean distance covered to access healthcare facility was 16.47 kilometers.

The result of the analysis shows that availability of specialized doctors (24 percent), all diagnostic tests under one roof (22 percent) and easy accessibility (14 percent) were the most preferred reasons for the choice of health facility utilized. Whereas, low-cost treatment (6 percent), no long queues (4 percent) and others (1 percent) were the least preferred reason for the choice of health facility utilized.

Table: 6.1.5 Healthcare Utilization of Diabetes for Inpatient Care in Punjab

Health Care Utilization	**n (%)**
In past 365 days whether you hospitalized due to diabetes?	
Yes	204 (29)
No	516 (71)
Type of health facility you utilized for inpatient care	
Government Hospital	38 (19)
Private Hospital	160 (78)
Private Clinic	05 (03)
Others (Trust Hospital)	01 (00)
Reasons for choice of health facility utilized	
Availability of specialized doctors	190 (24)
All diagnostic test under one roof	172 (22)
Best ancillary care	104 (13)
Clean rooms/wards	53 (07)
Easily accessible	110 (14)
Low cost treatment	47 (06)
No long queues	36 (05)
No other option	69 (09)
Others (Faith/Trust)	11 (01)
Visited health facility was easily accessible?	
Yes	145 (71)
No	59 (29)
Average distance covered to visit health facility	**16.47 Km**

Source: Authors calculation established on primary data.

6.1.6 Inpatient Cost of Diabetes by Socio-Demographic Variables in Punjab

The inpatient cost of diabetes by socio-demographic characteristics was shown in table 6.1.6. It was found that urban respondents incurred highest mean direct inpatient cost (₹40643) as compared to rural respondent (₹23568). Similarly, urban respondents also incurred highest mean indirect inpatient cost (₹4618) of diabetes as compared to rural respondents (₹3160). Moreover, it was observed that there exists a statistically significant difference in direct (p = 0.002) and indirect cost (p = 0.035) on the basis of region. The mean direct and indirect outpatient cost of male respondents was high as compared to female respondents. However, a significant difference exists on the basis of gender for indirect inpatient cost (p = 0.007).

The result of the analysis shows that respondents of age 60 years and above incurred the highest mean direct (₹41483) and indirect (₹4818) inpatient cost followed by 41-60 years, below 20 years and 21-40 years. Further, it was found that there exists a significant difference in direct inpatient cost based on age (p= 0.001). Respondents with other educational background incurred the highest mean direct inpatient cost (₹64000) as compared to the respondents with primary level of education (₹27518). Whereas, mean indirect inpatient cost incurred by graduates (₹4845) was highest as compared to others (₹1400). The result of the analysis revealed that businessman incurred the highest mean direct (₹53808, p= 0.008) and indirect inpatient (₹5851, p= 0.000) cost of diabetes followed by retired, homemaker, others, salaried and students respectively. Respondents with income ₹60,000 and above incurred the highest mean direct (₹57394) and indirect inpatient (₹7162) cost of diabetes as compared to low-income group respondents. Therefore, there exists a statistically significant difference in direct and indirect cost on the basis of income with p = 0.000. Further, it was found that joint family type respondents incurred higher direct inpatient cost (₹3121) of diabetes.

Respondents with a history of diabetes incurred highest mean direct inpatient cost (₹37104, p= 0.024) as compared to respondents with no history of diabetes (₹34761). The result highlighted that respondents with complications incurred significantly higher mean direct (₹41875, p = 0.000) and indirect inpatient (₹4819, p = 0.001) cost of diabetes. Lastly, it was found that household with 6 members and above incurred higher mean direct inpatient (₹52219, p= 0.028) cost as compared to households with less family members.

Table: 6.1.6 Inpatient Cost of Diabetes by Socio-Demographic Variables in Punjab

Socio-Demographic Variables	Direct Cost			Indirect Cost		
	Mean	Median (Range)	*p*-value	Mean	Median (Range)	*p*-value
Region						
Urban	₹40643*	24000 (250000-2500)	.002	₹4618*	3000 (24000-400)	.035
Rural	₹23568	10000 (162000-3000)		₹3160	2400 (16000-500)	
Gender						
Male	₹45045	23000 (250000-2500)	.117	₹4980*	3200 (24000-400)	.007
Female	₹27269	20000 (137000-2500)		₹3511	2500 (20000-400)	
Age						
Below 20 years	₹17750	16500 (28000-10000)	.001	₹2900	2900 (3000-2800)	.301
21- 40 years	₹11119	6000 (45000-2500)		₹2487	2000 (5800-800)	
41- 60 years	₹35169	21600 (250000-2500)		₹4133	3000 (16800-400)	
Above 60 years	₹41482**	24000 (188000-3000)		₹4818	3000 (24000-400)	
Marital Status						
Single	₹35946	22000 (125000-5200)	.601	₹3937	3000 (15000-1400)	.625
Married	₹35972	20000 (250000-2500)		₹4218	2900 (24000-400)	
Education						
Illiterate	₹33200	22000 (100000-4000)	.336	₹4170	1200 (16000-400)	.056
Primary	₹27518	18500 (200000-3000)		₹3179	2400 (15000-500)	
Secondary	₹39324	23500 (250000-2500)		₹4706	3000 (20000-400)	
Graduation	₹35229	20000 (188000-2500)		₹4845	3200 (24000-1000)	
Post-Graduation	₹59364	30000 (162000-5200)		₹3778	4000 (7000-1200)	
Others	₹64000	64000 (80000-48000)		₹1400	1200 (2500-600)	
Work Status						
Salaried	₹21581	14000 (94000-2500)	.008	₹3747	3200 (15000-400)	.000
Business	₹53808**	32000 (15000-400)		₹5851**	4800 (24000-800)	
Student	₹16033	16500 (28000-5200)		₹2591	3000 (3000-400)	

Homemaker	₹27197	18500 (137000-2500)		₹3431	2400 (20000-500)	
Retired	₹32236	22000 (162000-5800)		₹3873	3350 (8000-1000)	
Others	₹26225	29500 (60000-4000)		₹2590	2500 (5300-500)	
Income						
Less than ₹15,000	₹17467	15000 (60000-2500)		₹1918	2000 (4800-400)	
₹ 15,000- ₹ 30,000	₹28799	17000 (200000-2500)		₹3578	2500 (16000-800)	
₹ 30,000- ₹ 45,000	₹30732	20000 (162000-2500)	.000	₹4132	3200 (18000-500)	.000
₹ 45,000 - ₹ 60,000	₹53633	32600 (200000-5000)		₹5196	4000 (20000-1200)	
₹ 60,000 and above	₹57394**	35000 (188000-3800)		₹7162**	5250 (24000-600)	
Family Type						
Nuclear	₹34512	20000 (250000-2500)	.628	₹4288	3000 (18000-400)	.932
Joint	₹37254	23000 (200000-2500)		₹4267	3000 (24000-400)	
History of Diabetes						
Yes	₹37104*	24000 (250000-2500)	.024	₹3942	3000 (16800-400)	.336
No	₹34761	18500 (188000-3000)		₹4665	2600 (24000-400)	
Complications						
Yes	₹41875*	25000 (250000-3000)	.000	₹4819*	3000 (24000-500)	.001
No	₹15162	11000 (60000-2500)		₹2525	2400 (7400-400)	
Household Size						
Upto 3 Members	₹27169	18500 (162000-5000)		₹3654	2000 (13000-800)	
4-6 Members	₹30661	18500 (200000-2500)	.028	₹3964	3000 (18000-400)	.508
6 Members and above	₹52219**	31400 (250000-2500)		₹5302	3000 (24000-400)	

Source: Authors calculation established on primary data.

Note: *Mann Whitney U test and **Kruskal Wallis test done for group comparison

Significant at 5 percent.

6.1.7. Inpatient Cost of Treating Diabetes Complications in Punjab

Table 6.1.7 clearly explains the inpatient cost of treating diabetes complications in Punjab. The respondents were divided into three different categories based on their complications. The first group consists of respondents without complications, second group comprises of respondents with microvascular complications and third group encompassed of diabetic respondents with macrovascular complications.

The mean total direct inpatient cost (₹48001) of diabetes under macrovascular complications was highest followed by microvascular complications (₹36412) and without complications (₹20767). Respondents without complications witnessed others, hospitalization fees and expenditure on medicine as top three cost component of direct inpatient cost. It was found that respondents with microvascular and macrovascular complications witnessed others, diagnostic expenditure and expenditure on medicines as top three cost component of direct inpatient cost. Lastly, transportation cost was the least expensive cost component under direct inpatient cost.

The mean total indirect cost of respondents with macrovascular complications (₹5291) was highest as compared to microvascular complications (₹4226) and without complications (₹2525). It was found that mean wage loss incurred by respondents with macrovascular complications was highest ₹4587 followed by microvascular complication (₹3411) and without complications (₹2416) respondents. However, average wage loss incurred by accompanying person was highest among respondents with microvascular complications (₹3496) followed by macrovascular complications (₹3127) and without complications (₹2429).

Table: 6.1.7 Inpatient Cost of Treating Diabetes Complications in Punjab

Cost Variables	Group-1 (Without Complications)		Group-2 (With Microvascular Complications)		Group-3 (With Macrovascular Complications)	
	Mean	***Median (Range)***	***Mean***	***Median (Range)***	***Mean***	***Median (Range)***
Consultation Fee	₹1365	₹700 (5600-100)	₹1713	₹1200 (8000-20)	₹1949	₹1500 (8000-200)
Expenditure on Medicines	₹4058	₹3400 (12000-500)	₹5694	₹4000 (25000-500)	₹6364	₹4800 (35000-800)
Hospitalization Fees	₹5079	₹2250 (24000-750)	₹5077	₹3500 (25000-200)	₹6518	₹4900 (25000-200)
Diagnostic Expenditure	₹3561	₹2500 (12600-250)	₹5495	₹4000 (42000-250)	₹6547	₹5000 (24000-250)
Transportation	₹322	₹350 (700-100)	₹906	₹500 (12000-50)	₹533	₹4800 (4800-50)
Food and Other Material	₹1516	₹1000 (5000-300)	₹2659	₹2000 (8000-200)	₹3032	₹2500 (9000-300)
Others (Surgeries)	₹16447	₹15000 (35500-200)	₹31578	₹20000 (160000-200)	₹41099	₹25500 (160000-200)
Total Direct Cost	***₹20,767***	***₹14,000 (70000-2500)***	***₹36,412***	***₹21,800 (234000-3000)***	***₹48,001***	***₹28,000 (250000-3000)***
Wage loss incurred by diabetic patient	₹2416	₹2000 (4500-400)	₹3411	₹2400 (18000-400)	₹4587	₹3000 (18000-500)
Wage loss incurred by accompanying person	₹2429	₹2000 (7400-400)	₹3496	₹2800 (20000-300)	₹3127	₹2500 (20000-300)
Total Indirect Cost	***₹2525***	***₹2400 (7400-400)***	***₹4226***	***₹3000 (20000-500)***	***₹5291***	***₹3150 (24000-700)***

Source: Authors calculation established on primary data.

6.1.8 Cost of Diabetes by Component of Direct and Indirect Cost in Punjab

Table 6.1.8 estimates the direct and indirect annual cost of diabetes. The mean total cost of diabetes was ₹49037 of that total direct cost was 93 percent and total indirect cost was 7 percent. The 25th percentile of the total cost of diabetes highlights that 75 percent of the total cost is as large or larger than ₹60600 and 25 percent of the total cost is as small or smaller than ₹19200. Expenditure on medicine was the highest cost component of diabetes and accounts for 64 percent under the direct cost and 60 percent under total cost of diabetes (COD).

The mean total outpatient cost was ₹37169, the 75th percentile of the total outpatient cost of diabetes revealed that 25 percent of the total outpatient cost was as large or larger than ₹48000 and 75 percent of the total outpatient costs are as small or smaller than ₹15840. Moreover, table 6.1.8 revealed that total direct outpatient cost accounts for 95 percent of the annual outpatient cost of diabetes and indirect outpatient cost accounts for the rest 5 percent of the annual outpatient cost. Expenditure on medicines was reported as highest cost component (80 percent) of direct outpatient cost followed by diagnostic expenditure (13 percent), consultation fee (6 percent) and transportation cost (1 percent). Furthermore, it was found that wage loss incurred by diabetic respondents was 54 percent under indirect outpatient cost. Whereas, indirect outpatient cost accounts for merely 5 percent of the total outpatient cost.

The results of the analysis revealed that out of 720 respondents, 204 respondents utilized inpatient care. It was found that others was the highest cost component of direct inpatient cost (41 percent) followed by hospitalization fee (17 percent), expenditure on medicines (16 percent), diagnostic expenditure (15 percent), food and other material (7 percent), consultation fees (4 percent) and transportation cost (1 percent). The 25th percentile of the total inpatient cost of diabetes exhibits that 75 percent of the total inpatient costs are as large or larger than ₹47600 and 25 percent of the total inpatient cost are as small or smaller than ₹11550. The mean indirect cost of diabetes was ₹4277 and reports only 11 percent share under total inpatient cost. The mean wage loss of accompanying person was ₹3837 as compared to a wage loss of diabetic respondents (₹3172).

Table: 6.1.8 Cost of Diabetes by Component of Direct and Indirect Cost in Punjab

Cost Components	Mean	Median	25th Percentile	75th Percentile	% of Total Direct and Indirect Cost	Total Cost of Diabetes	% of Total Cost of Diabetes
1. Total Cost of Diabetes (COD)							
1.1. Direct Cost							
Consultation Fee	₹3992	₹3175	₹2400	₹4800	05	₹1772480	05
Medical Expenditure	₹29391	₹24050	₹14200	₹38500	64	₹21161420	60
Cost of Hospitalization	₹5785	₹3500	₹1575	₹7775	04	₹1168550	03
Diagnostic Expenditure	₹9316	₹6600	₹3600	₹11750	13	₹4453210	13
Transportation Cost	₹1622	₹1000	₹600	₹1537	01	₹366670	01
Food and Other Material	₹2632	₹2000	₹1000	₹3500	02	₹492100	02
Others	₹33427	₹20000	₹10000	₹45000	11	₹3409600	09
Total Direct Cost	*₹45915*	*₹34100*	*₹18000*	*₹56300*	*100*	*₹32824030*	*93*
1.2. Indirect Cost							
Wage loss of diabetic patient	₹5402	₹4000	₹2150	₹7200	52	₹1145200	04
Wage loss of accompanying person	₹4946	₹3100	₹2400	₹5800	48	₹1122800	03
Total Indirect Cost	*₹5884*	*₹4200*	*₹2400*	*₹7200*	*100*	*₹2268000*	*07*
Total Cost	**₹49037**	**₹36000**	**₹19200**	**₹60600**		**₹35092030**	
2. Outpatient Cost of Diabetes (n= 720)							
2.1. Direct Outpatient Cost							
Consultation Fee	₹3768	₹3600	₹2400	₹4800	6	₹1466040	5
Medical Expenditure	₹27797	₹24000	₹12000	₹36000	80	₹20013720	75
Diagnostic Expenditure	₹8003	₹6000	₹3600	₹9600	13	₹3377400	12
Transportation Cost	₹1854	₹1200	₹600	₹1800	1	₹313320	1
Total Direct Cost	*₹35253*	*₹30000*	*₹15840*	*₹48000*	*100*	*₹25170480*	*95*

2.2. Indirect Outpatient Cost							
Wage loss of diabetic patient	₹4668	₹4200	₹2400	₹4800	54	₹751500	03
Wage loss of accompanying person	₹5110	₹4800	₹3000	₹6000	46	₹643800	02
Total Indirect Cost	*₹4909*	*₹4200*	*₹2400*	*₹6000*	*100*	*₹1395300*	*05*
Total Cost	**₹37169**	**₹30600**	**₹16800**	**₹48000**		**₹26565780**	
3. Inpatient Cost of Diabetes in Past 365 Days (n= 204)							
2.1. Direct Inpatient Cost							
Consultation Fee	₹1751	₹1200	₹500	₹2500	4	₹306440	4
Medical Expenditure	₹5516	₹4000	₹2500	₹7200	16	₹1097700	14
Cost of Hospitalization	₹5784	₹3500	₹1550	₹7850	17	₹1162550	15
Diagnostic Expenditure	₹5478	₹4000	₹2000	₹7000	15	₹1040810	13
Transportation Cost	₹684	₹375	₹200	₹700	1	₹53350	1
Food and Other Material	₹2632	₹2000	₹1000	₹3500	7	₹492100	6
Others	₹30963	₹18000	₹8000	₹43250	41	₹2879600	36
Total Direct Cost	*₹35970*	*₹20000*	*₹9000*	*₹40000*	*100*	*₹7032550*	*89*
2.2. Indirect Inpatient Cost							
Wage loss of diabetic patient	₹3172	₹3000	₹1200	₹4150	44	₹383700	5
Wage loss of accompanying person	₹3837	₹2500	₹1500	₹3200	56	₹479000	6
Total Indirect Cost	*₹4277*	*₹3000*	*₹1800*	*₹5000*	*100*	*₹862700*	*11*
Total Cost	**₹41681**	**₹24500**	**₹11550**	**₹47600**		**₹7895250**	

Source: Authors calculation established on primary data.

6.1.9. Coping Strategies of Diabetes Mellitus in Punjab

Table 6.1.9 outlined the coping strategies employed by households to meet the healthcare expenditure of diabetes in Punjab. Coping strategies were categorized as behaviour-based coping strategies, asset-based coping strategies and assistance-based coping strategies. A large proportion of respondents used asset-based coping strategies followed by behaviour and assistance-based strategies.

Furthermore, it was found that a large proportion of respondents preferred "*buying part of medicines to cope with diabetes*" and "*intra-household labor substitution to compensate for any labor loss*" as the foremost behaviour-based coping strategies in Punjab. Whereas, 63 percent respondents observed "*reduced number of doctors visit*" as the least preferred behaviour-based coping strategy.

The results of the analysis revealed that 74 percent respondents strongly agreed "*mobilizing the available cash in hand*" as the most preferred asset-based coping strategy followed by "*using past savings to meet the healthcare expenses of diabetes*" and "*Mortgage productive assets*". Whereas, 95 percent respondents never utilized "*taking a loan from moneylenders to meet healthcare costs of diabetes*" and "*selling off productive assets to cope with diabetes*" as coping strategies.

Lastly, a very small proportion of respondents utilized assistance-based coping strategies. It was found that 38 percent respondents agreed to utilize "*seeking help from relatives to cope up with diabetes*" as a primary assistance-based coping strategy to meet the financial burden of diabetes. Whereas, 86 percent respondents disagreed to utilize "*borrowing from neighbors*" as assistance-based coping strategy in Punjab.

Table: 6.1.9 Coping Strategies of Diabetes Mellitus in Punjab

n (%)

Coping Strategies		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Behaviour-Based Coping Strategies	Consuming less of food items to meet healthcare expenditure on diabetes	77 (11)	108 (15)	165 (23)	257 (35)	113 (16)
	Buying part of medicines to cope with diabetes	278 (39)	274 (38)	91 (13)	60 (08)	17 (02)
	Reduced the number of visits to doctor	17 (02)	68 (09)	125 (18)	449 (63)	61 (08)
	Working overtime to meet the diabetes expenses	28 (04)	135 (19)	169 (23)	309 (43)	79 (11)
	Intra-household labor substitution to compensate for any labor loss	144 (20)	227 (31)	141 (20)	159 (22)	49 (07)
Asset-Based Coping Strategies	Managing diabetes by working as bonded laborer	02 (0)	07 (01)	09 (01)	382 (53)	320 (45)
	Using past savings to meet the healthcare expenses of diabetes	177 (24)	268 (37)	186 (26)	49 (07)	40 (06)
	Mobilizing the available cash in hand	536 (74)	150 (21)	22 (03)	08 (01)	04 (01)
	Selling of productive assets to cope with diabetes	01 (0)	06 (01)	08 (01)	505 (70)	200 (28)
	Mortgage productive assets to cope with diabetes	04 (01)	04 (01)	03 (0)	441 (61)	268 (37)
	Taking loan from moneylenders to meet healthcare costs of diabetes	-	03 (0)	04 (01)	516 (72)	197 (27)
Assistance-Based Coping Strategies	Seeking help from relatives to cope up with diabetes	122 (17)	149 (21)	101 (14)	242 (34)	106 (14)
	Borrowing from friends to meet healthcare expenditure of diabetes	23 (03)	62 (08)	107 (15)	423 (59)	105 (15)
	Borrowing from neighbors	16 (02)	43 (06)	41 (06)	495 (69)	125 (17)
	Received assistance from NGOs to manage diabetes	67 (09)	51 (07)	29 (04)	417 (58)	156 (22)

Source: Authors calculation established on primary data.

SECTION II

6.2 HEALTHCARE UTILIZATION AND COST FOR OUTPATIENT CARE AMONG HOUSEHOLDS IN RURAL AND URBAN PUNJAB

6.2.1 Healthcare Utilization of Diabetes for Outpatient Care in Rural-Urban Punjab

Table 6.2.1 shows the healthcare utilization of diabetes for outpatient care in rural-urban Punjab. It was found that a large proportion of urban and rural respondents utilized allopathic type of treatment for diabetes mellitus followed by home remedies, ayurveda and homeopathy. The results of the analysis revealed that a large proportion of both urban and rural respondents preferred private hospitals and clinics health facility for treatment of diabetes followed by government hospitals, chemists, others and homeopathy clinics. It was found that 86 percent of the urban respondents and 62 percent of the rural respondents mentioned healthcare facilities was easily accessible. The mean distance covered to access healthcare facility was 8.06 kilometers in urban Punjab and 12.34 kilometer in rural Punjab.

Availability of specialized treatment (22 percent), proximity to home (19 percent) and doctor familiarity (16 percent) were the top three reasons for the choice of health facility in the urban area. Similarly, it was observed that availability of specialized treatment (23 percent), low treatment cost (18 percent) and proximity to home (15 percent) were the utmost preferred reason for the choice of health facility utilization in rural Punjab. Finally, it was found that majority of urban respondents (36 percent) visit health facility on monthly basis, whereas, a large proportion of rural respondents visit half-yearly (28 percent) to the health facility for diabetes treatment.

Table: 6.2.1 Healthcare Utilization of Diabetes for Outpatient Care in Rural and Urban Punjab

Healthcare Utilization	Urban	Rural
Do you take any kind of treatment for diabetes mellitus?		
Yes	480 (100)	240 (100)
No	-	-
Which treatment you have taken for outpatient care of diabetes mellitus?*		
Allopathic	474 (74)	238 (67)
Ayurveda	32 (05)	18 (05)
Homeopathy	07 (01)	03 (01)
Home Remedies	126 (20)	91 (26)
Unani	0 (00)	03 (01)
Others	0 (00)	0 (00)
Which type of health facility have you visited for the treatment of diabetes mellitus?*		
Govt. Hospital	98 (15)	101 (31)
Private Hospital	306 (47)	107 (32)
Private Clinic	200 (31)	99 (30)
Homeopathy Clinic	02 (00)	06 (02)
Chemist	29 (04)	15 (05)
Faith Healer	0 (00)	0 (00)
Others	13 (02)	02 (01)
Visited facility was easily accessible?		
Yes	415 (86)	148 (62)
No	65 (14)	92 (38)
Distance covered to visit health facility?		
Average distance in kilometers	8.06 km	12.34 km
State the reasons for the choice of health facility utilized?*		
Availability of specialized treatment	378 (22)	194 (23)
Clean ambience	241 (14)	86 (10)
Doctor was familiar	269 (16)	112 (13)
Free treatment	0 (00)	02 (00)
Low cost treatment	209 (12)	150 (18)
Near to home	312 (19)	128 (15)
No long queues	134 (08)	24 (03)
No other option	93 (06)	100 (12)
Others (specify)	47 (03)	50 (06)
How frequently you visit the health facility to take treatment for diabetes?		
Once in a Month	175 (36)	48 (20)
Quarterly	190 (40)	90 (38)
Half-Yearly	79 (16)	67 (28)
Annually	10 (02)	14 (06)
Others (1-2 Week)	26 (05)	21 (09)

Source: Authors calculation established on primary data.
Note: * Multiple response possible.

6.2.2 Outpatient Cost of Diabetes by Socio-Demographic Variables in Rural and Urban Punjab

Table 6.2.2 shows outpatient cost of diabetes by socio-demographic characteristics in rural and urban Punjab. It was found that mean direct outpatient cost (₹3569) of urban female respondents was highest as compared to rural female respondents (₹2000). Similarly, mean indirect outpatient cost of urban female respondents was highest as compared to rural female respondents. However, the analysis revealed that there exists no significant difference in direct and indirect outpatient cost of diabetes on the basis of gender.

Furthermore, it was found that respondents of age below 20 years incurred the highest mean direct outpatient cost in urban (₹4819) and rural (₹2550) Punjab, but a significant difference in cost was witnessed in urban area with p = 0.002 as compared to rural respondents. Under indirect outpatient cost urban respondents (₹1090) of age 21-40 years incurred the highest cost of diabetes. Mean direct outpatient cost of single respondents was highest in urban area, exhibiting a statistically significant difference in cost as compared to married respondents (p = 0.036). The results revealed that indirect outpatient cost of single rural respondents (₹818) was highest as compared to married respondents (₹615), underlining statistical significance (p = 0.004).

With the increase in the level of education both direct and indirect outpatient costs of urban and rural respondents increased. The analysis revealed that there exists a statistically significant difference on the basis of education for direct outpatient cost of diabetes in both rural (p = 0.016) and urban (p = 0.000) Punjab. The results show that mean direct outpatient cost incurred by students (₹4568, p= 0.000) in urban area was highest followed by salaried (₹3852), retired (₹3747), businessman (₹3240), homemaker (₹3233) and others (₹1971). It was found that in rural area retired respondents incurred highest direct outpatient cost (₹2682) and students incurred highest indirect outpatient cost (₹1143). The results of Kruskal Wallis test show that there exists a significant difference in direct outpatient cost (p= 0.005) and indirect outpatient cost (p= 0.001) on the basis of work status.

Respondents with monthly income of ₹60,000 and above incurred highest direct (₹4812) and indirect (₹1315) outpatient cost in urban Punjab. It was found that there

exists a significant difference on the basis of income for direct outpatient cost in urban Punjab (p= 0.000). Whereas, rural respondents with monthly income of ₹30,000-₹45,000 incurred highest direct outpatient cost (₹2788) and respondents with monthly income of ₹45,000-₹60,000 incurred highest indirect outpatient cost (₹760).

Moreover, it was found that both rural and urban respondents of Punjab with a history of diabetes incurred high direct and indirect outpatient cost as compared to respondents with no history of diabetes. Respondents with complications incurred higher direct and indirect outpatient costs in both rural and urban Punjab. The mean direct and indirect outpatient cost of diabetes incurred by urban respondents was ₹4075 and ₹1019, highlighting a significant cost difference on the basis of complications for direct (p= 0.042) and indirect outpatient (p= 0.000) cost. Finally, the result of the analysis revealed that urban respondents having 6 members and above incurred the highest direct (₹3997) and indirect (₹948) outpatient cost. Moreover, a significant difference in direct outpatient cost was witnessed on the basis of household size (p= 0.017). Respondents having 6 members and above in rural Punjab incurred the highest direct outpatient cost (₹2242) and respondents having upto 3 members incurred the highest indirect outpatient (₹900) cost of diabetes.

Table: 6.2.2 Outpatient Cost of Diabetes by Socio-Demographic Variables in Rural and Urban Punjab

Socio-Demographic Variables	Urban Punjab				Rural Punjab			
	Direct Cost		Indirect Cost		Direct Cost		Indirect Cost	
	Mean (Median)	*p*-value	Mean (Median)	*p*-value	Mean (Median)	*p*-value	Mean (Median)	*p*-value
Gender								
Male	₹3280 (2800)	.089	₹890 (800)	.692	₹2033 (1500)	.692	₹654 (575)	.852
Female	₹3569 (3000)		₹924 (700)		₹2000 (1500)		₹665 (600)	
Age								
Below 20 years	₹4819** (4800)	.002	₹900 (800)	.385	₹2550 (2000)	.322	₹800** (800)	.049
21- 40 years	₹3869 (3600)		₹1090 (800)		₹2114 (1500)		₹788 (700)	
41- 60 years	₹3370 (3000)		₹938 (700)		₹1936 (1305)		₹645 (550)	
Above 60 years	₹3163 (2500)		₹765 (800)		₹2079 (1500)		₹543 (500)	
Marital Status								
Single	₹3703* (3500)	.036	₹796 (800)	.282	₹1979 (1500)	.463	₹818* (700)	.004
Married	₹3356 (3000)		₹920 (700)		₹2030 (1500)		₹615 (500)	
Education								
Illiterate	₹1864 (2000)	.000	₹500 (400)	.304	₹1837 (1175)	.016	₹570 (650)	.082
Primary	₹2613 (2300)		₹701 (525)		₹1791 (1300)		₹632 (600)	
Secondary	₹3384 (2750)		₹769 (700)		₹2253 (2000)		₹623 (500)	
Graduation	₹3764 (3400)		₹1011 (800)		₹2311 (2150)		₹795 (800)	
Post-Graduation	₹4584 (4300)		₹1426 (1200)		₹2733** (3000)		-	
Others	₹4360** (4700)		₹1400 (1200)		-		-	
Work Status								
Salaried	₹3852 (4000)	.000	₹1255 (800)	.976	₹2208 (1800)	.005	₹806 (700)	.001
Business	₹3240 (2700)		₹763 (700)		₹2020 (1500)		₹577 (550)	
Student	₹4568** (4100)		₹956 (800)		₹2660 (3000)		₹1143** (1200)	
Homemaker	₹3233 (3000)		₹897 (700)		₹1957 (1500)		₹680 (550)	
Retired	₹3747 (3100)		₹1500 (1500)		₹2682** (2150)		₹678 (700)	
Others	₹1971 (2000)		₹600 (450)		₹1597 (1200)		₹500 (500)	

Income								
Less than ₹15,000	₹1692 (1500)	.000	₹432** (400)	.029	₹1337 (900)	.000	₹548 (500)	.226
₹ 15,000- ₹ 30,000	₹3323 (3000)		₹723 (600)		₹1939 (1500)		₹655 (575)	
₹ 30,000- ₹ 45,000	₹3276 (3000)		₹836 (800)		₹2788** (2350)		₹692 (750)	
₹ 45,000 - ₹ 60,000	₹3903 (3550)		₹865 (750)		₹2422 (2775)		₹760 (800)	
₹ 60,000 and above	₹4812** (4500)		₹1315 (1000)		₹1940 (1100)		-	
Family Type								
Nuclear	₹3224 (3000)	.263	₹890 (700)	.651	₹1770 (1500)	.172	₹750* (700)	.003
Joint	₹3550 (3000)		₹915 (800)		₹2252 (1500)		₹573 (500)	
History of Diabetes								
Yes	₹3475 (3000)	.147	₹917 (700)	.705	₹2293* (1500)	.006	₹683 (600)	.535
No	₹3307 (2800)		₹886 (800)		₹1705 (1350)		₹610 (500)	
Complications								
Yes	₹4075* (3500)	.042	₹1019* (800)	.000	₹2296* (1900)	.001	₹659 (575)	.764
No	₹2646 (2500)		₹732 (600)		₹1737 (1300)		₹654 (600)	
Household Size								
Upto 3 Members	₹3304 (3000)	.017	₹762 (800)	.208	₹1911 (1700)	.516	₹900** (800)	.015
4-6 Members	₹3193 (2800)		₹906 (700)		₹1972 (1500)		₹660 (600)	
6 Members and above	₹3997** (3200)		₹948 (800)		₹2242 (1600)		₹585 (500)	

Source: Authors calculation established on primary data.

Note: *Mann Whitney U test and **Kruskal Wallis test done for group comparison.

A p-value was considered significant at $p < 0.05$.

6.2.3 Profile of Respondents based on Diabetes Complications in Rural and Urban Punjab

Table 6.2.3 shows the profile of respondents based on diabetes complications in rural and urban Punjab. The results of the study revealed that 94 percent urban respondents and 84 percent rural respondents knows that diabetes may cause complications in other organs. Further, it was found that 53 percent of the urban respondents and 51 percent of the rural respondents were diagnosed to suffer from any of the complications due to diabetes.

Under macrovascular complications it was found that a large proportion of urban (48 percent) and rural respondents (49 percent) of Punjab were diagnosed with heart disease (CAD) followed by blockage in blood vessels (PVC), low sugar stroke (Hypoglycemia) and brain stroke (TIA). Similarly, the results of analysis revealed that under microvascular complications a large proportion of urban respondents and rural respondents suffered from retinopathy. It was found that tooth infection (Periodontitis) was the second-highest microvascular complication in rural and urban Punjab followed by blood vessel disease (vasculopathy), kidney-related disease (nephropathy), nerve related disease (neuropathy) and foot ulcer.

Table: 6.2.3 Profile of Respondents based on Diabetes Complications in Rural and Urban Punjab

Complications	Urban	Rural
You know that diabetes can cause complications in other organs		
Yes	450 (94)	202 (84)
No	30 (06)	38 (16)
You suffer from any of the complication due to diabetes		
Yes	252 (53)	122 (51)
No	228 (47)	118 (49)
Macrovascular Complications		
Heart Disease (Coronary Artery Disease)	63 (48)	34 (49)
Brain Stroke (Transient Ischemic Attack)	04 (02)	00 (00)
Low Sugar Stroke (Hypoglycemia)	10 (09)	09 (13)
Blockage in Blood Vessels (Peripheral Vascular Disease)	55 (40)	26 (38)
Microvascular Complications		
Foot Ulcer	07 (03)	03 (02)
Gum/Tooth Infection (Periodontitis Complication)	50 (20)	27 (21)
Eyes Sickness (Retinopathy)	132 (54)	73 (57)
Nerves Related Disease (Neuropathy)	04 (02)	06 (05)
Kidney-Related Disease (Nephropathy)	18 (07)	06 (05)
Blood Vessel Disease (Vasculopathy)	33 (14)	12 (09)

Source: Authors calculation established on primary data

6.2.4 Outpatient Cost of Treating Diabetes Complications in Rural and Urban Punjab

Table 6.2.4 shows the outpatient cost of treating diabetes complications among different groups in the rural and urban Punjab. The study respondents were categorized into three different groups based on the incidence of complications. The first group comprised of respondents without complications, second group encompassed of respondents with microvascular complications and third group included diabetic respondents with macrovascular complications.

The analysis revealed that both rural (₹2312) and urban (₹4480) respondents with macrovascular complications incurred the highest mean total direct cost. Whereas, rural respondents with microvascular complications (₹698) incurred the highest mean total indirect cost as compared to urban respondents with macrovascular complications (₹1056). Further, it was found that under total direct cost, expenditure on medicines account for highest cost proportion followed by diagnostic expenditure, consultation fees and transportation cost in both rural and urban Punjab.

The mean wage loss incurred by diabetic patients was highest among urban respondents (₹1102) diagnosed with macrovascular complications and rural respondents (₹640) diagnosed with microvascular complications. The results of analysis show that wage loss incurred by accompanying person was highest among rural (₹703) and urban respondents (₹1150) of Punjab diagnosed with microvascular complications followed by macrovascular and without complications group.

Table: 6.2.4 Outpatient Cost of Treating Diabetes Complications in Rural and Urban Punjab

Cost Variables	Urban			Rural		
	Group-1 Mean (Median)	**Group-2** Mean (Median)	**Group-3** Mean (Median)	**Group-1** Mean (Median)	**Group-2** Mean (Median)	**Group-3** Mean (Median)
Consultation Fee (₹)	266 (250)	360 (300)	409 (400)	264 (200)	260 (250)	267 (250)
Expenditure on Medicines (₹)	2180 (2000)	2908 (2500)	3433 (3000)	1362 (1000)	1670 (1225)	1915 (1500)
Diagnostic Expenditure (₹)	590 (500)	744 (700)	815 (700)	508 (300)	598 (350)	478 (325)
Transportation (₹)	91 (100)	163 (100)	264 (100)	141 (100)	100 (100)	110 (100)
Total Direct Cost (₹)	***2646 (2500)***	***3787 (3500)***	***4480 (3675)***	***1737 (1300)***	***2182 (1600)***	***2312 (1900)***
Wage Loss Incurred by Diabetic Patients (₹)	748 (500)	780 (700)	1102 (900)	609 (450)	640 (700)	571 (600)
Wage Loss Incurred by Accompanying Person (₹)	737 (750)	1150 (1000)	1007 (1000)	639 (550)	703 (500)	550 (500)
Total Indirect Cost (₹)	***732 (600)***	***956 (800)***	***1056 (900)***	***654 (600)***	***698 (700)***	***543 (500)***

Source: Authors calculation established on primary data.

Note: Group-1 = Individuals Without Complications
Group-2 = Individuals with Microvascular Complications
Group-3 = Individuals with Macrovascular Complications

6.2.5. Healthcare Utilization for Inpatient Care of Diabetes in Rural and Urban Punjab

Table 6.2.5 presents the healthcare utilization for inpatient care of diabetes in rural and urban Punjab. Out of 720 respondents, 28 percent urban respondents and 27 percent rural respondents were hospitalized in past 365 days. It was found that a large proportion of urban (80 percent) and rural respondents (76 percent) of Punjab utilized private hospitals followed by government hospitals, private clinics and others.

The result exhibits that 71 percent of the urban respondents and 51 percent of the rural respondents mentioned that healthcare facilities were easily accessibility. It was found that availability of specialized doctors (24 percent), all diagnostic tests under one roof (22 percent) and easy accessibility (15 percent) were the top three reasons for the choice of health facility utilized by urban respondents. Whereas, rural respondents recognized availability of specialized doctors (24 percent), all diagnostic tests under one roof (21 percent) and best ancillary care (13 percent) as the top three reasons for the choice of health facility utilized. However, it was observed that no long queues, clean rooms/wards, low-cost treatment and others were amongst the least preferred reason for the choice health facility utilization in both rural and urban Punjab.

Table 6.2.5. Inpatient Healthcare Utilization by Diabetic Patients in Urban-Rural Punjab

Health Care Utilization	Urban	Rural
In past 365 days, whether you hospitalized due to diabetes?		
Yes	138 (28)	66 (27)
No	342 (72)	174 (73)
Type health facility you utilized for inpatient care		
Government Hospital	22 (16)	16 (24)
Private Hospital	110 (80)	50 (76)
Private Clinic	05 (03)	00 (00)
Others (Trust Hospital)	01 (01)	00 (00)
Reasons for choice of this type of health facility utilized		
Availability of specialized doctors	128 (24)	62(24)
All diagnostic test under one roof	119 (22)	53 (21)
Best ancillary care	71 (13)	33 (13)
Clean rooms/wards	34 (06)	19 (07)
Easily accessible	83 (15)	27 (11)
Low cost treatment	24 (04)	23 (09)
No long queues	26 (05)	10 (04)
No other option	43 (08)	26 (11)
Others (specify)	10 (02)	01 (00)
Visited facility was easily accessible		
Yes	111 (71)	34 (51)
No	27 (29)	32 (49)
Average distance covered to visit health facility	**11.85 Km**	**21.09 Km**

Source: Authors calculation established on primary data.

6.2.6 Inpatient Cost of Diabetes by Socio-Demographic Variables in Rural and Urban Punjab

The inpatient cost of diabetes by socio-demographic characteristics in rural and urban Punjab is presented in table 6.2.6. It was found that mean direct and indirect inpatient cost of urban male respondents were high as compared to female respondents. The result of Mann Whitney U test exhibits a statistically significant difference on the basis of gender for direct (p= 0.013) and indirect inpatient cost (p= 0.005). Whereas, direct and indirect inpatient cost of rural female respondents (₹31775 and ₹3653) was highest as compared to male respondents (₹30910 and ₹3052) in Punjab.

The results of the analysis revealed that respondents of age 60 years and above incurred the highest mean direct inpatient cost of diabetes in both urban (₹46837) and rural (₹46832) Punjab. Whereas, urban respondents of age 60 years and above (₹5231) and rural respondents of age 41-60 years (₹3797) incurred the highest indirect inpatient cost of diabetes. It was found that married respondents incurred highest mean direct (₹33823) and indirect inpatient (₹3428) cost in rural area. However, in urban area it was observed that single respondents incurred highest mean direct (₹40659) and indirect inpatient cost (₹4782). The results of the study revealed that urban respondents with others level of education incurred the highest direct (₹71571) and indirect inpatient (₹7100) cost of diabetes, highlighting a significant difference on the basis of indirect inpatient cost (p= 0.029). But, in rural area it was found that illiterate respondents incurred highest mean direct (₹71571) and indirect inpatient (₹7014) cost of diabetes as compared to literate respondents.

Respondents with business incurred the highest mean direct (₹61087) and indirect inpatient cost (₹6275), showing a statistically significant difference on the basis of work status in direct (p= 0.001) and indirect (0.003) inpatient cost. It was found that retired respondents incurred the highest mean direct (₹57087) and indirect (₹3929) inpatient cost followed by businessman, others, homemaker and students. The result of the analysis revealed that urban respondents with income of ₹60,000 and above incurred the highest mean direct (₹60570) and indirect (₹7547) inpatient cost of diabetes. It was found that there exists a significant difference on the basis of income with p-value = 0.000. Whereas, in rural area it was observed that respondents with income of ₹45,000-₹60000 incurred

the highest mean direct inpatient cost (₹64950) and respondents with income ₹30,000-₹45000 incurred highest mean indirect inpatient cost (₹4400) of diabetes. The result of Kruskal Wallis test exhibits a statistically significant difference in cost on the basis of income with p= 0.000 and p= 0.006.

It was found that both urban and rural respondents of Punjab with the history of diabetes in family incurred the highest direct and indirect inpatient cost of diabetes as compared to respondents with no history of diabetes. Respondents with complications incurred higher direct and indirect inpatient costs in both rural and urban areas of Punjab. The average direct and indirect inpatient cost spent by urban respondents was ₹46564 and ₹5283, highlighting a significant difference in cost with a p-value= 0.000. Lastly, it was observed that respondents with household size 6 member and above incurred higher direct (₹58622) and indirect (₹6149) inpatient cost in urban area. Whereas, in rural Punjab respondents with upto 3 members in household incurred highest direct (₹38143) and indirect (₹3633) inpatient cost of diabetes.

Table: 6.2.6 Inpatient Cost of Diabetes by Socio-Demographic Variables in Rural and Urban Punjab

Socio-Demographic Variable	Urban Punjab				Rural Punjab			
	Direct Cost		Indirect Cost		Direct Cost		Indirect Cost	
	Mean (Median)	p-value	Mean (Median)	*p*-value	Mean (Median)	*p*-value	Mean (Median)	*p*-value
Gender								
Male	₹52625* (32000)	.013	₹5801* (4000)	.005	₹30910 (10000)	.758	₹3052 (3000)	.519
Female	₹27945 (20000)		₹3563 (2800)		₹31775 (17500)		₹3653 (2450)	
Age								
Below 20 years	₹20500 (20500)	.127	₹2900 (2900)	.858	₹15000 (15000)	.015	₹2900 (2900)	.240
21- 40 years	₹15878 (11400)		₹3311 (3000)		₹7083 (6000)		₹2083 (2200)	
41- 60 years	₹38905 (24500)		₹4483 (3000)		₹32211 (20000)		₹3797 (3000)	
60 years and above	₹46837 (25000)		₹5231 (3200)		₹46832** (15000)		₹3417 (2400)	
Marital Status								
Single	₹40659 (24000)	.786	₹4782 (3200)	.555	₹13250 (10000)	.984	₹2775 (3000)	.733
Married	₹40641 (24000)		₹4603 (3000)		₹33823 (12500)		₹3428 (2500)	
Education								
Illiterate	₹16250 (17500)	.334	₹1150 (1200)	.029	₹71571 (35000)	.173	₹7014 (3000)	.827
Primary	₹33115 (21800)		₹3438 (2600)		₹27670 (15000)		₹2852 (2400)	
Secondary	₹47174 (32600)		₹5200 (3200)		₹17621 (9000)		₹2559 (3000)	
Graduation	₹38576 (24000)		₹5329 (3600)		₹25579 (10000)		₹3429 (3000)	
Post-Graduation	₹49100 (25000)		₹3778 (4000)		-		-	
Others	₹64000 (64000)		₹7100** (7100)		-		-	
Work Status								
Salaried	₹21581 (14000)	.001	₹3747 (3200)	.003	-	.568	-	.202
Business	₹61087** (35000)		₹6275** (4800)		₹31078 (14000)		₹3638 (3500)	
Student	₹16550 (16550)		₹1925 (2150)		₹11428 (10000)		₹2971 (3000)	
Homemaker	₹30200 (20500)		₹3475 (2500)		₹29326 (10000)		₹3359 (2000)	
Retired	₹29413 (24000)		₹3846 (3200)		₹57087 (17500)		₹3929 (4000)	
Others	₹12125 (12125)		₹2750 (2750)		₹30250 (35000)		₹2550 (2500)	

Income							
Less than ₹15,000	₹18447 (15000)	.000	₹1800 (1800)	.000	₹15800 (15000)	.000	₹2120 (2200)	.006
₹ 15,000- ₹ 30,000	₹35026 (20000)		₹3731 (2500)		₹18325 (9550)		₹3403 (2500)	
₹ 30,000- ₹ 45,000	₹28137 (18200)		₹3553 (3000)		₹63357 (52500)		₹4400** (4000)	
₹ 45,000 - ₹ 60,000	₹57168 (30200)		₹5705 (4000)		₹64950** (35000)		₹3583 (3550)	
₹ 60,000 and above	₹60570** (40000)		₹7547** (5500)		₹5000 (5000)		₹1000 (1000)	
Family Type							
Nuclear	₹36119 (20500)	.342	₹4233 (3000)	.466	₹26450 (10000)	.567	₹3947 (3000)	.424
Joint	₹44554 (25000)		₹4945 (3200)		₹35651 (20000)		₹2834 (2500)	
History of Diabetes							
Yes	₹40710 (25000)	.846	₹5022 (3300)	.702	₹39308 (15000)	.299	₹3470 (3000)	.376
No	₹40561 (20000)		₹4272 (2800)		₹21755 (10000)		₹3243 (2250)	
Complications							
Yes	₹46564* (29500)	.000	₹5283** (3800)	.000	₹33862 (10000)	.889	₹3404 (3000)	.365
No	₹17382 (15000)		₹2029 (1900)		₹25505 (10000)		₹3220 (2650)	
Household Size							
Upto 3 Members	₹23126 (17000)	.045	₹3661 (2000)	.274	₹38143 (20000)	.754	₹3633 (2300)	.604
4-6 Members	₹35438 (22500)		₹4033 (3200)		₹28607 (10000)		₹3551 (3000)	
6 Members and Above	₹58622** (31400)		₹6149 (3500)		₹38017 (30500)		₹2408 (2350)	

Source: Authors calculation established on primary data.

Note: *Mann Whitney U test and **Kruskal Wallis test done for group comparison.

A p-value was considered significant at $p < 0.05$.

6.2.7. Inpatient Cost of Treating Diabetes Complications in Rural and Urban Punjab

Table 6.2.7 shows the inpatient cost of treating diabetes complications in rural and urban Punjab. The study respondents were categorized into three different groups based on the complications incidence. The first group included respondents without complications, second group encompassed of respondents with microvascular complications and third group comprised of diabetic patients with macrovascular complications.

The results of the study revealed that urban respondents with macrovascular complications (₹56613) incurred the highest mean total direct inpatient cost. Whereas, rural respondents with microvascular complications (₹32474) incurred the highest mean total direct inpatient cost. Similarly, it was found that average total indirect cost of urban respondents with macrovascular complications (₹6470) and rural respondents with microvascular complications (₹3541) incurred the highest inpatient cost.

The result of the analysis shows that cost incurred on others, diagnostic expenditure and expenditure on medicines are the top three inpatient cost components under total direct cost in urban Punjab. Whereas, it was found that cost incurred on others, hospitalization fees and expenditure on medicines are the top three inpatient cost components under total direct cost in rural area for the majority of groups.

The average wage loss incurred by urban respondents without complications and with micro-vascular complications was lowest. Whereas, wage loss of accompanying persons in urban areas was highest for respondents with macro-vascular complications with a mean cost of ₹3581. Similarly, wage loss of accompanying persons in rural areas was highest for respondents with micro-vascular complications (₹3541).

Table: 6.2.7 Inpatient Cost for Treating Diabetic Complications in Rural and Urban Punjab

Cost Variables	Urban			Rural		
	Group-1 Mean (Median)	**Group-2** Mean (Median)	**Group-3** Mean (Median)	**Group-1** Mean (Median)	**Group-2** Mean (Median)	**Group-3** Mean (Median)
Consultation Fee (₹)	₹848 (500)	₹1864 (1500)	₹2160 (1750)	₹1293 (700)	₹1379 (800)	₹1328 (800)
Expenditure on Medicines (₹)	₹3600 (3400)	₹5838 (4500)	₹6931 (5450)	₹4700 (3150)	₹5378 (3800)	₹4912 (4500)
Hospitalization Fees (₹)	₹3571 (2900)	₹5587 (4000)	₹7325 (5750)	₹7190 (1700)	₹3943 (2400)	₹4365 (2350)
Diagnostic Expenditure (₹)	₹4352 (3750)	₹5852 (5000)	₹7972 (6250)	₹2547 (2000)	₹4734 (1800)	₹3014 (2200)
Transportation (₹)	₹308 (275)	₹1096 (500)	₹704 (500)	₹329 (375)	₹423 (200)	₹239 (200)
Food and Other Material (₹)	₹1787 (1600)	₹2934 (2500)	₹3453 (3000)	₹1014 (850)	₹2095 (1600)	₹1896 (2000)
Others (₹)	₹16143 (15000)	₹35216 (23000)	₹51733 (38750)	₹16640 (15000)	₹25461 (10000)	₹17171 (10000)
Total Direct Cost (₹)	***₹17382 (15000)***	***₹38211 (24000)***	***₹56613 (31400)***	***₹25505 (10000)***	***₹32474 (10000)***	***₹25954 (18500)***
Wage loss incurred by diabetic patients (₹)	₹1900 (1000)	₹3791 (2600)	₹4870 (3000)	₹3125 (4000)	₹2123 (1800)	₹2685 (1800)
Wage loss incurred by accompanying person (₹)	₹1994 (2000)	₹3463 (2800)	₹3581 (2500)	₹3031 (2400)	₹3566 (3000)	₹1817 (1450)
Total Indirect Cost (₹)	***₹2028 (1900)***	***₹4544 (3200)***	***₹6470 (4900)***	***₹3220 (2650)***	***₹3541 (3000)***	***₹2146 (1500)***

Source: Authors calculation established on primary data.

Note: Group-1 = Individuals Without Complications

Group-2 = Individuals with Microvascular Complications

Group-3 = Individuals with Macrovascular Complications

6.2.8 Coping Strategies of Diabetes Mellitus in Rural and Urban Punjab

Coping strategies of diabetes mellitus in rural and urban Punjab are presented in table 6.2.8. Coping strategies were categorized as behaviour-based coping strategies, asset-based coping strategies and assistance-based coping strategies. It was found that a large proportion of urban and rural respondents utilized asset-based coping strategies followed by behaviour and assistance-based strategies.

It was found that large proportion of urban (39 percent) and rural (37 percent) respondents utilized "*buying part of medicines to cope with diabetes*" as the foremost behaviour-based coping strategy followed by "*Intra-household labor substitution to compensate for any labor loss*" and "*Consuming less of food items to meet healthcare expenditure on diabetes*".

The result of the analysis revealed that 76 percent urban and 72 percent rural respondents strongly agreed "*mobilizing the available cash in hand*" as the primary asset-based coping strategy followed by "*using past savings to meet the healthcare expenses of diabetes*" and "*mortgage productive assets to cope with diabetes*". It was found that a large percentage of rural and urban respondent at no time utilized for "*taking a loan from moneylenders to meet healthcare costs of diabetes*" and "*selling off productive assets to cope with diabetes*" asset-based coping strategy to meet the economic burden of diabetes in Punjab.

Finally, the results of the study revealed that 35 percent of the urban respondents and 45 percent of the rural respondents utilize "*seeking help from relatives to cope up with diabetes*" as a primary assistance-based coping strategy followed by "*borrowing from neighbors*" and "*received assistance from NGOs to manage diabetes*" as a major coping strategy to meet the financial burden of diabetes.

Table: 6.2.8 Coping Strategies of Diabetes Mellitus in Rural and Urban Punjab

n (%)

Coping Strategies		Urban					Rural				
		Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Behaviour-Based Coping Strategies	Consuming less of food items to meet healthcare expenditure on diabetes	46 (09)	70 (15)	109 (23)	167 (35)	88 (18)	31 (12)	37 (16)	57 (25)	90 (37)	25 (10)
	Buying part of medicines to cope with diabetes	189 (39)	196 (41)	61 (13)	24 (05)	10 (02)	89 (37)	78 (32)	30 (13)	36 (15)	07 (03)
	Reduced the number of visits to doctor	13 (03)	44 (09)	96 (20)	296 (62)	31 (06)	04 (02)	24 (10)	29 (12)	153 (63)	30 (13)
	Working overtime to meet the diabetes expenses	20 (04)	76 (19)	131 (23)	210 (43)	43 (11)	08 (03)	59 (25)	38 (16)	99 (41)	36 (15)
	Intra-household labor substitution to compensate for any labor loss	97 (20)	155 (32)	97 (20)	94 (20)	37 (08)	47 (20)	72 (30)	44 (18)	65 (27)	12 (05)
Asset-Based Coping Strategies	Managing diabetes by working as bonded laborer	01(0)	05 (01)	5 (01)	233 (49)	237 (49)	01 (0)	02 (01)	05 (02)	149 (62)	83 (35)
	Using past savings to meet the healthcare expenses of diabetes	115 (24)	197 (41)	119 (25)	31 (06)	18 (04)	62 (26)	71 (30)	67 (28)	18 (07)	22 (09)
	Mobilizing the available cash in hand	365 (76)	96 (20)	12 (03)	06 (01)	03 (0)	173 (72)	54 (23)	10 (04)	02 (01)	01 (0)
	Selling of productive assets to cope with diabetes	01(0)	-	02 (0)	340 (71)	137 (29)	-	06 (02)	06 (02)	165 (69)	63 (27)
	Mortgage productive assets to cope with diabetes	-	02 (0)	02 (0)	291 (61)	185 (38)	04 (02)	02 (01)	01 (0)	150 (62)	83 (35)
	Taking loan from moneylenders to meet healthcare costs of diabetes	-	-	01 (0)	350 (73)	129 (27)	-	03 (01)	03 (01)	166 (70)	68 (28)
Assistance-Based Coping Strategies	Seeking help from relatives to cope up with diabetes	75 (16)	89 (19)	77 (16)	164 (34)	75 (16)	47 (20)	60 (25)	24 (10)	78 (33)	31 (12)
	Borrowing from friends to meet healthcare expenditure of diabetes	07 (01)	29 (06)	67 (14)	294 (62)	83 (17)	16 (07)	33 (13)	40 (17)	129 (54)	22 (09)
	Borrowing from neighbors	07 (01)	18 (04)	30 (06)	333 (69)	92 (19)	09 (04)	25 (10)	11 (04)	162 (69)	33 (13)
	Received assistance from NGOs to manage diabetes	34 (07)	30 (06)	18 (04)	306 (64)	92 (19)	33 (13)	21 (09)	11 (04)	111 (46)	64 (27)

Source: Authors calculation established on primary data.

SECTION III

6.3 SUMMARY AND CONCLUSION

The present chapter estimates and compares the healthcare utilization, cost and coping strategies of diabetes in Punjab. It was found that a large proportion respondents preferred allopathic type of treatment (72 percent) followed by home remedies (22 percent), ayurveda (5 percent) and homeopathy (1 percent). A large number of respondents preferred private hospitals over government healthcare facilities. The results of the analysis exhibits that 78 percent respondents mentioned that healthcare facilities were easily accessible. The mean distance covered to access healthcare facility was 9.49 kilometers. It was found that availability of specialized treatment (23 percent), proximity to home (17 percent) and doctor familiarity (15 percent) were the top three reasons for the choice of health facility utilized.

Outpatient cost of diabetes by socio-demographic characteristics was presented in table 6.1.2. It was found that rural respondents incurred less mean direct and indirect outpatient cost of diabetes as compared to urban respondents. The mean direct and indirect outpatient cost of female respondents was highest as compared to male respondents. The result of analysis exhibits that respondents of age below 20 years incurred the highest mean direct outpatient cost of ₹4342. Whereas, under indirect cost respondents of age 21-40 years (₹927) incurred the highest mean cost. Moreover, it was found that mean direct and indirect outpatient cost incurred by illiterates was lowest and it was highest for post-graduates. The average direct (₹3972) and indirect outpatient cost (₹1013) was highest for students as compared to others. Respondents with monthly income of ₹60,000 and above incurred highest direct (₹4649) and indirect outpatients cost (₹1340) as compared to respondents with monthly income less than ₹15,000. It was found that respondents with history of diabetes and complications incurred significantly higher mean direct outpatient and indirect outpatient cost of diabetes.

Mann Whitney U test revealed that a statistically significant difference exists on the basis of region, gender, history of diabetes and complications for direct outpatient cost with p-value < 0.05. Whereas, under indirect outpatient cost it was found that there exists a statistically significant difference on the basis of region and complications (p < 0.05). Similarly, Kruskal Wallis test revealed that a statistically significant difference

exists on the basis of age, education, work status, income and household size for direct outpatient cost. However, under indirect outpatient cost the results of Kruskal Wallis test exhibits that there exists a significant difference in cost on the basis of education, work status and income ($p < 0.05$).

Profile of diabetic respondents based on complications in Punjab was highlighted in table 6.1.3. The result of the study revealed that 91 percent respondents know diabetes can cause complications in other organs. It was found that 52 percent respondents were diagnosed from any of the complication due to diabetes. Moreover, it was observed that large proportion of respondents were diagnosed with microvascular complications and rest 39 percent with macrovascular complications. The result of the analysis shows that out of 201 respondents with macrovascular complications, 48 percent of the respondents were diagnosed with heart disease (CAD) followed by a blockage in blood vessels (PVC), low sugar stroke and brain stroke (TIA). However, under microvascular complications it was found that 55 percent respondents suffer from eye sickness (retinopathy) followed by gum/tooth infection (periodontitis), blood vessel disease (Vasculopathy), kidney-related disease (nephropathy) and foot ulcer and neuropathy.

The outpatient cost of treating diabetes complications in Punjab was lucidly explained in table 6.1.4. It was found that mean total direct cost (₹3717) of treating diabetes was highest among diabetic respondents with macrovascular complications as compared to microvascular (₹3240) and without complication (₹2336) respondents. Under total direct outpatient cost, expenditure on medicines accounts for the highest cost proportion in all groups followed by diagnostic expenditure, consultation fee and transportation cost. The mean wage loss incurred by respondents with macrovascular complications (₹946) was highest. Whereas, mean wage loss incurred by accompanying person was highest for diabetics with microvascular complications (₹944).

The results of the analysis found that out of 720 respondents, 29 percent of the diabetic respondents utilized inpatient care in past 365 days. The results of inpatient care revealed that a large number of diabetic respondents preferred private hospital over government hospitals. Furthermore, 71 percent respondents revealed that visited facility was easily accessible. Availability of specialized doctors (24 percent), all diagnostic tests under one roof (22 percent) and easy accessibility (14 percent) were the most preferred reasons for the choice of health facility utilized in Punjab.

The inpatient cost of diabetes by socio-demographic characteristics represents that urban respondents incurred highest mean direct and indirect inpatient cost of diabetes as compared to rural respondents. The mean direct and indirect outpatient cost of male respondents was highest as compared to female respondents. The results of analysis exhibit that respondents of age 60 years and above (₹41483 and ₹4818) incurred the highest mean direct and indirect inpatient cost followed by 41-60 years, below 20 years and 21-40 years.

The mean direct inpatient cost incurred by other (₹64000) was highest and it was found to be lowest for respondents with primary education (₹27518). Whereas, mean indirect inpatient cost incurred by graduates (₹4845) was highest. The result shows that businessman incurred the utmost mean direct (₹53808) and indirect inpatient (₹5851) cost of diabetes followed by retired, homemaker, others, salaried and students respectively. Further, it was found that respondents with income ₹60,000 and above incurred the highest average direct (₹57394) and indirect inpatient (₹7162) cost of diabetes. Respondents with a history of diabetes incurred highest mean direct inpatient cost (₹37104) as compared to respondents with no history of diabetes (₹34761). The results highlighted that respondents with complications incurred higher mean direct (₹41875) and indirect inpatient (₹4819) cost of diabetes. Lastly, it was found that households with 6 members and above incurred higher mean direct (₹52219) as compared to households with less family members.

The results of Mann Whitney U test exhibit that a significant difference exists on the basis of region, history of diabetes and complications for direct inpatient cost with p-value < 0.05. Whereas, under indirect inpatient cost it was found that there exists a statistically significant difference on the basis of region, gender and complications (p < 0.05). Kruskal Wallis test revealed that a statistically significant difference in cost exists on the basis of age, work status, income and household size for direct inpatient cost. However, under indirect inpatient cost the result of the analysis shows that there exists a significant difference in cost on the basis of work status and income (p < 0.05).

Table 6.1.7 clearly explains the inpatient cost of treating diabetes complications in Punjab. The mean total direct inpatient cost (₹48001) of diabetes was highest under macrovascular complications. The mean total indirect cost of respondents with

macrovascular complications (₹5291) was highest as compared to microvascular complications (₹4226) and without complications (₹2525). It was found that mean wage loss incurred by respondents with macrovascular complications was highest ₹4587 and the average wage loss incurred by accompanying person was highest among the respondents with microvascular complications (₹3496).

Coping strategies employed by households to meet the healthcare expenditure of diabetes in Punjab shows that large proportion of respondents utilized "*buying part of medicines to cope with diabetes*" and "*intra-household labor substitution to compensate for any labor loss*" as the foremost behaviour-based coping strategies in Punjab. The results of the analysis revealed that 74 percent respondents strongly agreed "*mobilizing the available cash in hand*" as the most preferred asset-based coping strategy followed by "*using past savings to meet the healthcare expenses of diabetes*" and "*Mortgage productive assets*". Lastly, a very small proportion of respondents utilized assistance-based coping strategies. It was found that 38 percent respondents agreed to utilize "*seeking help from relatives to cope up with diabetes*" as a primary assistance-based coping strategy to meet the financial burden of diabetes.

Healthcare utilization of diabetes for outpatient care in rural-urban area found that a large proportion of urban and rural respondents utilized allopathic type of treatment for diabetes mellitus followed by home remedies, ayurveda and homeopathy. The results of the analysis revealed that a large proportion of both urban and rural respondents preferred private hospitals over government hospitals. The mean distance covered to access healthcare facility was 8.06 kilometers in urban and 12.34 kilometer in rural Punjab. Availability of specialized treatment (22 percent), proximity to home (19 percent) and doctor familiarity (16 percent) were the top three reasons for the choice of health facility in the urban area. Finally, it was found that majority of urban respondents (36 percent) visit health facility on monthly basis, whereas, a large proportion of rural respondents visit half-yearly (28 percent).

The analysis shows outpatient cost of diabetes by socio-demographic characteristics in rural and urban Punjab. It was found that mean direct and indirect outpatient costs of urban female respondents were highest as compared to the rural female respondents. It was found that respondents of age below 20 years incurred the highest mean direct outpatient cost in urban (₹4819) and rural (₹2550) Punjab. Under indirect outpatient

cost urban respondents (₹1090) of age 21-40 years incurred highest cost of diabetes. Indirect outpatient cost of single respondents (₹818) was highest as compared to married respondents (₹615) in rural Punjab. With the increase in the level of education both direct and indirect outpatient costs of urban and rural respondents increased. The result shows that mean direct outpatient cost incurred by students (₹4568) in urban area was highest followed by salaried (₹3852), retired(₹3747), businessman (₹3240), homemaker (₹3233) and others (₹1971). Furthermore, it was found that retired respondents incurred highest direct outpatient cost (₹2682) and students incurred highest indirect outpatient cost (₹1143) in rural Punjab.

Respondents with monthly income of ₹60,000 and above incurred highest direct (₹4812) and indirect (₹1315) outpatient cost in urban area. Whereas, rural respondents with monthly income of ₹30,000-₹45,000 incurred the highest direct outpatient cost (₹2788). Rural respondents with monthly income of ₹45,000-₹60,000 incurred highest indirect outpatient cost (₹760). Rural and urban respondents of Punjab with a history of diabetes incurred more direct (₹3475 and ₹2293) and indirect outpatient (₹917 and ₹683) cost. Respondents with complications incurred higher direct and indirect outpatient costs in rural and urban Punjab. Finally, the results revealed that urban respondents having 6 members and above incurred the highest direct (₹3997) and indirect (₹948) outpatient cost.

A significant difference exists on the basis of marital status and complications for direct and indirect outpatient cost in urban and rural Punjab with p-value < 0.05. Whereas, in rural area direct and indirect outpatient costs observed a statistically significant difference on the basis of marital status, family type, history of diabetes and complications ($p < 0.05$). Likewise, the results of Kruskal Wallis test revealed that a statistically significant difference exists on the basis of age, education, work status, income and household size for direct outpatient cost in urban area. However, in rural area the analysis of Kruskal Wallis test exhibit that there exists a significant difference in direct outpatient cost on the basis of education, work status and income. Under indirect outpatient cost a significant difference in cost was observed on the basis of age, work status and household size.

Profile of respondents based on diabetes complications in rural and urban Punjab

revealed that 53 percent of the urban respondents and 51 percent of the rural respondents were diagnosed to suffer from any of the complications due to diabetes. Under macrovascular complications it was found that a large proportion of urban (48 percent) and rural respondents (49 percent) of Punjab were diagnosed with heart disease (CAD) followed by blockage in blood vessels (PVC), low sugar stroke (Hypoglycemia) and brain stroke (TIA). Similarly, the results of analysis revealed that under microvascular complications a large proportion of urban respondents and rural respondents suffered from retinopathy.

Outpatient cost of treating diabetes complications revealed that both rural (₹2312) and urban (₹4480) respondents with macrovascular complications incurred the highest mean total direct cost. Whereas, rural respondents with microvascular complications (₹698) incurred the highest mean total indirect cost as compared to urban respondents with macrovascular complications (₹1056). Further, it was found that under total direct cost, expenditure on medicines account for highest cost proportion. The mean wage loss incurred by diabetic patients was highest among urban respondents (₹1102) diagnosed with macrovascular complications and rural respondents (₹640) diagnosed with microvascular complications.

The results of the study highlighted that healthcare utilization for inpatient care in table 6.2.5. Out of 720 respondents, 28 percent urban respondents and 27 percent rural respondents were hospitalized in past 365 days. It was found that a large proportion of urban (80 percent) and rural respondents (76 percent) of Punjab utilized private hospitals followed by government hospitals, private clinics and others. The result exhibits that 71 percent of the urban respondents and 51 percent of the rural respondents mentioned that healthcare facilities were easily accessibility. It was found that availability of specialized doctors (24 percent), all diagnostic tests under one roof (22 percent) and easy accessibility (15 percent) were the top three reasons for the choice of health facility utilized by urban respondents. Whereas, rural respondents recognized availability of specialized doctors (24 percent), all diagnostic tests under one roof (21 percent) and best ancillary care (13 percent) as the top three reasons for the choice of health facility utilized.

The inpatient cost of diabetes by socio-demographic characteristics in rural and urban Punjab highlights that mean direct and indirect inpatient cost of urban male respondents were high as compared to female respondents. Whereas, direct and indirect inpatient cost of rural female respondents was highest as compared to male respondents in Punjab. The results of the analysis revealed that respondents of age 60 years and above incurred the highest mean direct inpatient cost of diabetes in both urban (₹46837) and rural (₹46832) Punjab. The results of the study revealed that urban respondents with others level of education incurred the highest direct (₹71571) and indirect inpatient (₹7100) cost of diabetes. But, in rural area it was found that illiterate respondents incurred highest mean direct (₹71571) and indirect inpatient (₹7014) cost of diabetes as compared to literate respondents. Respondents with business incurred the highest mean direct (₹61087) and indirect inpatient cost (₹6275). It was found that retired respondents incurred the highest mean direct (₹57087) and indirect (₹3929) inpatient cost followed by businessman, others, homemaker and students. The result of the analysis revealed that urban respondents with income of ₹60,000 and above incurred the highest mean direct (₹60570) and indirect (₹7547) inpatient cost of diabetes. Further, it was found that both urban and rural respondents of Punjab with the history of diabetes in family incurred the highest direct and indirect inpatient cost of diabetes as compared to respondents with no history of diabetes. Respondents with complications incurred higher direct and indirect inpatient costs in both rural and urban areas of Punjab.

Mann Whitney U test exhibit that a significant difference exists on the basis of gender and complications for direct and indirect outpatient cost in urban and rural Punjab with p-value < 0.05. Kruskal Wallis test revealed that a statistically significant difference exists on the basis of work status, income and household size for direct inpatient cost in urban area. However, in rural area the analysis of Kruskal Wallis test exhibit that there exists a significant difference in direct outpatient cost on the basis of age and income. Under indirect outpatient cost a significant difference in cost was observed on the basis of work status only.

Coping strategies of diabetes mellitus in rural and urban Punjab was categorized in three segments. It was found that large proportion of urban (39 percent) and rural (37 percent) respondents utilized "*buying part of medicines to cope with diabetes*" as the

foremost behaviour-based coping strategy followed by "*Intra-household labor substitution to compensate for any labor loss*" and "*Consuming less of food items to meet healthcare expenditure on diabetes*". The result of the analysis revealed that 76 percent urban and 72 percent rural respondents strongly agreed "*mobilizing the available cash in hand*" as the primary asset-based coping strategy followed by "*using past savings to meet the healthcare expenses of diabetes*" and "*mortgage productive assets to cope with diabetes*". Finally, the results of the study revealed that 35 percent of the urban respondents and 45 percent of the rural respondents utilize "*seeking help from relatives to cope up with diabetes*" as a primary assistance-based coping strategy.

The findings of the present study emphasize upon economic burden of diabetes in Punjab and cost variations in different segments. The result exhibits that respondents with high level of income incurred three times higher cost of diabetes as compared to respondents with income less than ₹15000. Similarly, respondents below 20 years of age witnessed 1.5 times higher outpatient cost as compared to old age respondents. Expenditure on medicines reports highest cost proportion as compared to other cost components. Presence of both micro and microvascular complications such as retinopathy, coronary artery disease, peripheral vascular disease and tooth infections substantially predicts direct and indirect cost of diabetes. Diabetics with macrovascular complications incurred two times higher direct cost burden as compared to the diabetics with no comorbidity. Under inpatient care, old age respondents with comorbidities incurred 2.5 times higher cost of treatment as compared to young respondents in Punjab. To reduce the economic burden of diabetes, the present study suggests that primarily the onset of diabetes and its associated complications should be delayed. Secondly, prompt diagnosis of all vital organs should be done to prevent any physical and financial loss. As monetary protection measure medicines should be made available at subsidized rates at all government hospitals and primary healthcare centers (PHC) through "*Jan Aushadhi Kendra*". Thus, the economic burden of diabetes could be restrained by formulating new health policies, reimbursing the outpatient cost under the '*Ayushman Bharat-Sarbat Sehat Bima Yojana'* and promoting the use of generic medicines.

CHAPTER VII

CATASTROPHIC HEALTHCARE EXPENDITURE OF DIABETES AMONG HOUSEHOLDS IN PUNJAB

With the rising epidemiological conditions, the cost of treating and managing diabetes is on upsurge. In 2019, diabetes alone engendered healthcare expenditure of US$760 billion and 79 percent of the diagnosed individuals are the natives of low and middle-income economies. The healthcare system in such economies are not endowed to handle the swiftly rising economic burden of diabetes. According to International Diabetes Federation (2015), "*Diabetes impacts disproportionately on those who are older and socially and economically vulnerable*". Considering the fact, epidemiological alteration of diabetes mellitus has an enormous economic burden.

According to Xu et al. (2003, pp. 3), "*Catastrophic healthcare expenditure refers to situations where households make OOP payments for healthcare above a reasonable proportion of their income*". The major consequence of catastrophic healthcare expenditure (CHE) is reduced spending on essentials such as food, clothing, housing, etc. Ghosh (2011) concluded that, "*Out-of-pocket (OOP) spending's are the primary source of healthcare finance in the majority of developed and developing Asian economies and India is no exception*".

Thus, the present chapter estimates the incidence and intensity of out-of-pocket (OOP) payments and identifies the key determinants of catastrophic health expenditure (CHE) in Punjab. The chapter has been divided into three sections. Section I of the chapter estimates the catastrophic healthcare expenditure (CHE) of diabetes at the household level in Punjab. Section II discusses the rural-urban comparison of the catastrophic healthcare expenditure (CHE) of diabetes. Lastly, Section III highlights the summary and conclusion.

SECTION I

7.1 CATASTROPHIC HEALTHCARE EXPENDITURE OF DIABETES IN PUNJAB

7.1.1. Incidence and Intensity of Catastrophic Healthcare Expenditure (CHE) for Outpatient Care in Punjab.

Table 7.1.1 shows that incidence (Headcount) of catastrophic health expenditure (CHE) for outpatient care of diabetic respondents without complications was 74.17 followed by 38.83, 9.54 percent and 2.63 percent at 5 percent, 10 percent, 20 percent and 30 percent threshold level. The intensity (Overshoot) of catastrophe for the diabetic respondents without complications at 5 percent threshold level was 5.97 percent. It was found that on an average respondents spend 5.97 percent beyond the 10 percent catastrophic threshold level. Further, the intensity of catastrophic health expenditure for diabetic respondents without complications was 3.04 percent at 10 percent, 0.81 percent at 20 percent and 0.22 percent at 30 percent catastrophic threshold level. Lastly, the intensity (Mean Positive Overshoot) of outpatient care was highest at 20 percent and lowest at 10 percent.

The incidence of outpatient catastrophic health expenditure of diabetic respondents with complications was 85.37 percent, 65.71 percent, 17.21 percent and 06.71 percent at 5 percent, 10 percent, 20 percent and 30 percent threshold levels. The intensity (Overshoot) of catastrophic health expenditure was highest at 5 percent threshold level for respondents with associated complications. It was found that on an average respondents spend 8.96 percent beyond the 5 percent catastrophic threshold level. Similarly, the intensity (Overshoot) of catastrophic expenditure was lowest at the 20 percent threshold level. The mean positive overshoot (MPO) of outpatient care among respondents with complications was lowest at 10 percent and highest at 30 percent. Thus, an average outpatient respondent with complications spent 41.20 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

The result of analysis highlighted that the incidence of outpatient catastrophic healthcare expenditure for overall respondents in Punjab was 80.56 percent followed by 50.97 percent, 14.03 percent and 5 percent at 5 percent, 10 percent, 20 percent and 30 percent catastrophic threshold levels. The intensity (Overshoot) of catastrophic expenditure was highest at 5 percent threshold level and lowest at the 30 percent threshold level. Lastly, the intensity (MPO) of outpatient care was highest at 30 percent that is an average respondent spends 10.58 percent beyond the 30 percent catastrophic threshold level or respondents spent 40.58 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent threshold level (Table 7.1.1).

Table: 7.1.1 Incidence and Intensity of Catastrophic Healthcare Expenditure for Outpatient Care in Punjab

Measures of Catastrophic Healthcare Expenditure (CHE)		**Threshold level to measure catastrophic healthcare expenditure (CHE)**			
		05%	**10%**	**20%**	**30%**
Without Complications	Headcount (%)	74.17	38.82	09.54	02.63
	Overshoot (%)	05.97	03.04	0.810	0.22
	Mean Positive Overshoot (%)	08.05	07.83	08.52	08.38
With Complications	Headcount (%)	85.37	65.71	17.27	6.71
	Overshoot (%)	08.96	05.25	01.80	0.75
	Mean Positive Overshoot (%)	10.49	08.01	10.40	11.20
Overall	Headcount (%)	80.56	50.97	14.03	05.00
	Overshoot (%)	07.77	04.32	01.38	0.53
	Mean Positive Overshoot (%)	09.65	08.48	09.87	10.58

Source: Authors calculation established on primary data.

7.1.2. Incidence and Intensity of Catastrophic Healthcare Expenditure (CHE) for Inpatient Care in Punjab.

Table 7.1.2 revealed that incidence of inpatient catastrophic healthcare expenditure of the diabetic respondents without complications was 53.85 percent followed by 38.46 and 20.51 percent at 5 percent, 10 percent and 20 percent threshold level. The incidence (Headcount) of catastrophic healthcare expenditure was observed to be Zero percent at 30 percent threshold level. Further, the intensity (Overshoot) of catastrophe for the diabetic respondents without complications was highest at 5 percent threshold level. It was observed that an average respondent spends 5.41 percent beyond the 5 percent catastrophic threshold level. Moreover, the intensity (MPO) of inpatient care was 10.05 percent, 08 percent and 1.50 percent at 5 percent, 10 percent and 20 percent catastrophic threshold level. Therefore, in simple words an average diabetic patient without complications spent an average of 15.05 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 5 percent catastrophic threshold level.

The incidence of inpatient catastrophic healthcare expenditure of the diabetic respondents with complications was 69.09 percent, 41.82 percent, 21.82 percent and 9.70 percent at 5 percent, 10 percent, 20 percent and 30 percent threshold levels. The intensity (Overshoot) of catastrophic expenditure was highest at 5 percent threshold level for diabetic respondents with complications. Moreover, the intensity (Overshoot) of catastrophic expenditure was lowest at the 30 percent threshold level. The mean positive overshoot of inpatient care among diabetic respondents with complications was lowest at 5 percent threshold level. Respondents with complications faced catastrophe at 30 percent threshold level spent an average of 21.56 percent beyond the threshold level. Therefore, respondents with complications spent an average of 51.56 percent of their income on out-of-pocket (OOP) payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

Further, it was found that the incidence of the inpatient catastrophic healthcare expenditure for diabetic respondents in Punjab was 66.18 percent, 41.67 percent, 22.06 percent and 08.33 percent at 5 percent, 10 percent, 20 percent and 30 percent catastrophic threshold levels. The intensity (Overshoot) of catastrophic expenditure was highest at 5 percent threshold level and lowest at 30 percent threshold level. Lastly, the

intensity (MPO) of outpatient care was utmost at 30 percent that is an average respondent spends 20.29 percent beyond the 30 percent catastrophic threshold level.

Table: 7.1.2 Incidence and Intensity of Catastrophic Healthcare Expenditure for Inpatient Care in Punjab

Measures of Catastrophic Healthcare Expenditure (CHE)		Threshold level to measure catastrophic healthcare expenditure (CHE)			
		5%	10%	20%	30%
Without Complications	Headcount (%)	53.85	38.46	20.51	-
	Overshoot (%)	05.41	03.08	0.31	-
	Mean Positive Overshoot (%)	10.05	08.00	01.50	-
With Complications	Headcount (%)	69.09	41.82	21.82	9.70
	Overshoot (%)	09.38	6.65	03.67	02.09
	Mean Positive Overshoot (%)	13.58	15.91	16.83	21.56
Overall	Headcount (%)	66.18	41.67	22.06	8.33
	Overshoot (%)	08.62	05.97	03.03	01.69
	Mean Positive Overshoot (%)	13.03	14.33	13.76	20.29

Source: Author calculation based on primary data.

7.1.3. Determinants of Catastrophic Healthcare Expenditure (CHE) of Diabetes in Punjab.

The key determinants of catastrophic healthcare expenditure (CHE) of diabetic respondents were identified by performing logistic model (Table 7.1.3). Based on the "*Omnibus Test of Model*" the value of 0.000 exhibits model to be significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as $p = 0.845$. At 5 percent threshold level region ($p = 0.019$), gender ($p = 0.046$), age 21-40 years ($p = 0.034$), others work status ($p = 0.020$), income ₹15,000- ₹30,000 ($p = 0.045$) and complications ($p = 0.000$) witnessed significant association with catastrophic healthcare expenditure (CHE). As shown in the table the probability of incurring catastrophic health expenditure was less among urban respondents as compared to rural respondents. The odds of incurring catastrophic health expenditure

were two times more among male respondents (OR= 2.574) in Punjab. Similarly, the odds of incurring catastrophic health expenditure were two times high among respondents of age 21-40 years. The results of the analysis revealed that probability of catastrophic health expenditure (CHE) was three times more among respondents with others as compared businessman, students, salaried, etc. The result of analysis shows that respondents under low income group were at higher probability of incurring catastrophic health expenditure. Lastly, the respondents with complications of diabetes were less likely to experience catastrophic health expenditure.

The results revealed that at 10 percent threshold level region (p = 0.027), age 60 years and above (p = 0.036), homemaker (p = 0.022), income ₹15,000- ₹30,000 (p = 0.000), income ₹30,000- ₹45,000 (p = 0.001), income ₹45,000 - ₹60,000 (p = 0.027) and complications (p = 0.000) observed a significant relationship with catastrophic healthcare expenditure (CHE). It was found that odds of incurring catastrophic health expenditure was less among urban respondents (OR = 0.647). Whereas, the probability of incurring catastrophic health expenditure was high among old age respondents as compared to young respondents in Punjab. The odds of incurring catastrophic health expenditure (CHE) was thirteen times more among homemakers as compared to businessman, students, retired and others. At 10 percent threshold level the probability of incurring catastrophic health expenditure was high among respondents with low income level. Respondents with income ₹15,000- ₹30,000 were three times more likely to experience catastrophic health expenditure as compared to respondents with income ₹60,000 and above. The odds of incurring catastrophic expenditure was less among respondents with complication of diabetes (OR = 0.417). Based on the "*Omnibus Test of Model*" the value of 0.000 exhibits model to be significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as p = 0.620.

The results of logistic regression analysis revealed that at 20 percent threshold level region (p = 0.029), gender (p = 0.015), homemaker (p = 0.002), income ₹15,000- ₹30,000 (p = 0.000), income ₹30,000- ₹45,000 (p = 0.004), income ₹45,000 - ₹60,000 (p= 0.021) and complications (p= 0.008) observed a significant association with catastrophic healthcare expenditure. The results exhibit that probability of experiencing catastrophic health expenditure was high among rural respondents as compared to

urban respondents (OR = 0.529). At 20 percent threshold level male respondents were twice likely to experience higher catastrophic health expenditure. The probability of incurring catastrophic healthcare expenditure was 15 times more among homemakers. Whereas, retired respondents were least likely to experience catastrophic healthcare expenditure (OR = 0.470). The results of the analysis revealed that respondents with low income group experience the highest catastrophic healthcare expenditure at 20 percent threshold level. Respondents with monthly income of ₹15,000- ₹30,000 were 9 times likely to incur catastrophic health expenditure as compared to those in high income group. Complications was witnessed as a significant determinant but the odds of incurring catastrophic health expenditure was low among respondents (OR = 0.495). It was found that family type was not a significant determinant at 20 percent threshold level but irrespective of result the probability of incurring catastrophic healthcare expenditure was highest among joint family type respondents (OR = 1.333).

Based on the "*Omnibus Test of Model*" the value of 0.000 displays model to be significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as $p = 0.195$. Finally, the model at 20 percent threshold level explained 20.9 percent of the variance in catastrophic healthcare expenditure (CHE) of diabetic respondents.

Table: 7.1.3 Determinants of Catastrophic Healthcare Expenditure of Diabetes in Punjab

Socio-Demographic Variables	Threshold Level to Measure Catastrophic Health Expenditure (CHE)					
	5%		10%		20%	
	Odd Ratios (OR)	p-value	Odd Ratios (OR)	p-value	Odd Ratios (OR)	p-value
Region (Rural)						
Urban	0.572	0.019*	0.647	0.027**	0.529	0.029***
Gender (Females)						
Male	2.574	0.046*	1.197	0.572	2.551	0.015***
Age (Below 20 years)						
21- 40 years	3.379	1	1.344	0.826	0.489	0.453
41- 60 years	2.771	0.034*	1.647	0.125	0.716	0.509
60 years and above	0.989	0.960	1.490	0.036**	0.643	0.114
Marital Status (Married)						
Single	0.502	0.112	1.000	0.998	1.148	0.788
Education (Illiterate)						
Primary	1.212	0.875	0.150	0.108	0.614	0.703
Secondary	0.635	0.690	0.185	0.135	0.657	0.723
Graduation	0.981	0.987	0.160	0.103	0.751	0.807
Post-Graduation	0.907	0.931	0.187	0.135	0.586	0.648
Others	2.075	0.569	0.227	0.202	0.310	0.384
Work Status (Salaried)						
Business	1.759	0.274	1.966	0.107	0.967	0.957
Student	1.379	0.409	1.047	0.894	0.857	0.765
Homemaker	0.714	0.999	13.441	0.022**	15.413	0.002***
Retired	0.958	0.943	1.096	0.834	0.470	0.205
Others	3.561	0.020*	1.699	0.221	0.986	0.983

Income (Less than ₹15,000)						
₹ 15,000- ₹ 30,000	2.448	0.045*	3.939	0.000**	9.164	0.000***
₹ 30,000- ₹ 45,000	1.998	0.055	2.463	0.001**	4.824	0.004***
₹ 45,000 - ₹ 60,000	1.079	0.829	1.876	0.027**	3.513	0.021***
₹ 60,000 and above	0.922	0.827	1.235	0.485	1.458	0.545
Family Type (Nuclear)						
Joint	1.213	0.443	1.154	0.476	1.333	0.349
History of Diabetes (No)						
Yes	0.935	0.748	0.874	0.426	0.856	0.536
Complications (No)						
Yes	0.461	0.000*	0.417	0.000**	0.495	0.008***
Household Size (Upto 3 Members)						
4-6 Members	0.711	0.440	1.399	0.349	1.82	0.223
6 Members and above	0.999	0.997	0.949	0.815	0.973	0.937
Model Summary						
Omnibus Test of Model	Sig. = 0.000		Sig. = 0.000		Sig. = 0.000	
Hosmer & Lemeshow Test	Chi-Square = 4.137; Sig.= 0.845		Chi-Square = 6.246; Sig.= 0.620		Chi-Square = 11.125; Sig.= 0.195	
Nagelkerke (R^2)	0.162		0.168		0.209	

Source: Authors calculation established on primary data.

Note: * Significant at 5 percent threshold level

** Significant at 10 percent threshold level

*** Significant at 20 percent threshold level

SECTION II

7.2 CATASTROPHIC HEALTHCARE EXPENDITURE OF DIABETES IN RURAL AND URBAN PUNJAB

7.2.1. A Rural-Urban Comparison of Incidence and Intensity of Catastrophic Healthcare Expenditure (CHE) for Outpatient Care.

Table 7.2.1 compared the incidence (Headcount) and intensity (Overshoot & Mean Positive Overshoot) of catastrophic healthcare expenditure for outpatient care among rural and urban respondents of Punjab. Urban respondents without complications experienced a greater incidence of catastrophic healthcare expenditure for outpatient care as compared to rural respondents. The incidence of both urban and rural respondents without complications was highest at 5 percent threshold level and lowest at 30 percent threshold level. The intensity (Overshoot) of catastrophic healthcare expenditure for outpatient care was 6.23 percent among the urban respondents and 5.51 percent for rural respondents at 5 percent catastrophic threshold level. The intensity (MPO) of catastrophic healthcare expenditure for outpatient care was highest among rural respondents at 20 percent threshold levels. Whereas, the intensity of outpatient care among urban respondents without complication was highest at 30 percent threshold level.

The incidence of catastrophic healthcare expenditure for outpatient care among urban (82.46 percent) and rural respondents (80.15 percent) with complications was highest at 5 percent catastrophic threshold level. Similarly, the intensity (Overshoot) of catastrophic healthcare expenditure for both urban and rural respondents with complications was highest at 5 percent threshold level. It was found that an average urban respondent spends 9.24 percent and rural respondent spends 8.18 percent beyond the 5 percent catastrophic threshold level. The intensity (MPO) of catastrophic healthcare expenditure for outpatient care was highest among urban respondents at 30 percent threshold level. Whereas, the intensity of outpatient care among rural respondents with complications was highest at 5 percent threshold level. Thus, an average rural respondent with complications spends 15.21 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 5 percent catastrophic threshold level.

The overall incidence of catastrophic healthcare expenditure for outpatient care among urban respondents was 81.25 percent and 76.25 percent for rural respondents at 5 percent threshold levels. Moreover, the intensity (Overshoot) of catastrophic healthcare expenditure for urban respondents was greater than rural respondents at 5 percent threshold level. It was observed that on an average urban respondents spends 8.01 percent beyond the 5 percent catastrophic threshold level as compared to 6.97 percent by rural respondents. Lastly, the overall intensity (MPO) of outpatient care among rural respondents was highest at 5 percent threshold levels. The overall intensity of catastrophic healthcare expenditure for outpatient care was highest among urban respondents at 30 percent threshold level. Hence, an average urban respondent spends 43.04 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

Table: 7.2.1 Incidence and Intensity of Catastrophic Healthcare Expenditure (CHE) for Outpatient Care in Rural and Urban Punjab

Measures of Catastrophic Healthcare Expenditure (CHE)		Threshold level to measure catastrophic health expenditure (CHE)				Threshold level to measure catastrophic health expenditure (CHE)			
		Urban				Rural			
		05%	10%	20%	30%	05%	10%	20%	30%
Without Complications	Headcount (%)	75.38	40.51	11.28	02.56	70.64	37.61	6.42	2.75
	Overshoot (%)	06.23	03.22	01.04	0.22	5.51	2.72	0.59	0.23
	Mean Positive Overshoot (%)	08.27	07.94	08.32	08.40	7.79	7.24	9.14	8.33
With Complications	Headcount (%)	82.46	61.05	17.19	06.67	80.15	54.96	16.79	6.11
	Overshoot (%)	09.24	05.46	02.05	0.95	8.18	4.82	1.27	0.33
	Mean Positive Overshoot (%)	11.20	08.94	11.92	14.26	10.21	8.78	7.55	5.38
Overall	Headcount (%)	81.25	52.71	14.79	05.00	76.25	47.08	12.08	4.58
	Overshoot (%)	08.01	04.55	01.60	0.65	6.97	3.87	0.95	0.28
	Mean Positive Overshoot (%)	09.86	08.63	10.80	13.04	9.14	8.22	7.90	6.18

Source: Author calculation based on primary data.

7.2.2. A Rural-Urban Comparison of Incidence and Intensity of Catastrophic Healthcare Expenditure (CHE) for Inpatient Care

Table 7.2.2 highlighted that rural respondents without complications experienced a greater incidence (Headcount) of catastrophic healthcare expenditure for inpatient care as compared to urban respondents at 5 percent, 10 percent and 20 percent threshold levels. Similarly, the intensity (Overshoot & Mean Positive Overshoot) of catastrophic healthcare expenditure for inpatient care was also greater among rural respondents as compared to urban respondents. It was found that on an average rural respondents without complications spent 16.03 percent, 19.50 percent and 30.43 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 5 percent, 10 percent and 20 percent catastrophic threshold level.

Further, the analysis revealed that urban respondents with complications experienced a greater incidence of catastrophic healthcare expenditure for inpatient care at 5 percent, 10 percent, 20 percent and 30 percent threshold levels as compared to rural respondents. The intensity (Overshoot & Mean Positive Overshoot) of catastrophic expenditure for inpatient care was found to be highest among rural respondents with complications as compared to urban respondents. The intensity (Overshoot) was highest at 5 percent threshold level, an average rural respondent with complications spends 10.29 percent beyond the 05 percent catastrophic threshold level. Furthermore, the mean positive overshoot of rural respondents with complications was observed to be highest at 30 percent threshold level. It was found that an average rural respondent with complication spends 62.18 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

The results highlighted that overall incidence of catastrophic healthcare expenditure for inpatient care among urban respondents was 66.67 percent and 65.15 percent for rural respondents at a 5 percent threshold levels. Whereas, the overall intensity (Overshoot) of catastrophic expenditure for inpatient care was 9.09 percent among rural respondents at 5 percent threshold level as compared to 8.30 percent in the urban area. The mean positive overshoot was highest among rural respondents at 30 percent threshold level i.e. an average rural respondent with complications spends 65.40 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

Table: 7.2.2. Incidence and Intensity of Catastrophic Healthcare Expenditure (CHE) for Inpatient Care in Rural and Urban Punjab

Measures of Catastrophic Healthcare Expenditure (CHE)		Threshold level to measure catastrophic health expenditure (CHE)				Threshold level to measure catastrophic health expenditure (CHE)			
		Urban				Rural			
		05%	10%	20%	30%	05%	10%	20%	30%
Without Complications	Headcount (%)	47.62	38.10	09.52	-	61.11	44.44	33.33	-
	Overshoot (%)	04.33	02.10	01.01	-	6.72	4.22	1.67	-
	Mean Positive Overshoot (%)	09.10	05.5	01.5	-	11.03	9.50	10.43	-
With Complications	Headcount (%)	70.09	45.30	22.22	09.40	66.67	33.33	20.83	11.46
	Overshoot (%)	09.01	06.18	03.05	01.44	10.29	7.81	5.19	3.69
	Mean Positive Overshoot (%)	12.85	13.64	13.73	15.27	15.44	23.44	24.90	32.18
Overall	Headcount (%)	66.67	44.20	20.29	07.97	65.15	34.85	24.24	7.58
	Overshoot (%)	08.30	05.56	02.60	01.22	9.09	6.83	3.92	2.68
	Mean Positive Overshoot (%)	12.45	12.57	12.82	15.27	13.95	19.61	16.19	35.40

Source: Author calculation based on primary data.

7.2.3. Determinants of Catastrophic Healthcare Expenditure (CHE) of Diabetes in Urban Punjab.

Table 7.2.3. exhibits that based on the "*Omnibus Test of Model*" the value of 0.000 shows model to be statistically significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as $p = 0.145$. At 5 percent of threshold level variables such as gender ($p = 0.015$), marital status ($p = 0.012$), homemaker ($p = 0.023$) and complications of diabetes ($p= 0.001$) observed a significant association with catastrophic healthcare expenditure in urban Punjab.

As shown in the table probability of incurring catastrophic healthcare expenditure was less among male respondents (OR= 0.058) as compared to female respondents in urban Punjab. The odds of incurring catastrophic healthcare expenditure was highest among respondents with age 21- 40 years (OR= 1.674). The results of analysis revealed that odds of experiencing catastrophic healthcare expenditure was 5 time more among single respondents as compared to married respondents. The result of analysis shows that respondents with low monthly income of ₹15,000- ₹30,000 were at highest probability of incurring catastrophic health expenditure (OR= 1.183). It was found that respondents with complications were twice likely to experience catastrophic health expenditure (OR= 2.525).

At 10 percent threshold level urban diabetics identified gender ($p = 0.008$), marital status ($p= 0.046$), income ₹15,000- ₹30,000 ($p= 0.049$), complications ($p = 0.000$) and household size of 4-6 members (0.047) witnessed a significant relationship with catastrophic healthcare expenditure (CHE). The logit model was statistically significant (sig.= 0.000) at 10 percent threshold level. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as $p = 0.337$.

The result of analysis revealed that at 10 percent threshold level male respondents are more likely to experience catastrophic healthcare expenditure (OR= 1.197). Marital status was observed as a significant determinant and the odds of incurring catastrophic healthcare expenditure was more among single respondents (OR= 1.868) as compared to married respondents. Irrespective of the results it was found that urban respondents with others level of education were 4 times more likely to experience catastrophic healthcare expenditure as compared to illiterates. Further, the result of analysis revealed that probability of incurring catastrophic healthcare expenditure was highest among low

income group respondents (OR= 1.228). Urban respondents with complications were two times more likely to experience catastrophic healthcare expenditure as compared to respondents with no complications. Household size of 4-6 members was witnessed as a significant determinant and the probability of incurring catastrophic healthcare expenditure was low among households having 4-6 family members (OR= 0.493).

The results of logistic regression exhibit that based on the "*Omnibus Test of Model*" the value of 0.000 reveals model to be significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as p = 0.516. At 20 percent catastrophic threshold level variables such as gender (p= 0.013), marital status (p = 0.038), income ₹15,000- ₹30,000 (p = 0.027), ₹30,000- ₹45,000 (p= 0.020), ₹45,000-₹60,000 (p= 0.003), ₹60,000 and above (p= 0.000) and history of diabetes (p = 0.048) witnessed a significant association with catastrophic healthcare expenditure in urban Punjab.

Further, the results revealed that at 20 percent threshold level odds of experiencing catastrophic healthcare expenditure was low among male respondents as compared to female respondents. Irrespective of the results old age respondents (OR= 1.695) were more likely to incur catastrophic healthcare at 20 percent catastrophic threshold level. Single respondents were twice likely to experience catastrophic healthcare expenditure as compared to married respondents in urban Punjab. The probability of incurring catastrophic healthcare expenditure was highest among students (OR= 1.803) and others (OR= 1.151). Income was observed as significant determinant at all levels, the odds of incurring catastrophic healthcare expenditure was highest among low income group respondents as compared to high income group respondents. History of diabetes was a significant determinant but the probability of incurring catastrophic healthcare expenditure was low among respondents with history of diabetes in their family (OR= 0.810).

Table 7.2.3: Determinants of Catastrophic Health Expenditure in Urban Punjab

Socio-Demographic Variables	Threshold Level to Measure Catastrophic Health Expenditure (CHE)					
	5%		10%		20%	
	Odd Ratios (OR)	p-value	Odd Ratios (OR)	p-value	Odd Ratios (OR)	p-value
Gender (Females)						
Male	0.058	0.015*	1.197	0.008**	0.333	0.013***
Age (Below 20 years)						
21- 40 years	1.674	0.515	0.888	0.830	0.732	0.693
41- 60 years	1.467	0.539	0.954	0.918	1.292	0.684
60 years and above	1.421	0.586	0.653	0.374	1.695	0.422
Marital Status (Married)						
Single	5.947	0.012*	1.868	0.046**	2.234	0.038***
Education (Illiterate)						
Primary	0.291	0.269	0.742	0.611	0.662	0.510
Secondary	0.298	0.274	0.674	0.498	0.579	0.394
Graduation	0.360	0.359	0.859	0.796	0.598	0.432
Post-Graduation	0.686	0.773	1.242	0.765	0.375	0.359
Others	0.434	0.999	4.425	0.223	2.272	0.406
Work Status (Salaried)						
Business	0.473	0.175	0.562	0.120	0.903	0.848
Student	0.552	0.560	0.925	0.895	1.803	0.366
Homemaker	0.055	0.023*	0.388	0.055	0.362	0.108
Retired	0.561	0.426	0.665	0.419	0.951	0.944
Others	0.277	0.165	0.527	0.357	1.151	0.866

Income (Less than ₹15,000)						
₹ 15,000- ₹ 30,000	1.183	0.751	1.228	0.049**	0.391	0.027***
₹ 30,000- ₹ 45,000	0.618	0.376	0.663	0.311	0.335	0.020***
₹ 45,000 - ₹ 60,000	0.614	0.388	0.634	0.283	0.192	0.003***
₹ 60,000 and above	0.845	0.776	0.493	0.104	0.077	0.000***
Family Type (Nuclear)						
Joint	0.970	0.924	1.075	0.767	0.982	0.960
History of Diabetes (No)						
Yes	0.738	0.271	0.838	0.392	0.810	0.048***
Complications (No)						
Yes	2.525	0.001*	2.421	0.000**	1.518	0.173
Household Size (Upto 3 Members)						
4-6 Members	0.516	0.228	0.493	0.047**	0.590	0.209
6 Members and above	0.494	0.276	0.625	0.293	0.808	0.712
Model Summary						
Omnibus Test of Model	Sig. = 0.000		Sig. = 0.000		Sig. = 0.000	
Hosmer & Lemeshow Test	Chi-Square = 12.15; Sig.= 0.145		Chi-Square = 9.064; Sig.= 0.337		Chi-Square = 7.192; Sig.= 0.516	
Nagelkerke (R^2)	0.194		0.174		0.216	

Source: Authors calculation established on primary data.

Note: * Significant at 5 percent threshold level

** Significant at 10 percent threshold level

*** Significant at 20 percent threshold level

7.2.4. Determinants of Catastrophic Healthcare Expenditure (CHE) of Diabetes in Rural Punjab.

The key determinants of catastrophic healthcare expenditure of diabetes in rural Punjab were identified using logistic model (Table 7.2.4). Based on the "*Omnibus Test of Model*" the value of 0.000 reveals model to be significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as $p = 0.176$. At 5 percent threshold level income ₹30,000- ₹45,000 ($p = 0.017$), income ₹60,000 and above ($p = 0.005$), history of diabetes ($p = 0.029$), household size of 4-6 members ($p = 0.009$) and household size of 6 members & above ($p = 0.027$) observed a significant association with catastrophic healthcare expenditure.

The analysis revealed that odds of incurring catastrophic healthcare expenditure was low among male respondents (OR= 0.504). Irrespective of the results respondents of age 21-40 years were 13 times more likely to experience catastrophic healthcare expenditure as compared to old age respondents in rural Punjab. The probability of incurring catastrophic healthcare expenditure was high among businessman and homemakers as compared to students, retired and others. Respondents with income ₹30,000-₹45,000 and ₹60,000 and above were observed significant determinants but the odds of incurring catastrophic healthcare expenditure was low among high income group respondents. At 5 percent threshold level respondents with history of diabetes were twice likely to experience catastrophic healthcare expenditure (OR= 2.417). Finally, households with 4-6 members (OR= 6.204) and 6 members and above (OR= 6.855) were 6 times more likely to incur catastrophic healthcare expenditure.

At 10 percent catastrophic threshold level income ₹15,000- ₹ 30,000 ($p = 0.001$), ₹45,000 - ₹60,000 ($p = 0.005$), ₹60,000 and above ($p= 0.026$), history of diabetes ($p = 0.025$) and complications ($p= 0.006$) witnessed significant association with catastrophic healthcare expenditure. The value of 0.000 of "*Omnibus test of model*" revealed model to be statistically significant. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as $p = 0.832$.

The results of logistic regression revealed that male respondents were twice likely to experience catastrophic healthcare expenditure (OR= 2.939) as compared to female respondents. Moreover, the probability of incurring catastrophic healthcare expenditure was high among single respondents (OR= 1.095). At 10 percent threshold level

homemakers and retired respondents were most likely to experience catastrophic healthcare expenditure. Respondents with highest income group ₹60,000 and above were least likely to incur catastrophic healthcare expenditure (OR= 0.058). The results of analysis revealed that respondents with history of diabetes were twice likely to experience catastrophic healthcare expenditure as compared to respondents with no history of diabetes in their families. Lastly, the respondents with complications were two times more likely to incur catastrophic healthcare expenditure (OR= 2.489).

The logistic regression exhibits that at 20 percent catastrophic threshold level homemakers (p = 0.011), history of diabetes (p = 0.029) and complications (p = 0.036) were determined as the key predictors of catastrophic healthcare expenditure. The results of "*Omnibus Test of Model*" revealed that model was statistically significant at 20 percent with sig. value of 0.000. Hosmer and Lemeshow test of the goodness of fit suggests that the model is a good fit to the data as p = 0.134.

The results of analysis revealed that male respondents were less likely to incur catastrophic healthcare expenditure as compared to female respondents. Irrespective of the results respondents with age 60 years and above were twice likely to experience catastrophic healthcare expenditure (OR= 2.761). Marital status was not a significant determinant but single respondents were three times more likely (OR= 3.341) to experience catastrophic healthcare expenditure as compared to married respondents. At 20 percent threshold level the probability of incurring catastrophic health expenditure was highest among students followed by homemakers and retired. It was found that respondents with history of diabetes were 4 times more likely to experience catastrophic healthcare expenditure. The results of the analysis revealed that respondents with complications were three times more likely to incur catastrophic healthcare expenditure (OR= 3.783) as compared to respondents with no complications.

Table 7.2.4: Determinants of Catastrophic Health Expenditure in Rural Punjab

Socio-Demographic Variables	Threshold Level to Measure Catastrophic Healthcare Expenditure (CHE)					
	5%		10%		20%	
	Odd Ratios (OR)	p-value	Odd Ratios (OR)	p-value	Odd Ratios (OR)	p-value
Gender (Female)						
Male	0.504	0.380	2.939	0.111	0.928	0.949
Age (Below 20 years)						
21- 40 years	13.418	0.114	0.461	0.404	1.088	0.950
41- 60 years	0.326	0.321	0.58	0.499	1.585	0.678
60 years and above	0.421	0.451	0.278	0.125	2.761	0.354
Marital Status (Married)						
Single	0.768	0.745	1.095	0.886	3.341	0.190
Education (Illiterate)						
Primary	0.44	0.187	2.308	0.114	1.197	0.844
Secondary	1.392	0.613	2.255	0.141	2.016	0.450
Graduation	0.875	0.883	2.039	0.328	0.27	0.391
Work Status (Salaried)						
Business	1.936	0.491	0.582	0.463	0.475	0.599
Student	-	0.999	-	0.999	52.521	0.011***
Homemaker	1.692	0.642	2.195	0.391	1.468	0.816
Retired	8.688	0.061	1.736	0.519	1.051	0.975
Others	0.827	0.848	0.536	0.402	0.482	0.622
Income (Less than ₹15,000)						
₹ 15,000- ₹ 30,000	0.590	0.321	0.239	0.001**	0.989	0.986
₹ 30,000- ₹ 45,000	0.227	0.017*	0.384	0.052	0.436	0.322
₹ 45,000 - ₹ 60,000	0.323	0.138	0.134	0.005**	-	0.998
₹ 60,000 and above	0.010	0.005*	0.058	0.026**	2.230	0.576

Family Type (Nuclear)						
Joint	0.534	0.216	0.879	0.750	0.487	0.301
History of Diabetes (No)						
Yes	2.417	0.029*	2.108	0.025**	4.125	0.029***
Complications (No)						
Yes	0.920	0.837	2.489	0.006**	3.783	0.036***
Household Size (Upto 3 Members)						
4-6 Members	6.204	0.009*	0.966	0.955	0.330	0.293
6 Members and above	6.855	0.027*	0.803	0.768	0.361	0.428
Model Summary						
Omnibus Test of Model	Sig. = 0.000		Sig. = 0.000		Sig. = 0.000	
Hosmer & Lemeshow Test	Chi-Square = 11.483; Sig.= 0.176		Chi-Square = 4.273; Sig.= 0.832		Chi-Square = 12.403; Sig.= 0.134	
Nagelkerke (R^2)	0.364		0.297		0.382	

Source: Authors calculation established on primary data.

Note: * Significant at 5 percent threshold level

** Significant at 10 percent threshold level

*** Significant at 20 percent threshold level

SECTION III

7.3 SUMMARY AND CONCLUSION

With the rise of epidemiological conditions, the cost of treating and managing diabetes is on the upsurge. Out-of-pocket (OOP) payments by households for healthcare services such as inpatient and outpatient care lead to catastrophic health expenditure (CHE), pushing households toward impoverishment (Bredenkamp & Gragnolati, 2011; Li et al., 2012). Therefore, catastrophic healthcare expenditure is a situation where households make out-of-pocket payments for healthcare services exceeding a threshold level of their income.

Table 7.1.1 shows the incidence (Headcount) of catastrophic health expenditure for outpatient care of diabetic respondents without complications was 74.17 percent highest at 5 percent threshold levels. The intensity (Overshoot) of catastrophe for the diabetic respondents without complications at 05 percent threshold level was 05.97 percent that is on an average respondents spend 05.97 percent beyond the 10 percent catastrophic threshold level. Lastly, the intensity (MPO) of outpatient care was highest at 20 percent and lowest at 10 percent that is an average respondent spends 07.83 percent beyond the 10 percent catastrophic threshold level.

The incidence of outpatient catastrophic healthcare expenditure of the diabetic respondents with complications was 85.37 percent, 65.71 percent, 17.21 percent and 06.71 percent at 5 percent, 10 percent, 20 percent and 30 percent threshold levels. The intensity (Overshoot) of catastrophic health expenditure was highest at 5 percent threshold level for respondents with associated complications that is on an average respondents spend 08.96 percent beyond the 05 percent catastrophic threshold level. The mean positive overshoot (MPO) of outpatient care among respondents with complications was lowest at 10 percent and highest at 30 percent. Thus, an average outpatient respondent with complications spent 41.20 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

The results of table 7.1.1. revealed that the incidence of outpatient catastrophic healthcare expenditure for overall respondents in Punjab was 80.56 percent at 05 percent catastrophic threshold levels. The intensity (MPO) of outpatient care was highest at 30 percent i.e.an average respondent spends 10.58 percent beyond the 30

percent catastrophic threshold level or respondents spent 40.58 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent threshold level.

Table 7.1.2 reveals the incidence of inpatient catastrophic healthcare expenditure of the diabetic respondents without complications was 53.85 percent at 5 percent threshold levels. Further, the intensity (Overshoot) of catastrophe for the diabetic respondents without complications was highest at the 05 percent threshold level that is average respondents spend 05.41 percent beyond the 5 percent catastrophic threshold level. Moreover, the intensity (MPO) of inpatient care highlights an average diabetic patient without complications spent an average of 15.05 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 05 percent catastrophic threshold level.

The incidence of inpatient catastrophic healthcare expenditure of the diabetic respondents with complications was 69.09 percent at 05 percent. The intensity (Overshoot) of catastrophic expenditure was highest at 5 percent (09.38 percent) threshold level for diabetic respondents with complications that is on an average respondents spend 09.96 percent beyond the 05 percent catastrophic threshold level. The mean positive overshoot (MPO) of inpatient care among diabetic respondents with complications was lowest at the 05 percent (13.58 percent) threshold level.

The results of table 7.1.2. shows that the incidence of the inpatient catastrophic healthcare expenditure for diabetic respondents in Punjab was 66.18 percent, 41.67 percent, 22.06 percent and 08.33 percent. The intensity (Overshoot) of catastrophic expenditure was 08.62 percent highest at 5 percent threshold level and 01.69 percent lowest at 30 percent threshold level. Lastly, the intensity (MPO) of outpatient care was utmost at 30 percent that is an average respondent spends 20.29 percent beyond the 30 percent catastrophic threshold level.

The key determinants of catastrophic health expenditure of diabetic respondents were identified by performing logistic model (Table 7.1.3). At 5 percent threshold level region (p = 0.019), gender (p = 0.046), age 21-40 years (p = 0.034), others work status (p = 0.020), income ₹15,000- ₹30,000 (p = 0.045) and complications (p = 0.000) witnessed significant association with catastrophic healthcare expenditure. As shown in the table the probability of incurring catastrophic health expenditure was less among

urban respondents as compared to rural respondents. The odds of incurring catastrophic health expenditure was two times more among male respondents (OR= 2.574) in Punjab. The results of the analysis revealed that probability of catastrophic health expenditure was three times more among respondents with others. Lastly, the respondents with complications of diabetes were less likely to experience catastrophic health expenditure.

The results revealed that at 10 percent threshold level region (p = 0.027), age 60 years and above (p = 0.036), homemaker (p = 0.022), income ₹15,000- ₹30,000 (p = 0.000), income ₹30,000- ₹45,000 (p = 0.001), income ₹45,000 - ₹60,000 (p = 0.027) and complications (p = 0.000) observed a significant relationship with catastrophic healthcare expenditure. It was found that odds of incurring catastrophic health expenditure was less among urban respondents (OR = 0.647). Whereas, the probability of incurring catastrophic health expenditure was high among old age respondents. At 10 percent threshold level the probability of incurring catastrophic health expenditure was high among respondents with low income level. Respondents with income ₹15,000- ₹30,000 were three times more likely to experience catastrophic health expenditure as compared to respondents with income ₹60,000 and above.

The results of logistic regression revealed that at 20 percent threshold level region (p = 0.029), gender (p = 0.015), homemaker (p = 0.002), income ₹15,000- ₹30,000 (p = 0.000), income ₹30,000- ₹45,000 (p = 0.004), income ₹45,000 - ₹60,000 (p= 0.021) and complications (p= 0.008) observed a significant association with catastrophic healthcare expenditure. At 20 percent threshold level male respondents were twice likely to experience higher catastrophic health expenditure. The probability of incurring catastrophic healthcare expenditure was 15 times more among homemakers. Whereas, retired respondents were least likely to experience catastrophic healthcare expenditure (OR = 0.470). It was found that family type was not a significant determinant at 20 percent threshold level but irrespective of result the probability of incurring catastrophic healthcare expenditure was highest among joint family type respondents (OR = 1.333).

A rural-urban comparison of incidence and intensity of catastrophic healthcare expenditure for outpatient care was observed in table 7.2.1. Urban respondents without complications experienced a greater incidence of catastrophic healthcare expenditure

for outpatient care in comparison to rural respondents. The intensity (Overshoot) of catastrophic healthcare expenditure for outpatient care was 06.23 percent among urban respondents and 05.51 percent in rural respondents at 05 percent catastrophic threshold level. The intensity (MPO) of catastrophic healthcare expenditure for outpatient care was highest among rural and urban respondents at 20 percent and 30 percent threshold levels.

The incidence of catastrophic healthcare expenditure for outpatient care among urban (82.46 percent) and rural respondents (80.15 percent) with complications was highest at the 5 percent threshold level. The intensity (Overshoot) of catastrophic health expenditure for urban and rural respondents with complications was highest at 5 percent threshold level that is on an average urban respondent spends 09.24 percent and rural respondent spends 08.18 percent beyond the 05 percent catastrophic threshold level. The intensity (MPO) of outpatient care among rural respondents with complications was highest at 5 percent threshold levels. Thus an average rural respondent with complications spends 15.21 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 05 percent catastrophic threshold level.

The overall incidence of catastrophic healthcare expenditure for outpatient care among urban respondents was 81.25 percent and 76.25 percent for rural respondents at 5 percent threshold levels. Moreover, the intensity (Overshoot) of catastrophic healthcare expenditure for urban respondents was greater than rural respondents at 5 percent threshold level i.e. on average urban respondents spends 08.01 percent beyond the 05 percent catastrophic threshold level, as compared to 06.97 percent by rural respondents (Table 7.2.1). The overall intensity of catastrophic healthcare expenditure for outpatient care was highest among urban respondents at 20 percent and 30 percent threshold levels. Hence, an average urban respondent spends 43.04 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 30 percent catastrophic threshold level.

Table 7.2.2. exhibits a rural-urban comparison of incidence and intensity of catastrophic healthcare expenditure for inpatient care. Rural respondents without complications experienced a greater incidence of catastrophic healthcare expenditure for inpatient care in comparison to urban respondents at 5 percent, 10 percent and 20 percent threshold levels. Similarly, the intensity of catastrophic healthcare expenditure

for inpatient care was also greater among rural respondents as compared to urban respondents that is an average rural respondent without complications spends 16.03 percent, 19.50 percent and 30.43 percent of their income on out-of-pocket payments (threshold level + MPO) beyond the 5 percent, 10 percent and 20 percent catastrophic threshold level.

Urban respondents with complications experienced higher incidence of catastrophic healthcare expenditure for inpatient care at 5 percent, 10 percent, 20 percent and 30 percent threshold levels, in comparison to rural respondents (Table 7.2.2). The intensity (Overshoot) was highest at 5 percent threshold level that is an average rural respondent with complications spends 10.29 percent beyond the 05 percent catastrophic threshold level. Moreover, the mean positive overshoot of rural respondents with complications was highest at the 30 percent threshold level.

The overall incidence of catastrophic healthcare expenditure for inpatient care among urban respondents was 66.67 percent and 65.15 percent for rural respondents at 5 percent threshold levels. The overall intensity of catastrophic expenditure for inpatient care was highest among rural respondents at 5 percent, 10 percent, 20 percent and 30 percent catastrophic threshold level as compared to urban respondents (Table 7.2.2).

Table 7.2.3. shows that based on the "*Omnibus Test of Model*" the value of 0.000 displays model to be statistically significant. Hosmer and Lemeshow test of goodness of fit suggests that the model is a good fit to the data as $p = 0.145$. At 5 percent of threshold level variables such as gender ($p = 0.015$), marital status ($p = 0.012$), homemaker ($p = 0.023$) and complications of diabetes ($p= 0.001$) observed a significant association with catastrophic healthcare expenditure in urban Punjab. As shown in the table probability of incurring catastrophic healthcare expenditure was less among male respondents (OR= 0.058) as compared to female respondents in urban Punjab. The odds of incurring catastrophic healthcare expenditure was highest among respondents with age 21- 40 years (OR= 1.674). The result of analysis shows that respondents with low monthly income of ₹15,000- ₹30,000 were at highest probability of incurring catastrophic health expenditure (OR= 1.183).

At 10 percent threshold level urban diabetics identified gender ($p = 0.008$), marital status ($p= 0.046$), income ₹15,000- ₹30,000 ($p= 0.049$), complications ($p = 0.000$) and household size of 4-6 members (0.047) witnessed a significant relationship with

catastrophic healthcare expenditure. The result of analysis revealed that at 10 percent threshold level male respondents are more likely to experience catastrophic healthcare expenditure (OR= 1.197). Marital status was observed as a significant determinant and the odds of incurring catastrophic healthcare expenditure was more among single respondents (OR= 1.868) as compared to married respondents. Irrespective of the results it was found that urban respondents with others level of education were 4 times more likely to experience catastrophic healthcare expenditure as compared to illiterates. The probability of incurring catastrophic healthcare expenditure was low among households having 4-6 family members (OR= 0.493).

The results revealed that at 20 percent threshold level odds of experiencing catastrophic healthcare expenditure was low among male respondents as compared to female respondents. Irrespective of the results old age respondents (OR= 1.695) were more likely to incur catastrophic healthcare at 20 percent catastrophic threshold level. Single respondents were twice likely to experience catastrophic healthcare expenditure as compared to married respondents in urban Punjab. the odds of incurring catastrophic healthcare expenditure were highest among low income group respondents as compared to high income group respondents. History of diabetes was a significant determinant but the probability of incurring catastrophic healthcare expenditure was low among respondents with history of diabetes in their family (OR= 0.810).

The key determinants of catastrophic healthcare expenditure of diabetes in rural Punjab were identified using logistic model (Table 7.2.4). At 5 percent threshold level income ₹30,000- ₹45,000 (p = 0.017), income ₹60,000 and above (p = 0.005), history of diabetes (p = 0.029), household size of 4-6 members (p = 0.009) and household size of 6 members & above (p = 0.027) observed a significant association with catastrophic healthcare expenditure. The analysis revealed that odds of incurring catastrophic healthcare expenditure was low among male respondents (OR= 0.504). Irrespective of the results respondents of age 21-40 years were 13 times more likely to experience catastrophic healthcare expenditure as compared to old age respondents in rural Punjab. The probability of incurring catastrophic healthcare expenditure was high among businessman and homemakers as compared to students, retired and others. At 5 percent threshold level respondents with history of diabetes were twice likely to experience catastrophic healthcare expenditure (OR= 2.417). Finally, households with 4-6

members (OR= 6.204) and 6 members and above (OR= 6.855) were 6 times more likely to incur catastrophic healthcare expenditure.

At 10 percent catastrophic threshold level income ₹15,000- ₹ 30,000 (p = 0.001), ₹45,000 - ₹60,000 (p = 0.005), ₹60,000 and above (p= 0.026), history of diabetes (p = 0.025) and complications (p= 0.006) witnessed significant association with catastrophic healthcare expenditure. The results of logistic regression analysis revealed that male respondents were twice likely to experience catastrophic healthcare expenditure (OR= 2.939) as compared to female respondents. Moreover, the probability of incurring catastrophic healthcare expenditure was high among single respondents (OR= 1.095). Respondents with highest income group ₹60,000 and above were least likely to incur catastrophic healthcare expenditure (OR= 0.058). The results of analysis revealed that respondents with history of diabetes were twice likely to experience catastrophic healthcare expenditure as compared to respondents with no history of diabetes in their families.

The logistic regression exhibits that at 20 percent catastrophic threshold level homemakers (p = 0.011), history of diabetes (p = 0.029) and complications (p = 0.036) were determined as the key predictors of catastrophic healthcare expenditure. The results of analysis revealed that male respondents were less likely to incur catastrophic healthcare expenditure as compared to female respondents. Irrespective of the results respondents with age 60 years and above were twice likely to experience catastrophic healthcare expenditure (OR= 2.761). Marital status was not a significant determinant but single respondents were three times more likely (OR= 3.341) to experience catastrophic healthcare expenditure as compared to married respondents. Respondents with complications were three times more likely to incur catastrophic expenditure.

The findings of the present study shows that majority of diabetic respondents in Punjab make out-of-pocket payments for outpatient and inpatient care. It was witnessed that diabetic respondents preferred private hospitals over government hospitals for healthcare services. As a consequence, a large proportion of household's incur financial catastrophe at different threshold levels. To cope with the catastrophic out of pocket expenditures a large number of diabetic respondents mobilize cash or utilize savings but some respondents have to resort for borrowing or seek financial assistance. The analysis revealed that socio-economic variables *viz.* region, gender, age, work status,

income and complications were significantly associated with catastrophic healthcare expenditure in Punjab. Hence, it is imperative to provide financial protection to the diabetic respondents having low socio-economic status in Punjab. The results of the study suggest that prevailing government health insurance scheme "*Ayushman Bharat-Sarbat Sehat Bima Yojana*" must include outpatient and diagnostic charges incurred by diabetics in Punjab. Respondents with type-1 diabetes (insulin dependent) must be covered under health insurance benefits. Lastly, respondents diagnosed and being treated for diabetes mellitus for more than 10 years should be covered under health insurance schemes. Therefore, policymakers must design equitable health financing measure that will reduce the economic burden of individuals/households in Punjab.

CHAPTER VIII

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

Globally, diabetes is recognized as a chronic disease that does not consider any ethnic background and monetary level. Diabetes touches individuals at the beginning of their productive age, impoverishes households and reduces life expectancy (International Diabetes Federation, 2017). Diabetes mellitus is an obtrusive universal health emergency for both developing and developed nations and has been designated with the status of public health priority (Zimmet *et al.,* 2001). It is one of the leading cause of morbidity and mortality worldwide. According to Pradeepa and Mohan (2021) diabetes is the eighth leading cause of mortality and it accounts 1.6 million deaths globally. Therefore, diabetes has emerged as a major cause of mortality among individuals younger than 60 years of age. In 2019, the global assessment of adults living with diabetes was 463 million (20-79 years), which is expected to be 700 million by 2045 (International Diabetes Federation, 2019).

According to the International Diabetes Federation (2019), "*India is the epicenter of diabetes and accounts for the second-largest populace of 73 million diabetic patients after China and the figure is expected to be 134 million by 2045*". Considering the fact, the epidemiological transition of diabetes has a huge economic burden (Cho *et al.,* 2018). Over the past three decades, specifically since the economic reforms of 1991, lifestyle modification of an average Indian has undergone a drastic change (Ramachandran, 2007). Diabetes alone depletes 5 to 25 percent share of an average Indian household earning (Yesudian *et al.,* 2014; Holla *et al.,* 2014; Kansra, 2018). Despite the economic turnaround in India, public health spending remains to be lowest in the world. The healthcare spending in India is merely 1.4 percent of the GDP of which the budget for treating and managing diabetes is a small portion (World Health Organization, 2016).

Understanding the provision, utilization of healthcare services and determinants of catastrophic healthcare expenditure is a difficult task, especially when the healthcare sector is diverse. Thus, chronic nature and the rising epidemic of diabetes mellitus have everlasting consequences on the economy and health status of the nation. Therefore, managing diabetes and its comorbidities is a massive challenge in Punjab due to several issues such as the dearth of awareness regarding diabetes mellitus, its associated risk

factors, prevention strategies and health care system.

8.1 Rationale of the Study

India has emerged to become the "*Diabetes Capital*" of the world after China, with an estimated 65 million patients aged 20 years and above (Guariguata et al., 2014; Tripathy et al., 2017). The number of diabetic patients in India is expected to be 109 million by 2035 (Yesudian et al., 2014). A Pan-India survey conducted by the Indian Council of Medical Research (ICMR) on the economic burden of diabetes exhibited that wealthy states had a higher incidence of diabetes mellitus.

Punjab is amongst the richest state of India and it is deemed to be the country's diabetes capital (Tandon, 2018). Punjab is the second-highest carrier state of diabetes after Kerala and the national front-runner in obesity, dyslipidemia and hypertension (Tripathy et al., 2017; Sanghera, 2018). According to the Indian Council of Medical Research (ICMR) Punjab has the highest prevalence of both generalized and abdominal obesity which is a major risk factor of diabetes. According to the Ministry of Health and Family Welfare (2017) diabetes was ranked at 21st position in 1990 as the leading cause of DALYs in Punjab (Disability Adjusted Life Years) with a share of 1.3 percent and by 2016 diabetes accelerated to 4th position as a leading cause of DALYs with a share of 3.9 percent.

Numerous studies are available on the various aspects of diabetes but still there is a dearth of systematic and empirical analysis to understand the economic burden, healthcare utilization and coping strategies of diabetes employed by the households in Punjab. Thus, the main aim of the present study is to examine the socio-economic implications of diabetes on household expenditure in Punjab.

The objectives of the present study are as follows:

1. To study the awareness about diabetes risk factors and prevention strategies among households;
2. To identify the socio-economic determinants of diabetes among households;
3. To estimate the cost of diabetes among households;
4. To study the coping strategies employed by households to deal with economic cost of diabetes;
5. To identify the determinants of catastrophic healthcare expenditure of diabetes among households.

8.2 Awareness About Diabetes Risk Factors and Prevention Strategies Among Households

The results of the analysis revealed that majority of respondents in Punjab have moderate awareness regarding what diabetes actually is? and there exists a lack of knowledge regarding different types of diabetes. Out of different sources of awareness, doctors were the main source from where diabetics learn most about diabetes followed by family, friends, internet, books, television and newspapers. Further, the analysis shows that majority of aware respondents were from the urban area as compared to rural respondents. The result of Chi-square analysis shows that out of different socio-economic variables region, age, marital status, education, work status, income and history of diabetes were significantly associated with the higher level of awareness regarding diabetes mellitus.

The perception of respondents towards diabetes risk factors in Punjab highlighted that a large proportion of respondents strongly agreed that "*If I am diabetic, my family has higher tendency to be diabetic*", "*Obesity increases the occurrence of diabetes*" and "*Smoking highly contributes to diabetes*" as the primary biological, physical and behavioral risk factors of diabetes. The results of the "*Mann-Whitney U*" and "*Kruskal-Wallis*" test revealed a significant difference in the level of awareness about diabetes risk factors among respondents based on various socio-economic variables such as region, age, marital status, education, work status, income and history of diabetes. "*Individuals with diabetes should avoid alcohol consumption*" is witnessed as the primary behavioral prevention strategy. Whereas, intervention strategies such as "*Proper health education helps to prevent diabetes*" and "*Regular monitoring of blood glucose can prevent diabetes*" were perceived as the significant prevention strategies in Punjab. Prevention strategies awareness score and its association with socio-demographic variables in Punjab were analyzed using the "*Mann-Whitney U*" and "*Kruskal-Wallis test*". The result exhibited that there exists a statistically significant difference between socio-economic variables such as region, age, work status, education, income and level of awareness about diabetes prevention strategies.

A rural-urban comparison of awareness and perception about diabetes is a pivotal step towards eliciting the risk factors and prevention strategies in Punjab. Out of 356 aware respondents, a large proportion of urban respondents were aware of diabetes and

36.6 percent of the rural respondents know about what diabetes actually is? The respondents from both rural and urban areas were least aware of the type of diabetes they were diagnosed with. Out of various sources of awareness, doctors were the main source of awareness about diabetes for both rural and urban respondents. The results of Chi-square analysis revealed that out of different socio-economic variables age, marital status, education, work status, income and history of diabetes were significantly associated with a higher level of awareness regarding diabetes in urban and rural Punjab variables such as gender, family type and history of diabetes were not significantly associated with a higher level of awareness regarding diabetes.

"*If I am diabetic, my family has higher tendency to be diabetic*" is perceived as the major biological risk factor in both urban and rural Punjab followed by "*Hypertension increases the prevalence of diabetes mellitus*" and "*With the increase in age the incidence of diabetes mellitus increases*". Urban respondents recognized "*Lack of regular exercise regimen*" and rural respondents recognized "*Rising prevalence of diabetes is primarily attributed to rapid urbanization*" as primary physical risk factor of diabetes in Punjab. "*Mann-Whitney U*" and "*Kruskal-Wallis tests*" were performed to estimate the rural-urban comparison of the awareness scores of diabetes risk factors and their association with socio-demographic variables. The analysis displayed a significant difference between education, work status, income and awareness for diabetes risk factors in both rural and urban Punjab.

The perception of rural and urban respondents highlighted that "*Individuals with diabetes should avoid alcohol*" as a key behavioral prevention strategy of diabetes in rural and urban Punjab. Whereas, under intervention strategies, both rural and urban respondents strongly agreed "*Proper health education helps to prevent diabetes*" as the foremost prevention strategy followed by "*Regular monitoring of blood glucose can prevent diabetes*". The results of the "*Mann-Whitney U test*" highlights that there exists no significant difference between the level of awareness about diabetes prevention strategies and socio-economic variables in both rural and urban Punjab. However, the results of the "*Kruskal-Wallis test*" shows significant difference between the level of awareness about diabetes prevention strategies and work status in rural area as compared to education, work status and income in urban Punjab.

8. 3 Socio-Economic Determinants of Diabetes Among Households in Punjab

The socio-economic determinants are perceived as the primary predictors of the incidence of diabetes. An attempt has been made to identify the socio-economic determinants based on region, gender, age, marital status, education, work status, income, family type, household size, history of diabetes and type of diabetes. The socio-economic profile of the diabetics exhibits that out of 720 respondents in Punjab, 67 percent were from the urban area and 33 percent were from the rural area. It was found that 50 percent of the respondents were from the 41-60 years of age group followed by 60 years and above, 21-40 years and upto 20 years. A large number of respondents were businessmen followed by homemakers, salaried, retired, student and others respectively in Punjab. The result shows that 32 percent of respondents had a monthly income of ₹15,000- ₹30,000 and respondents with monthly of less than ₹15,000 and ₹60,000 and above had a similar percentage share of 15 percent in income level. It was found that 53 percent of respondents were from joint family and 54 percent of respondents were having a history of diabetes in the family. Moreover, 30 percent of the diabetics in the family were mothers followed by siblings (28 percent), father (23 percent), both parents (14 percent) and children (5 percent).

The results of the study revealed that out of 480 urban respondents, 60 percent were male and 40 percent were female respondents. It was witnessed that the majority of respondents were married and 11 percent respondents were single. Age highlights that 50 percent of the respondents were from 41-60 years of age followed by 60 years and above, 21-40 years and upto 20 year of age. A large proportion of urban respondents had a monthly income of ₹15,000- ₹ 30,000 and only 10 percent of respondents had a monthly income less than ₹15,000. History of diabetes was found to be prevalent in the urban area. It was found that 1/3rd of the diabetics were mothers followed by siblings, father, both parents and children. The analysis found that age, marital status, education, work status, income, history of diabetes and complications were the key socio-economic determinants of urban Punjab. The results of the logistic regression revealed that the probability of incidence of diabetes was less among male respondents (OR = 0.675) as compared to female respondents. The analysis shows that the odds of diabetes incidence was less among young respondents. Further, it was found that with the increase in the level of education the probability of incidence of diabetes reduces

significantly. Respondents with income ₹45,000- ₹60,000 were thrice and income group ₹60,000 and above were 9 times likely to experience a higher incidence of diabetes as compared to low-income group respondents. Similarly, respondents with complications of diabetes are twice likely to experience higher diabetes progression as compared to respondents with no complications.

The socio-demographic profile of the rural respondents in Punjab highlighted that out of 240 respondents, 65 percent of respondents are male and 35 percent were female respondents. It was found that 29 percent of the respondents were homemakers, 26 percent were businessmen, 22 percent of the respondents were others, 10 percent were retired, 8 percent of respondents belonged to salaried and students accounts for 4 percent. Moreover, the result shows that a large proportion of respondents were having the primary level of education followed by secondary, graduation, illiterate and post-graduation. The study revealed that more than 90 percent of the rural respondents were having a low level of income as compared to urban respondents. It was found that 56 percent of the respondents agreed to have a history of diabetes in their family in rural Punjab. Age, marital status, education, work status, income and history of diabetes in the family were identified as key socio-economic determinants of diabetes in the rural Punjab. The results of the logistic regression show that young respondents were 8 times more likely to experience a higher incidence of diabetes as compared to old respondents. Moreover, single respondents were twice likely to experience higher incidence of diabetes as compared to married respondents. Further, it was found that higher education level decreases the probability of diabetes incidence as compared to low education level. Respondents with history of diabetes were more likely to experience higher incidence of diabetes as compared to respondents with no history of diabetes. Complication of diabetes was not a significant determinant, but the probability of diabetes progression increases with the upsurge in complications.

8.4 Healthcare Utilization, Cost and Coping Strategies of Diabetes in Punjab

An effort was made to estimate the healthcare utilization, cost and coping strategies of diabetes in Punjab. It was found that large proportion of diabetic respondents preferred allopathic types of treatment followed by home remedies, ayurveda and homeopathy. Respondents preferred private hospitals over government hospitals and 78 percent of the respondents highlighted that healthcare facilities were easily accessible.

It was found that availability of specialized treatment, proximity to home and familiarity with doctors were the top three reasons for the choice of health facility.

Outpatient cost of diabetes in Punjab by socio-demographic characteristics found that rural respondents incurred less mean direct and indirect outpatient cost of diabetes as compared to urban respondents. The mean direct and indirect outpatient cost of female respondents was highest as compared to male respondents. Respondents of age below 20 years incurred the highest mean direct outpatient cost of ₹4342. Whereas, under indirect cost respondents of age 21-40 years (₹927) incurred the highest mean cost. It was found that respondents with a history of diabetes and complications incurred higher mean direct outpatient and indirect outpatient costs of diabetes. The results of "*Mann Whitney U*" and "*Kruskal Wallis test*" revealed that a statistically significant difference exists on the basis of region, gender, age, education, work status, income, household size, history of diabetes and complications for direct outpatient cost. Whereas, under indirect outpatient cost it was found that there exists a statistically significant difference on the basis of region education, work status, income and complications.

The profile of diabetic respondents based on complications in Punjab highlighted that 91 percent of respondents knew diabetes can cause complications in other organs. It was found that 52 percent of respondents were diagnosed with any of the complications due to diabetes. Moreover, it was observed that 61 percent of respondents were diagnosed with microvascular complications and 39 percent with macrovascular complications. A large proportion of diabetic respondents were suffering from heart disease, eye sickness, blockage in blood vessels, low sugar stroke and gum/tooth infection. For outpatient care diabetics with macrovascular complications experienced two times higher direct cost burden as compared to the diabetics with no comorbidity.

The results of the analysis found that out of 720 respondents in Punjab, only 29 percent of the diabetic respondents utilized inpatient care in the past 365 days. The results of inpatient care revealed that a large number of diabetic respondents preferred private hospitals over government hospitals. Availability of specialized doctors, all diagnostic tests under one roof and easy accessibility were the most preferred reasons for the choice of health facility utilized in Punjab. The inpatient cost of respondents in Punjab shows that urban people experience a high mean direct and indirect inpatient

cost of diabetes as compared to rural respondents. The mean direct and indirect outpatient cost of male respondents was highest as compared to female respondents. The result of the analysis exhibits that respondents of age 60 years and above incurred the highest mean direct and indirect inpatient cost. Businessman incurred the highest direct (₹53808) and indirect inpatient (₹5851) cost followed by retired, homemaker, others, salaried and students respectively. For inpatient care, respondents with old age and comorbidities incurred 2.5 times higher cost of treatment as compared to young respondents in Punjab. The results of "*Mann Whitney U test*" exhibits that a statistically significant difference exists on the basis of region, history of diabetes and complications for direct inpatient cost. While, under indirect inpatient cost it was found that there exists a statistically significant difference on the basis of region, gender and complications. The results of "*Kruskal Wallis test*" revealed that a statistically significant difference in cost exists on the basis of age, work status, income and household size for direct inpatient cost. However, under indirect inpatient cost the result of the analysis shows that there exists a significant difference in cost on the basis of work status and income.

Coping strategies employed by households to meet the healthcare expenditure of diabetes in Punjab show that a large proportion of respondents utilized "*buying part of medicines to cope with diabetes*" and "*intra-household labor substitution to compensate for any labor loss*" as the prominent behaviour-based coping strategies in Punjab. "*Mobilizing the available cash in hand*" is the most preferred asset-based coping strategy followed by "*using past savings to meet the healthcare expenses of diabetes*" and "*Mortgage productive assets*". Lastly, it was found that a large percentage of respondents agreed to utilize "*seeking help from relatives to cope up with diabetes*" as a prime assistance-based coping strategy to meet the financial burden of diabetes.

A rural-urban comparison for healthcare utilization of diabetes highlights that a large proportion of both urban and rural respondents utilized allopathic type of treatment followed by home remedies, ayurveda and homeopathy. The results revealed that both urban and rural respondents preferred private hospitals over government hospitals. The mean distance covered to access healthcare facilities was 8.06 kilometers in urban and 12.34 kilometers in rural Punjab. Further, it was found that the majority of urban respondents visit health facilities on monthly basis, whereas, the rural respondents visit on half-yearly. The analysis shows the outpatient cost of diabetes by socio-demographic

characteristics in rural and urban Punjab. It was found that mean direct and indirect outpatient costs of urban female respondents were highest as compared to the rural female respondents. It was found that respondents of age below 20 years incurred the highest mean direct outpatient cost in urban (₹4819) and rural (₹2550) Punjab. The indirect outpatient cost of single respondents (₹818) was highest as compared to married respondents (₹615) in rural Punjab. Students incurred the highest mean direct outpatient cost in the urban area, while, retired respondents incurred highest direct outpatient cost and students experienced the highest indirect outpatient cost in rural Punjab. Respondents with a monthly income of ₹60,000 and above incurred the highest direct and indirect outpatient cost in urban area. Whereas, rural respondents with a monthly income of ₹30,000-₹45,000 and ₹45,000-₹60,000 incurred the highest direct and indirect outpatient cost. Finally, respondents with complications incurred greater direct and indirect outpatient costs in the rural and urban Punjab. The results of the "*Mann-Whitney U test*" revealed that a statistically significant difference exists on the basis of marital status and complications for direct and indirect outpatient cost in urban Punjab. Similarly, in rural areas direct and indirect outpatient costs observed a statistically significant difference on the basis of marital status, family type, history of diabetes and complications. Likewise, the results of the "*Kruskal Wallis test*" revealed that a statistically significant difference exists on the basis of age, education, work status, income and household size for direct outpatient cost in the urban area. However, in rural area there exists a significant difference in direct outpatient cost on the basis of education, work status and income.

Profile of respondents based on diabetes complications in rural and urban Punjab shows that 53 percent urban and 51 percent rural respondents were diagnosed with complications. A large proportion of urban and rural respondents were diagnosed with heart disease (CAD) followed by a blockage in blood vessels (PVC), low sugar stroke (Hypoglycemia) and brain stroke (TIA). Similarly, the results of the analysis revealed that under microvascular complications a large proportion of urban respondents and rural respondents suffered from retinopathy. Outpatient cost of treating complications revealed that both rural and urban respondents with macrovascular complications incurred highest mean direct cost. Whereas, the rural respondents with microvascular complications incurred the highest mean total indirect cost.

Out of 720 respondents, 28 percent urban and 27 percent rural respondents were hospitalized in the past 365 days. It was found that large proportion of urban and rural respondents utilized private hospitals followed by government hospitals, private clinics and others. Availability of specialized doctors, all diagnostic tests under one roof and easy accessibility were the top three reasons for the choice of health facility utilized by the urban respondents. Whereas, the rural respondents recognized the availability of specialized doctors, all diagnostic tests under one roof and best ancillary care as the top three reasons for the choice of health facility utilized. The inpatient cost of diabetes by socio-demographic characteristics in rural and urban Punjab highlights that mean direct and indirect inpatient cost of urban male respondents were high as compared to female respondents. The results of the analysis revealed that respondents of age 60 years and above incurred the highest mean direct inpatient cost of diabetes in both urban and rural Punjab. It was found that urban respondents with a higher level of education incurred the highest direct and indirect inpatient cost of diabetes. But, in rural area illiterates incurred the highest mean direct and indirect inpatient cost. Furthermore, it was found that both urban and rural respondents in Punjab with history of diabetes incurred the highest direct and indirect inpatient cost. The results of "*Mann Whitney U test*" exhibits that a significant difference exists on the basis of gender and complications for direct and indirect outpatient costs in urban and rural. Similarly, the results of "*Kruskal Wallis test*" revealed that a statistically significant difference exists on the basis of work status, income and household size for direct inpatient cost in the urban area. However, in rural area the analysis exhibits that there exists a significant difference in direct outpatient cost on the basis of age and income.

Coping strategies of diabetes mellitus in rural and urban Punjab was categorized into three segments. It was found that a large proportion of urban and rural respondents utilized "*buying part of medicines to cope with diabetes*" as the foremost behaviour-based coping strategy. The analysis revealed that 76 percent of urban and 72 percent of rural respondents strongly agreed "*mobilizing the available cash in hand*" as the primary asset-based coping strategy. Finally, the results highlighted that 35 percent of the urban respondents and 45 percent of the rural respondents utilize "*seeking help from relatives to cope up with diabetes*" as a primary assistance-based coping strategy.

8.5 Catastrophic Healthcare Expenditure of Diabetes Among Households in Punjab

With the rise of epidemiological conditions, the cost of treating and managing diabetes is on the rise. Therefore, out-of-pocket (OOP) payments by households for healthcare leads to catastrophic health expenditure. An attempt was made to identify the determinants of catastrophic healthcare expenditure of diabetes among households in Punjab. The result shows that the incidence of catastrophic healthcare expenditure for outpatient care of diabetic respondents without complications was 74.17 percent at 5 percent threshold level and the intensity (MPO) of outpatient care was highest at 20 percent threshold level and lowest at 10 percent catastrophic threshold level. The incidence (headcount) of outpatient catastrophic healthcare expenditure of the diabetic respondents with complications was 85.37 percent, 65.71 percent, 17.21 percent and 06.71 percent at 5 percent, 10 percent, 20 percent and 30 percent threshold level. The intensity (Overshoot) of catastrophic health expenditure was highest at 5 percent threshold level for respondents with associated complications in Punjab. Thus, an average outpatient respondent with complications spent 41.20 percent of their income on out-of-pocket payments beyond the 30 percent catastrophic threshold level. Lastly, the incidence of outpatient catastrophic healthcare expenditure for all respondents in Punjab was 80.56 percent at 05 percent catastrophic threshold levels. The intensity of outpatient care was highest at 30 percent i.e. an average respondent spends 10.58 percent beyond the 30 percent threshold level.

Similarly, the incidence of inpatient catastrophic healthcare expenditure of the diabetic respondents without complications was 53.85 percent at 5 percent threshold levels. Moreover, the intensity of inpatient care highlights that an average diabetic patient without complications spent an average of 15.05 percent of their income on out-of-pocket payments beyond the 5 percent threshold level. The incidence of inpatient catastrophic healthcare expenditure of the diabetic respondents with complications was 69.09 percent at 5 percent threshold level. The mean positive overshoot of inpatient care among diabetic respondents with complications was lowest at 5 percent (13.58 percent) threshold level. The result shows that the incidence of the inpatient catastrophic healthcare expenditure for all diabetic respondents in Punjab was 66.18 percent, 41.67 percent, 22.06 percent and 08.33 percent. Lastly, the intensity of

outpatient care was highest at 30 percent i.e. an average respondent spends 20.29 percent beyond the 30 percent catastrophic threshold level.

The key determinants of catastrophic healthcare expenditure of diabetic respondents were identified by performing the logistic regression. At 5 percent threshold level region, gender, age 21-40 years, others work status, income ₹15,000- ₹30,000 and complication witnessed significant association with catastrophic health expenditure. Similarly, at 10 percent threshold level region, 60 years and above age, homemaker, income ₹15000-₹30000, income ₹30000-₹45000, income ₹45000-₹60000 and complications observed an association with catastrophic healthcare expenditure. Lastly, at 20 percent threshold level region, gender, homemaker, income ₹15000- ₹30000, income ₹30000- ₹45000 and complications witnessed a significant association with catastrophic healthcare expenditure.

A rural-urban comparison of incidence and intensity of catastrophic healthcare expenditure for outpatient care exhibits that urban respondents without complications experienced a greater incidence of catastrophic healthcare expenditure as compared to rural respondents. The intensity of catastrophic healthcare expenditure for outpatient care was 6.23 percent among urban respondents and 5.51 percent among rural respondents at 5 percent catastrophic threshold level. The incidence of catastrophic healthcare expenditure for outpatient care among urban (82.46 percent) and rural respondents (80.15 percent) with complications was highest at 5 percent threshold level. Thus, an average rural respondent with complications spends 15.21 percent of their income on out-of-pocket payments beyond the 5 percent catastrophic threshold level. The overall incidence of catastrophic healthcare expenditure for outpatient care among urban respondents was 81.25 percent and 76.25 percent for rural respondents at 5 percent threshold levels. The overall intensity of catastrophic healthcare expenditure for outpatient care was highest among urban respondents at 20 percent and 30 percent threshold levels. Therefore, an average urban respondent spends 43.04 percent of their income on out-of-pocket payments

A rural-urban comparison of incidence and intensity of catastrophic healthcare expenditure for inpatient care exhibits that rural respondents without complications experienced a greater incidence of catastrophic healthcare expenditure for inpatient care in comparison to urban respondents at 5 percent, 10 percent and 20 percent threshold

levels. Similarly, the intensity of catastrophic healthcare expenditure for inpatient care was also greater among rural respondents as compared to urban respondents. Urban respondents with complications experienced greater incidence of catastrophic healthcare expenditure for inpatient care at 5 percent, 10 percent, 20 percent and 30 percent threshold levels, as compared to rural respondents. The mean positive overshoot of rural respondents with complications was highest at the 30 percent threshold level. The overall incidence of catastrophic healthcare expenditure for inpatient care among urban respondents was 66.67 percent and 65.15 percent for rural respondents at 5 percent threshold levels. The overall intensity of catastrophic expenditure for inpatient care was highest among rural respondents at 5 percent, 10 percent, 20 percent and 30 percent threshold level as compared to urban respondents.

The key determinants of catastrophic healthcare expenditure were identified by performing logistic regression. At 5 percent threshold level variables such as gender, marital status, homemaker and complications of diabetes witnessed a significant association with catastrophic healthcare expenditure in urban Punjab. Similarly, at 10 percent threshold level urban diabetics identified gender, marital status, income ₹15,000- ₹30,000, complications and household size of 4-6 members observed a significant relationship with catastrophic healthcare expenditure. Lastly, at 20 percent gender, marital status, income ₹15000-₹30000, ₹30000-₹45000, ₹45000-₹60000, ₹60000 and above and history of diabetes were observed as key determinants having a statistically significant relationship with catastrophic healthcare expenditure.

8.6 Policy Implications

- Awareness programmes on diabetes risk factors and prevention strategies should be organised at offices, public meetings, religious gatherings, educational institutions and exclusively in women's organisations.
- Lack of awareness was observed regarding '*high level of bad cholesterol*' and '*cholesterol makes people prone to diabetes*' as risk factors. The study directs that diet modification is a pre-requisite to reduce the incidence of diabetes in Punjab.
- The rural respondents with low educational status, low-income level and history of diabetes should be well educated about diabetes, its risk factors and prevention strategies as compared to urban respondents.

- There is an immediate need to strengthen the government healthcare infrastructure to early detect the onset of diabetes and provide uniform healthcare facilities with a focus on respondents with low socio-economic status in Punjab.
- The results of the present study direct that respondents with macrovascular and microvascular complications should timely diagnose all vital organs to prevent any physical and monetary loss.
- It was observed that expenditure on medicine reports the highest cost proportion. Therefore, as a monetary protection measure, medicines should be made available at subsidized rates through '*Jan Aushadhi Kendra*'.
- The respondents below 20 years of age and macrovascular complications incurred high out-of-pocket expenditures. Therefore, outpatient costs should be reimbursed under the '*Ayushman Bharat-Sarbat Sehat Bima Yojana*'.
- The study highlights that rural respondents were more likely to incur catastrophic health expenditures. Thus, early detection of diabetes among high-risk individuals and effective management of the identified patients should be prioritized to reduce the incidence and intensity of catastrophic healthcare expenditure.

8.7 Scope for Future Research

Future research can be carried out to cover the following research areas:

- Estimation of awareness, costs and coping strategies of diabetes using longitudinal data.
- Inclusion of all districts of Punjab to estimate the out-of-pocket expenditure and coping mechanism.
- To evaluate the knowledge and awareness of expectant mothers about gestational diabetes mellitus in Punjab.
- Comparative analysis of the economic implications of diabetes between patients with or without health insurance policy.

8.8 Conclusion of the Study

With the rising incidence of diabetes and its associated complications, awareness regarding diabetes could help in timely prevention and reduction of prevalence. The level of awareness and perception of diabetics regarding risk factors and prevention strategies majorly depends upon social, economic and behavioral characteristics. Households with low socio-economic status such as income and education are most likely to experience a higher incidence of diabetes. The above discussion clearly shows that majority of respondents in Punjab have moderate awareness regarding what diabetes actually is? and there exists a lack of knowledge and awareness regarding different types of diabetes. This leads to an enormous economic burden upon diabetic households in Punjab, resulting in indebtedness and depletion of their savings and available cash. With the rise of epidemiological conditions, the cost of treating and managing diabetes is increasing in Punjab. Diabetics with macrovascular complications incur two times higher direct costs as compared to diabetics with no comorbidity. Similarly, for inpatient care diabetic respondents with old age and comorbidities incur 2.5 times higher cost of treatment because large proportion of diabetics utilized private hospitals over government hospitals. Thus, out-of-pocket payments by households for healthcare treatment leads to catastrophic healthcare expenditure and impoverishment among households with low socio-economic status such as income, education and history of diabetes.

Awareness regarding diabetes mellitus, risk factors, prevention strategies and costs help in designing innovative awareness programs and government campaigns to educate individuals about the consequences of lifestyle modification, sedentary lifestyle and altering epidemiology of diabetes. Thus, there is a dire need to create awareness about diabetes and its complications through mass media campaigns such as the distribution of pamphlets, advertisements in magazines, newspapers, television, radio, etc. Awareness programmes should be designed at offices, public meetings, religious gatherings, schools, colleges and especially in women's organisations. Considering the economic burden of diabetes in Punjab, it is imperative to strengthen the government healthcare infrastructure to detect the early onset of diabetes and provide uniform healthcare facilities. It was observed that expenditure on medicine reports the highest cost proportion, therefore, medicines should be made available at subsidized rates

through '*Jan Aushadhi Kendra*'. The results of the study direct that respondents with macrovascular complications and respondents below 20 years of age incurred high out-of-pocket expenditure. Therefore, outpatient costs should be reimbursed under the '*Ayushman Bharat-Sarbat Sehat Bima Yojana*'. The findings of the study highlighted that a very small proportion of respondents utilize assistance-based coping strategies. Thus, early detection of diabetes among high-risk individuals and effective management of identified patients should be prioritized to reduce the catastrophic health expenditure.