



**2<sup>nd</sup> National  
Diabetes Survey  
of  
Pakistan  
2016-2017**



## **Collaborating Organizations**

**Ministry of National Health Services, Regulation and Coordination**

Islamabad – Pakistan

**Pakistan Health Research Council**

Islamabad – Pakistan

**Diabetic Association of Pakistan; WHO Collaborating Centre**

Karachi – Pakistan

**Baqai Institute of Diabetology and Endocrinology, Baqai Medical University**

Karachi – Pakistan

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**2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016-2017**

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## Foreword

Diabetes is a major public health issue resulting in morbidity and mortality worldwide. The complications including stroke, cardiovascular diseases, renal failure etc resulting from diabetes are major cause of premature deaths globally. It is estimated that a person died every 6<sup>th</sup> second due to diabetic complications. Major risk factors for diabetes are physical inactivity, obesity and unhealthy diet. According to International Diabetes Federation, about 425 million people are living with diabetes and more than 70% cases are in low and middle-income countries. Diabetes is common in South East Asia constituting 19.3% of total world's diabetic population. It is estimated that in Pakistan, about 7.5 million people have diabetes and this number is predicted to increase to 16.1 million by the year 2045. About 1.8% of the global GDP (1.31 trillion USD) is being spent on the management of diabetes.

First National Diabetes Survey of Pakistan was conducted in 1994-98. Keeping in view the changing demography of the country, a need was felt to have renewed data on diabetes in term of its prevalence in different age groups, gender and urban rural setting. It aimed to help policy makers in making informed policies on the prevention and control of this deadly disease.

To achieve above goal, Pakistan Health Research Council (PHRC) together with Diabetic Association of Pakistan (DAP) and Baqai Institute of Diabetology and Endocrinology (BIDE) planned 2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016-17 under the auspices of the Ministry of National Health Services, Regulation and Coordination (NHSRC). The Survey was conducted in all four Provinces of Pakistan i.e. Punjab, Sindh, Khyber Pakhtunkhwa and Baluchistan to provide national level data on the prevalence of diabetes and its risk factors in the country.

I congratulate PHRC, DAP and BIDE; for successfully completing the 2<sup>nd</sup> NDSP 2016-2017 and bringing out report which I believe would be highly beneficial to policy makers in planning for prevention and control of diabetes in Pakistan. I am confident that academicians, policy makers, healthcare experts and all relevant stakeholders would make optimal use of this report.

**MUHAMMAD ALI SHAHZADA**

Additional Secretary  
Ministry of National Health Service,  
Regulation and Coordination

Source: International Diabetes Federation (IDF) Atlas 8th Edition 2017

## *Message*



**Prof. Nam H. Cho**

President  
International Diabetes  
Federation

As the President of International Diabetes Federation (IDF), it gives me great pleasure to express my feelings at the accomplishment of “National Diabetes Survey of Pakistan (NDSP) 2016 – 2017”

The mission of the International Diabetes Federation (IDF) is to promote diabetes care, prevention, and cure worldwide with an estimated number of people with diabetes worldwide close to 425 million and projections indicating well over 629 million in 2045. The current diabetes epidemics is of great concern to those affected, their families and all the concerned governments and social security systems.

This survey will help to understand the current epidemic situation in one out of the seven IDF Regions, namely the Middle East and North Africa (MENA) Region and will contribute to identify solutions in the Region with special emphasis to Pakistani population where the number of people affected is particularly very high.

I on behalf of IDF, congratulate all the stakeholders in this regard and I am confident that this survey will help in early identification and effective management. Moreover, nationwide preventive strategies will be focused to combat the situation.

## *Message*



**Prof. Akhtar Hussain**  
President  
Diabetes in Asia Study Group

I feel honored and privileged to write a message at the successful completion of “National Diabetes Survey of Pakistan 2016–2017”. The survey comprehensively looks at the prevalence of diabetes, hypertension, obesity and dyslipidemia along with their associated risk factors in all provinces of the country.

Globally, diabetes is a major cause of morbidity and mortality. A progressive rise of diabetes in the productive age group specifically in Asia foretells a serious public health issue in this part of the world. There is enough evidence on preventability of the disease by applying sets of effective preventive and curative measures.

Pakistan had an estimated 7.5 million people with diabetes and this number was predicted to be increased up to 16.1 million by the year 2045 according to an International Diabetes Federation. This number was extrapolated on the basis of previous National Diabetes Survey of Pakistan conducted in 1994-1999. I congratulate, Ministry of National Health Services, Regulation and Coordination, Pakistan Health Research Council, Diabetic Association of Pakistan, Baqai Institute of Diabetology and Endocrinology and the whole NDSP team on the successful completion of this survey.

These figures are alarming and emphasizing the urgent need for National strategies for early diagnosis, comprehensive management along with cost effective preventive measures. I wish them all the best in this regard.



**Dr. S. Abbas Raza**

President  
South Asian Federation of  
Endocrine Societies

## *Message*

On behalf of the South Asian Federation of endocrine Societies (SAFES), it gives me an immense pleasure to write a message for the 2nd National Diabetes Survey of Pakistan (NDSP 2016 – 2017), conducted in all four provinces of Pakistan simultaneously.

The mission of the South Asian Federation of endocrine Societies (SAFES) is to focus the region-specific health related issues, particularly diabetes and other endocrine disorders and to facilitate their standardized treatment as per the available region-specific evidences and guidelines.

At present, nearly half a billion people live with diabetes worldwide. Low and middle-income countries share almost 80% of the diabetes burden. Rapid urbanization, unhealthy diets and increasingly sedentary lifestyles have resulted in previously unheard higher rates of diabetes. Diabetes can be successfully managed and complications can be prevented especially when detected early. Even better, by making lifestyle changes the risk of developing diabetes can be reduced markedly. Many countries still lack prevalence studies and many populations are not systematically surveyed. Still, more multi-dimensional and multi-sectoral research is needed to tackle the diabetes epidemic.

NDSP was well planned community-based survey providing current estimates of people suffering from diabetes in different strata of the Pakistani population. I would like to express my deepest gratitude to Ministry of National Health Services, Regulation and Coordination, Pakistan Health Research Council, Diabetic Association of Pakistan, Baqai Institute of Diabetology and Endocrinology and the whole NDSP team along with it's participants on conducting and successful completion of this National Survey and at the same time I on behalf of SAFES would like to extend our unconditional and full support to combat this epidemic support in Pakistan.



**Prof. Ali Jawa**

President

Pakistan Endocrine Society

## *Message*

It gives me great pleasure to write this message on behalf of Pakistan Endocrine Society (PES) for the 2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016–2017. Pakistan Endocrine Society promotes educational and research activities in Endocrinology, Diabetes and Metabolism and has always supported the initiatives taken to address the National level health related issues, specifically in the field of diabetology and endocrinology.

Diabetes is a global health crisis and its chronic nature can lead to its debilitating complications. Globally, Governments are struggling to meet the cost of diabetes care and the financial burden will continue to expand due to the growing number of people developing diabetes. International and National researchers are convinced that prevention at all levels is the only solution to halt this rising epidemic.

I take this opportunity to extend my heartiest congratulations to all the contributors and stakeholders of NDSP on this successful accomplishment.

Keeping the scale of the problem in mind, we certainly need ongoing research in the field of Diabetes and Endocrinology. It indeed is my sincerest hope that scientists and researchers redouble their efforts to refine our understanding of diabetes epidemic especially in Pakistan not only to benefit local population but ultimately the greater humanity as a whole.



## **Acknowledgements**

The 2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016 - 2017 was successfully completed due to the efforts and involvement of numerous organizations and individuals at different stages of the survey. We would like to thank everyone who participated and make this survey a success.

First of all, we are grateful to the Ministry of National Health Services, Regulation and Coordination (NHSRC) in Pakistan for its support. We would like to extend Special thanks to Capt® Zahid Saeed, the Secretary Ministry of National Health Services Regulation and Coordination. We would also like to thank Mr. Naveed Kamran Baloch and Mr. Muhammad Ayub Sheikh, former Secretaries, Ministry of NHSRC and Dr. Assad Hafeez, Director General (Health) for their valuable and constant support throughout the survey.

We wish to express our special thanks to Pakistan Health Research Council and Diabetic Association of Pakistan for their support and facilitation in this survey. We sincerely appreciate the efforts of Ms. Rabia Irshad and Mr. Ejaz Haider at PHRC Research Centre JPMC, Karachi for performing laboratory tests for the survey. We also pay special thanks to Dr. Faiza Bashir, Ms. Saima Naz and Mrs. Sumera Abid for their contribution and efforts.

In addition, the untiring efforts of survey Coordinators and field supervisors are highly acknowledged. We appreciate the efforts of the monitoring teams who despite the difficult field conditions visited the field areas and monitored the survey activities.

We acknowledge the support of Research and Laboratory department of Baqai Institute of Diabetology and Endocrinology (BIDE), Karachi for data management. We are extremely grateful to the Seventeen teaching hospitals and/or diabetes centers participated in the 2<sup>nd</sup> NDSP 2016 - 2017.

Last but not the least we would like to express our sincere thanks and gratitude to the Survey Coordinators, survey teams, data entry teams and above all the household members/community who participated in the survey.

**Prof. Abdul Basit**

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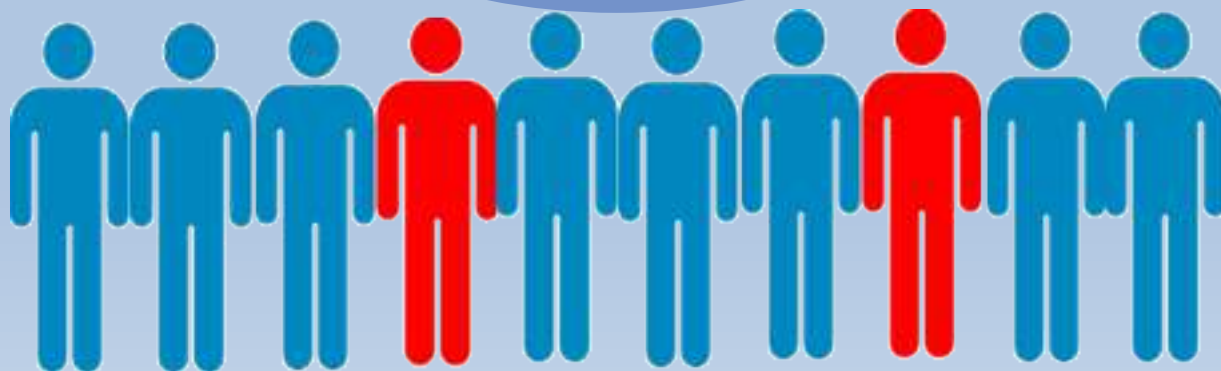
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# *Diabetes – A growing national crisis*

## **Executive Summary**



*1 in every 4 person aged 20 and above is diabetic*





## EXECUTIVE SUMMARY

Diabetes mellitus is major public health issue of 21<sup>st</sup> century, especially for lower middle-income countries (LMIC). According to estimation, number of people suffering from diabetes is anticipated to be increase to 629 million people worldwide by 2045 as compared to 425 million people in 2015. The complications resulting from diabetes are major cause of premature deaths round the globe and it is estimated that a person died every 6<sup>th</sup> second due to diabetic complications. In 2015 only, approximately 5 million deaths were reported from developing countries.

Pakistan has an estimated 7.5 million people with diabetes and this number is predicted to increase to 16.1 million by the year 2045. This number is extrapolated on the basis of surveys done by the Diabetic Association of Pakistan (DAP) and World Health Organization (WHO) collaborating center in 1994 – 1998 (1<sup>st</sup> National Diabetes survey of Pakistan, 1<sup>st</sup> NDSP). Hence, a repeat survey is needed to estimate the recent numbers of people suffering from type 2 diabetes so as to take a step forward in developing strategies for cost effective management and primary prevention. Therefore, 2<sup>nd</sup> NDSP 2016 – 2017 was designed to obtain the recent number of type 2 diabetics in urban and rural areas of Pakistan.

The survey was conducted using three stage sampling technique. In the first stage, population was stratified into urban and rural areas. In the second stage, clusters were randomly selected using probability proportional to size (PPS) technique. In the third stage, sub-clusters based on tehsils/towns were selected randomly.

A total of 27 clusters were selected from all four Provinces of Pakistan and 46 sub-clusters (21 urban and 25 rural). The sample size was distributed into clusters and sub-clusters based on probability proportionate to size technique so that cluster with larger population size will have larger sample size.

Data was collected in two phases. In the 1<sup>st</sup> phase, a pre-survey visit was made for the selection of houses following systematic sampling technique. The first house in the lane was selected randomly and afterwards every tenth house was identified. The selected household members were requested to come after an overnight fast (at least 8 hours) to the camp on the specific day. Participants were enrolled after taking informed consent. The fasting sample and sample for

glucose tolerance test (two hours after giving 75 grams of anhydrous glucose load) were taken. Height, weight, waist circumference, waist-hip ratio and blood pressure were measured as per the standardized procedures.

Plasma glucose, lipid profile (total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol) and HbA1c was performed using standard biochemical methods. Fasting and random (2-hour post 75gm glucose load) plasma glucose levels were performed at the site while HbA1c and lipid profile was done in laboratory.

A total of 10834 persons were enrolled (43.9% males, 56.1% females). More than half (53.5%) had at least primary level education. Almost 30.2% had positive family history of diabetes.

According to Asian BMI cut off values, 27.7% respondents had normal (BMI <23), 14.2 % were overweight (BMI 23-24.9) and 58.1% were obese (BMI  $\geq$  25). Mean BMI of participants was  $27.2 \pm 6.0$  kg/m<sup>2</sup> which were almost similar in all Provinces.

Overall, mean systolic and diastolic blood pressure was  $126 \pm 19$  mmHg and  $84 \pm 14$  mm/Hg respectively. Highest mean blood pressure was seen in Baluchistan and lowest in Khyber-Pakhtunkhwa. Around half of the population (46.2%) had hypertension. The prevalence of hypertension increased with age and was highest (65.7%) in age group 60 years or above.

As per oral glucose tolerance test (OGTT) criteria, overall age adjusted weighted prevalence of diabetes was 26.3%. Among them, 19.2% were known diabetic cases while 7.1% were diagnosed during this survey. Prevalence of diabetes in urban and rural areas was 28.3% and 25.3%, respectively. Highest prevalence of diabetes was observed in Sindh (32.3%) followed by Punjab (30.2%), Baluchistan (29.5%) and KPK (13.2%). Prevalence of pre-diabetes was 14.4%, urban and rural distribution was 15.5% and 13.9%, respectively.

Overall glycemic dysregulation (diabetes, plus pre-diabetes) was 43.8% and 39.2% in urban and rural areas, respectively. Prevalence of pre-diabetes and newly diagnosed diabetes was higher in Baluchistan as compared to other provinces.

Urban women showed significantly higher prevalence of diabetes than rural women above the age of 40 years ( $p < 0.05$ ). On the other hand, urban men in the age group 30-39 years showed significantly ( $p < 0.05$ ) lower prevalence of diabetes than rural men. Rural men showed significantly higher prevalence of pre-diabetes than urban men for the age group of 40-49 years

while for women, significant difference was seen in urban as compared to rural population for the age group of 30-39 years. Age (greater than or equal to 43 years), family history of diabetes, hypertension, obesity and dyslipidemia were significant risk factors for diabetes ( $p \leq 0.0001$ ).

Overall, 60.7% population had normal cholesterol levels. Deranged cholesterol was mostly seen in people aged between 50-59 years followed by those aged 40-49 years. High triglycerides were seen in 48.9% respondents and this was mostly seen in individuals who were between 50-59 years of age. Overall 39.7% respondents had high levels of low density lipoprotein. Majority of the population had low values of high density lipoprotein (83.5% men, 90% women).

## FACT SHEET

The 2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016-2017 was a population-based survey of adults aged 20 years above which was carried out from February 2016 to August 2017. A three-stage sampling technique was used to produce representative data for that age range in Pakistan. A total of 10834 adults participated in the Survey and information were collected on demographics and physical measurements such as height, weight and blood pressure as well as testing of blood samples for fasting and random(2-hours oral glucose tolerance test) plasma blood glucose levels, HbA1c and lipid profile was also done. A repeat survey is planned after 05 years if funds permit.

Fact sheet; Gender			
Descriptions	Both Sexes (%) (95% CI)	Males (%) (95% CI)	Females (%) (95% CI)
Normal glucose tolerance			
Oral glucose tolerance test (OGTT)	60.0 (59.0-60.9)	61.6 (60.2-62.9)	58.9 (57.6-60.1)
HbA1c	64.5 (63.6-65.4)	63.4 (62.0-64.7)	65.3 (64.1-66.5)
Pre-diabetes			
Oral glucose tolerance test (OGTT)	14.4 (13.7-15.0)	12.8 (11.8-13.7)	15.6 (14.6-16.5)
HbA1c	5.5 (5.0-5.9)	5.1 (4.4-5.7)	5.9 (5.3-6.4)
Prevalence of newly diagnosed diabetes mellitus			
Oral glucose tolerance test (OGTT)	7.1 (6.6-7.5)	7.3 (6.5-8.0)	6.9 (6.2-7.5)
HbA1c	7.4 (6.9-7.8)	8.5 (7.7-9.2)	6.7 (6.0-7.3)
Prevalence of known diabetes			

Fact sheet; Gender			
Descriptions	Both Sexes (%) (95% CI)	Males (%) (95% CI)	Females (%) (95% CI)
Oral glucose tolerance test (OGTT)	19.2 (18.4-19.9)	18.9 (17.7-20.0)	19.4 (18.4-20.3)
HbA1c	22.4 (21.6-23.1)	22.9 (21.7-24.0)	22.1 (21.0-23.1)
Prevalence of diabetes mellitus			
Oral glucose tolerance test (OGTT)	26.3 (25.4-27.1)	26.2 (24.9-27.4)	26.3 (25.1-27.4)
HbA1c	29.9 (29.0-30.7)	31.5 (30.1-32.8)	28.8 (27.6-29.9)
Lipid profile			
Hypercholesterolemia	39.3 (38.3-40.2)	39.1 (37.7-40.4)	39.5 (38.2-40.7)
High low density lipoprotein	87.4 (86.7-88.0)	83.5 (82.4-84.5)	90 (89.2-90.7)
Low high density lipoprotein	38.7 (37.7-39.6)	38.9 (37.5-40.2)	40.4 (39.1-41.6)
Hypertriglyceridemia	48.9 (48.0-49.8)	54.1 (53.0-55.5)	45.6 (44.3-46.8)

Fact sheet; Province				
Description	Punjab (%) (95% CI)	Sindh (%) (95% CI)	Khyber Pakhtunkhwa (%) (95% CI)	Baluchistan (%) (95% CI)
Diabetes				
Known diabetes	23.7 (22.6-24.7)	23.6 (21.9-25.2)	10.2 (8.7-11.7)	19.1 (15.7-22.4)
Fasting glucose	3.3 (2.8-3.7)	3.6 (2.8-4.3)	1 (0.5-1.5)	3.1 (1.6-4.5)
2 hours oral glucose tolerance test*	1.1 (0.8-1.3)	1.4 (0.9-1.8)	0.4 (0.1-0.7)	4.7 (2.9-6.4)
Both fasting glucose and 2 hours glucose tolerance	1.1 (0.8-1.3)	3.7 (2.9-4.4)	1.6 (0.9-2.2)	2.6 (1.2-3.9)

Fact Sheet; Provinces				
Description	Punjab (%) (95% CI)	Sindh (%) (95% CI)	Khyber Pakhtunkhwa (%) (95% CI)	Baluchistan (%) (95% CI)
Newly diagnosed	6.5 (5.8-7.1)	8.7 (7.6-9.8)	3 (2.1-3.8)	10.4 (7.8-12.9)
Total diabetes	30.2 (29.0-31.3)	32.3 (30.4-34.1)	13.2 (11.5-14.8)	29.5 (25.6-33.3)
Pre-Diabetes				
Fasting glucose	1.8 (1.4-2.1)	1.8 (1.2-2.3)	1.1 (0.5-1.6)	0.4 (0.1-0.9)
2 hours glucose tolerance test	11.2 (10.4-11.9)	8.4 (7.3-9.4)	2.9 (2.0-3.7)	42.4 (38.2-46.5)
Both fasting glucose and 2 hours glucose tolerance	2.1 (1.7-2.4)	1.5 (1.0-1.9)	0.5 (0.1-0.8)	8.7 (6.3-11.0)
Total Pre-diabetes	15.1 (14.2-15.9)	11.7 (10.4-12.9)	4.5 (3.4-5.5)	51.5 (47.2-55.7)

## HIGHLIGHTS

The 2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016-2017 was a population-based survey of adults aged 20 years above which was carried out from February 2016 to August 2017. The data was weighted to give a representative figure for the country. The burden was calculated using recent census findings 2017.

### HIGHLIGHTS

#### PREVALENCE OF DIABETES

- Overall 26.3% were diabetic (27.4 million people aged 20 and above)
- 1 in 4 persons aged 20 and above had diabetes
- Glycemic dysregulation (diabetes, pre-diabetes) was more in urban (43.8%) as compared to rural (39.2%).

#### MEASUREMENTS:

- 14.2% were overweight (14.4 million people aged 20 and above)
- 43.9% were obese (44.6 million people aged 20 and above)
- 46.2% were hypertensive (47 million people aged 20 and above).

#### CHOLESTEROL

- Overall 39.3% had hypercholesterolemia (40 million people aged 20 and above)







*Globally, about 42.9 million people have diabetes  
which is expected to rise 628.6 million by 2045.*



# **Introduction**



## 1. INTRODUCTION

The epidemic of diabetes is an alarming public health issue of 21<sup>st</sup> century, especially for lower middle-income countries (LMIC).<sup>1</sup> It is predicted that between 2010-2030, the prevalence of diabetes in developing countries would become 67%.<sup>2</sup> Macrovascular and microvascular complications of diabetes are the major cause of premature deaths globally<sup>3,4</sup> with one person dying every sixth second due to the complications of diabetes.<sup>4,5</sup> Approximately, five million (2/3<sup>rd</sup>) diabetes related deaths were reported from developing countries in 2015.<sup>4,6</sup>

Globally, according to World Health Organization (WHO), hypertension (13%), tobacco use (9%), diabetes (6%), physical inactivity (6%) and overweight & obesity (5%) are the major risk factors causing morbidity and mortality related to cardiovascular diseases (CVD).<sup>7,8</sup> It is estimated that about 17 million deaths occur worldwide due to CVD each year, out of which hypertension alone accounts for 9.4 million mortalities.<sup>9</sup> Although the prevalence of hypertension is rising worldwide<sup>10</sup> but this increase is quite sharp in many LMIC.<sup>11</sup> Obesity is now recognized as a disease on its own<sup>12</sup> and according to WHO, obesity is one of the most serious and common, yet not well focused public health problem in both developed and developing countries.<sup>13</sup> The World Health Statistics report 2012, reported that worldwide, one in six adult is obese and about 2.8 million subjects die each year due to the consequences of obesity.<sup>14</sup>

In Pakistan, the 1<sup>st</sup> National Diabetes Survey of Pakistan (NDSP) 1994-1998 revealed 8.7% prevalence of diabetes.<sup>15-19</sup> Since then, many small-scale studies have done which showed that the prevalence of diabetes varies between 13.1% to 26.9%.<sup>20-22</sup> In 2003, the prevalence of hypertension was reported as 20%.<sup>23</sup> In 2016, Pakistan Medical Research Council (PMRC) conducted the NCDs survey in the Punjab and Sindh using WHO's STEPS methodology (no blood testing was done) in which prevalence of hypertension and obesity were 37% and 41.3% respectively.<sup>24</sup> Few other studies from Pakistan reported obesity between 27% to 49%.<sup>25,26</sup> Dyslipidemia is a major risk factor for atherosclerosis leading to CVD.<sup>27</sup> Few community-based studies from Pakistan have reported the prevalence of dyslipidemia to be around 30%.<sup>28,29</sup>

Keeping in view above, there was a need to do a national level survey to determine the current prevalence of diabetes, hypertension, obesity and dyslipidemia in Pakistan. Therefore, this 2<sup>nd</sup> National Diabetes Survey of Pakistan (NDSP) 2016 - 2017 was planned which was conducted to

determine the prevalence of diabetes, hypertension, obesity and dyslipidemia in Pakistan including urban and rural populations of all four Provinces.



# Methods





## **2. MATERIALS AND METHODS**

### **2.1 Ethical approval**

The ethical approval for the 2<sup>nd</sup> NDSP (2016 – 2017) was obtained from National Bioethics Committee (NBC) of Pakistan.

### **2.1 Study area and population**

This nationwide 2<sup>nd</sup> NDSP (2016 - 2017) was conducted over a period of eighteen months from February 2016 to August 2017 in all four Provinces of Pakistan (i.e. Punjab, Sindh, Khyber Pakhtunkhwa and Baluchistan). The survey was a joint collaboration of Ministry of National Health Services, Regulation and Coordination (MoNHSRC), Pakistan Health Research Council (PHRC), Diabetic Association of Pakistan (DAP) and Baqai Institute of Diabetology and Endocrinology (BIDE). The available census data of 1998 was obtained from Pakistan Bureau of Statistics (PBS) regarding information about actual population and area distribution of Pakistan<sup>30</sup>.

### **2.3 Inclusion and Exclusion criteria:**

The inclusion criteria were as follow;

- Healthy individual age 20 and above living in Pakistan (Punjab, Sindh, Khyber Pakhtunkhwa, and Baluchistan) with Pakistani nationality

The exclusion criteria were as follow;

- Pregnant cases
- Subjects who were non-residents of Pakistan or living army locations, Jail inmates and migratory population

### **2.4 Sample Size**

The sample size details are given below.

#### **2.4.1 Sample size calculation**

In order to calculate the prevalence at national level, following formula was used to calculate the overall sample size.<sup>31</sup>



$$\text{Sample size (n)} = \frac{Z^2 \times (\text{Expected prevalence}) \times (1 - \text{expected prevalence})}{(\text{Margin of error})^2} \times \text{design effect}$$

An estimated sample size of 10697 subjects was calculated using the above formula with reasonable margin of error and level of confidence <sup>32</sup>.

#### 2.4.2 Sampling technique

Multi-stage sampling technique was used. The first stage involved the stratification of population on the basis of urban and rural domains under Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan and Islamabad as defined in census (1998). The second stage constituted of clusters made under each stratum. Clusters were randomly selected using probability proportional to size (PPS) technique and number of clusters to be selected from each province were based on “Rule of thumb” given as under <sup>32</sup>.

$$\text{Number of clusters (k)} = (\text{sample size of stratum} / 2)^{0.5}$$

Third stage contained sub-clusters based on tehsils/towns which were selected randomly.

#### 2.4.3 Sample size distribution

A total of 27 clusters were selected from all four Provinces of Pakistan. In the 3rd stage, sub-clusters based on tehsils/towns were selected randomly. There were 46 sub-clusters comprising of 21 tehsils/towns from urban and 25 tehsils/towns from rural areas that were finally selected. The overall sample size was divided into each stratum and then to each cluster according to their population sizes. Sample size was equally distributed to sub-clusters (tehsils/towns) (Appendix 1). Therefore, stratum or cluster with larger population size will have larger sample size and greater probability of being selected.

### 2.5 Survey team

Seventeen teaching hospitals and/or diabetes centers participated in the 2<sup>nd</sup> NDSP 2016 - 2017. The training sessions of these teams were conducted from February 2016 to July 2016. The teams were trained to identify households, to fill the questionnaire, to take anthropometric measurements and to collect blood samples. Each team comprised of laboratory technicians, paramedical staff and survey officers, led by the physician as provincial coordinator of that cluster. A detailed structure of whole survey is given in Figure 1, 2 and 3.



## **2.6 Data collection method**

Data collection method of this study was based on multiple indicator cluster survey manual<sup>33</sup>. It was done in two phases. In the 1<sup>st</sup> phase, a pre-survey visit was made for the selection of houses following systematic sampling technique. The first house in the lane was selected randomly and afterwards every tenth house was identified. In case, residents of the identified household were not present or if they refused to participate, the next consecutive household was taken. Teams marked the houses and informed the adult residents about the survey and their participation. The selected household members were requested to come after an overnight fast (at least 8 hours) to the camp on the specific day. Only those who gave an informed written consent for interview, anthropometry, screening, blood sample and data collection were selected for the survey. Once fasting sample was taken then each participant was given 75 grams of anhydrous glucose load and were requested to stay in the screening facility for at least two hours. Meanwhile, their clinical and anthropometric data was collected by the trained paramedic staff under the supervision of survey officer.

## **2.7 Measurements**

Height, weight, waist circumference, waist-hip ratio and blood pressure were measured as per the standardized procedure.<sup>16, 22, 25</sup> Individuals were requested to take 10 minutes rest in a sitting position before measurement of blood pressure and two readings was taken and mean of these reading was used.

## **2.8 Blood Sampling and Testing**

Blood samples were collected by using sterilized disposable vacutainer tubes containing sodium fluoride (for glucose), EDTA K2 (for HbA1c) and gel (for lipids). Within 1 hour of blood collection, the samples were centrifuged, separated and sent to the laboratory. Plasma glucose was measured using the glucose oxidase peroxidase method, total cholesterol by CHOD-PAP method, triglycerides by GPO-PAP method, high density lipoprotein cholesterol (HDL-C) by homogeneous enzymatic calorimetric method, low density lipoprotein cholesterol (LDL-C) by CHOD-PAP method and HbA1c by high-performance liquid chromatography (HPLC) method.<sup>34</sup> Fasting and random (2-hour post 75gm glucose load) plasma glucose levels were performed at the site while samples for HbA1c and lipid profile were transported as per protocol to BIDE

where they were kept in -80 freezer until transported to PHRC, Jinnah Postgraduate Medical Centre (JPMC), Karachi for analysis.

## **2.9 Definitions**

Following definitions were used to interpret the results.

### **2.9.1 Diabetes**

According to WHO diagnostic criteria, diabetes was diagnosed and the results of plasma glucose testing were categorized as follows: isolated impaired fasting glucose (fasting glucose level,  $\geq 110$  mg/dl and  $< 126$  mg/dl, 2-hour glucose level in the glucose tolerance test  $\leq 140$  mg/dl); isolated impaired glucose tolerance (fasting glucose level,  $< 110$  mg/dl and 2-hour glucose level,  $> 140$  and  $< 200$  mg/dl); combined impaired fasting glucose and impaired glucose tolerance (fasting glucose level,  $\geq 110$  and  $< 126$  mg/dl, and 2-hour glucose level  $> 140$  and  $< 200$  mg/dl); and undiagnosed diabetes (fasting glucose level,  $\geq 126$  mg/dl or 2-hour glucose level,  $\geq 200$  mg/dl or both).<sup>35</sup>

For diagnosing diabetes, HbA1c was used as the diagnostic tool. According to the American Diabetes Association (ADA) standards of care HbA1c  $\geq$  to 6.5% (48 mmol/mol) was diagnosed as diabetic while HbA1c between 5.7 – 6.4 % (39 to 46 mmol/mol) was considered as pre-diabetic.<sup>36</sup>

### **2.9.2 Hypertension**

Participants were considered hypertensive if they were already diagnosed by a physician or if they were taking any anti-hypertensive medication or if the systolic blood pressure (SBP) was  $\geq 140$  mmHg and/or diastolic blood pressure (DBP)  $\geq 90$  mmHg.<sup>16,19</sup>

### **2.9.3 Body Mass Index**

Using WHO definition for obesity in Asian population, Body mass index (BMI) of 25 and 27 ( $\text{kg/m}^2$ ) was labeled as overweight and obesity respectively. Central obesity was defined as waist-to-hip ratio (WHR)  $\geq 0.9$  and  $\geq 0.8$ , and/or waist circumference  $\geq 90$  cm and  $\geq 80$  cm in males and females respectively.<sup>12, 13</sup>

### 2.9.4 Dyslipidemia

Using the Adult Treatment Panel III guidelines; dyslipidemia was classified as one or more of the following conditions in fasting state; serum cholesterol >200 mg/dl, serum low density lipoprotein cholesterol (LDL-C) >130 mg/dl, serum high density lipoprotein cholesterol (HDL-C) < 40 mg/dl and < 50 mg/dl for male and female respectively and serum triglycerides (TG) > 150 (mg/dl).<sup>37</sup> Participants were also considered to have dyslipidemia if they were taking any anti-cholesterol medications.

### 2.10 Data Analysis

Data analysis was conducted on Statistical Package for Social Sciences (SPSS), version 20. Descriptive analysis included the estimation of mean values and standard deviations for continuous variables. Categorical variables and prevalence values were presented in the form of frequency and percentage. Risk factors of diabetes, hypertension, obesity and dyslipidemia, were examined using multivariate logistic regression. P-value of <0.01 was considered statistically significant. For all estimates, the study population was weighted to the latest available demographic information at Pakistan Bureau of Statistics.

**Figure 1: Structure of survey team**

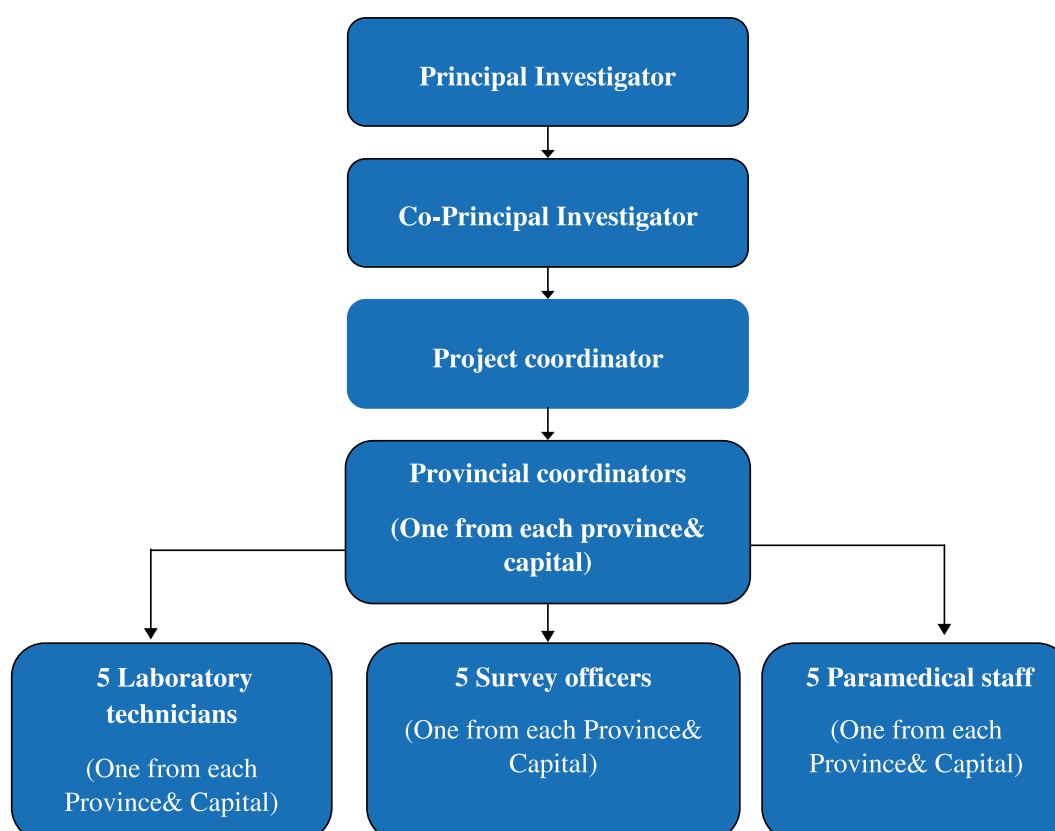


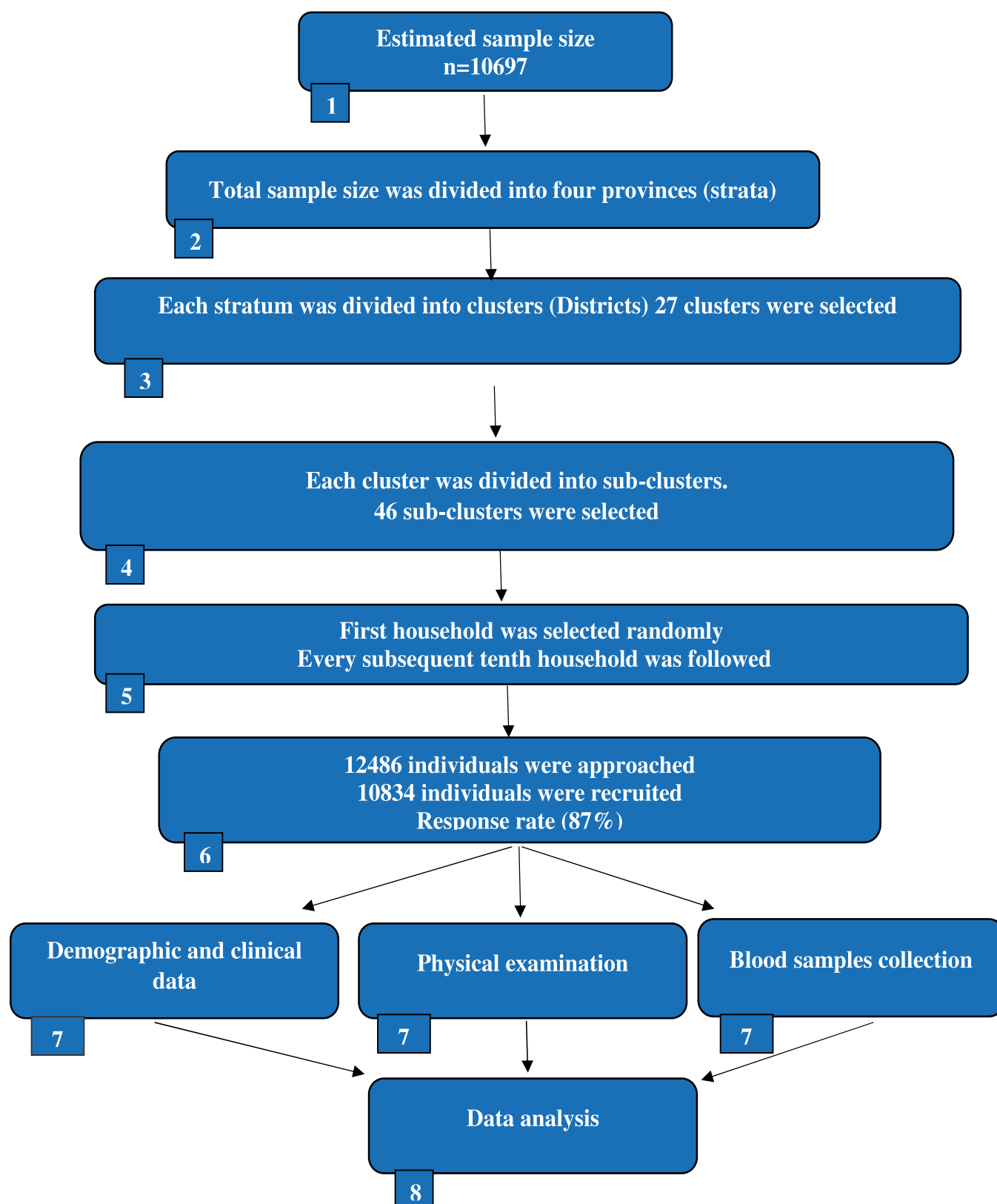
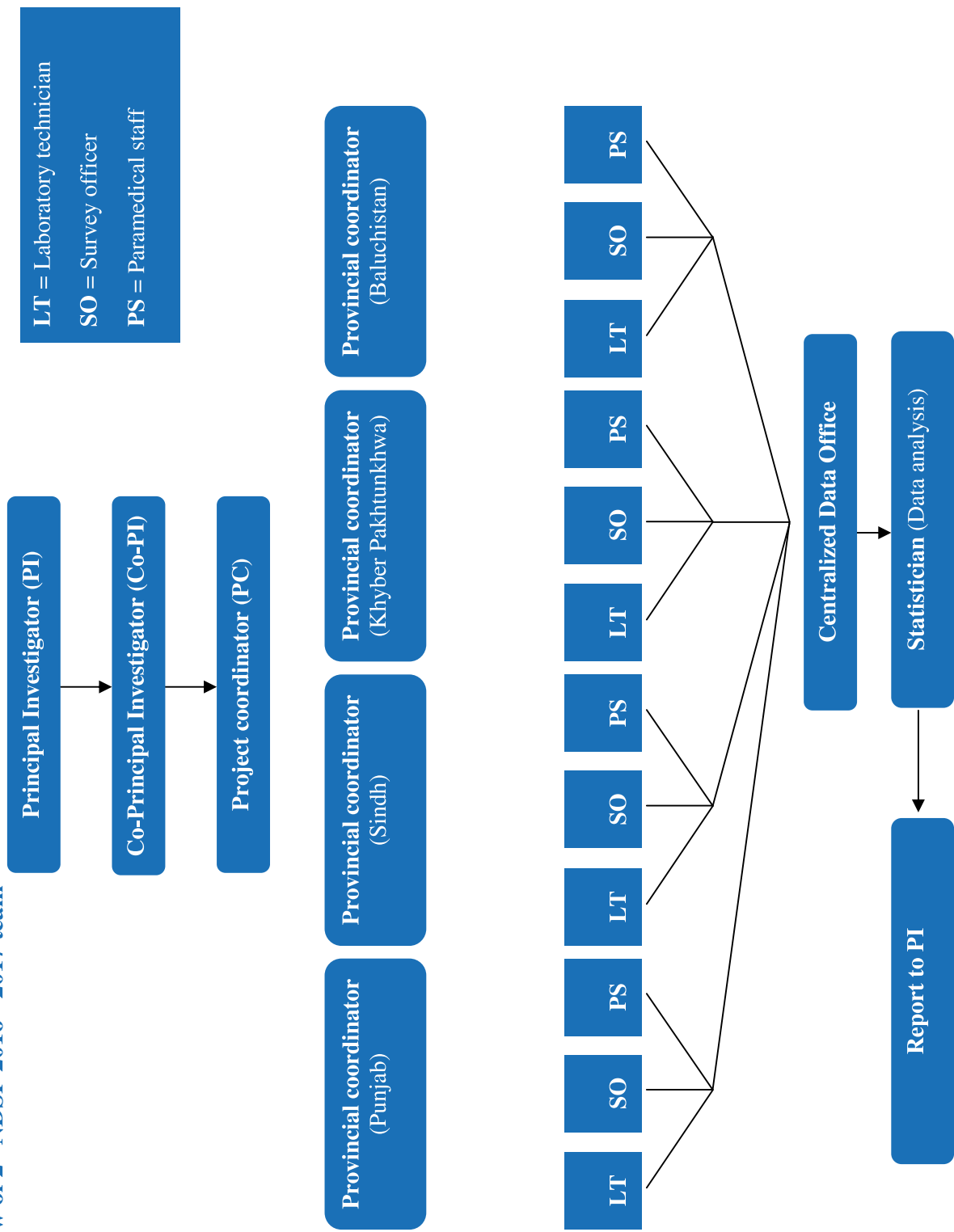
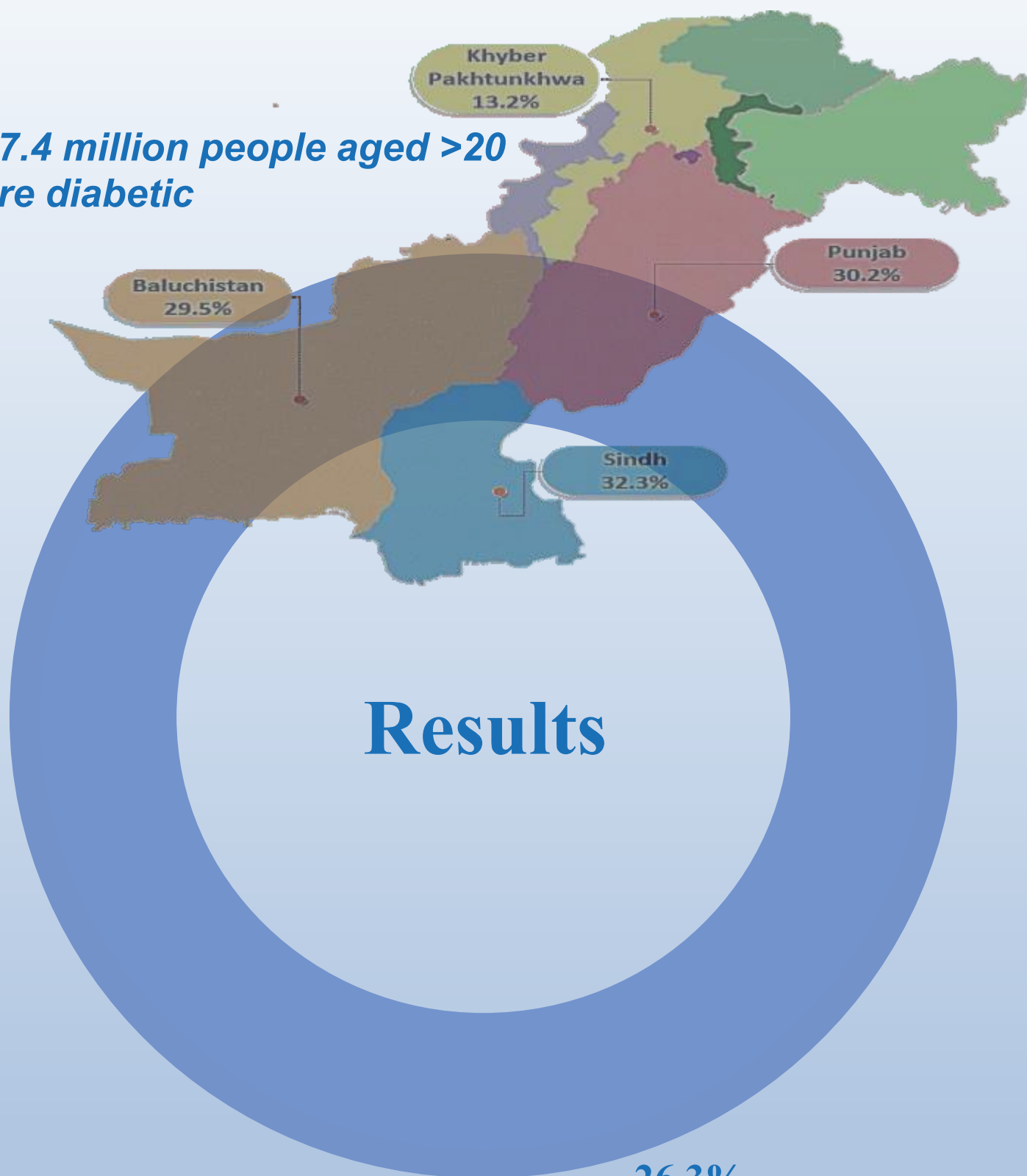
Figure 2: Step by step approach for the 2<sup>nd</sup>NDSP 2016 - 2017

Figure 3: Flow of 2<sup>nd</sup>NDSP 2016 - 2017 team

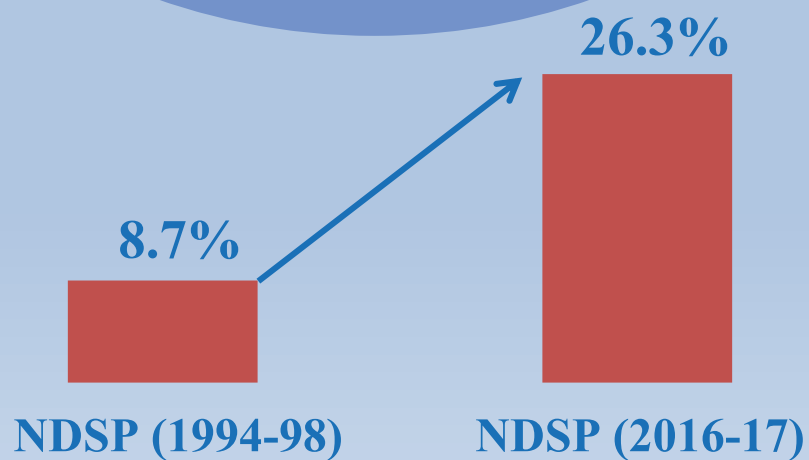




**27.4 million people aged >20  
are diabetic**



## Results







### **3. RESULTS**

#### **3.1 Demographic characteristics**

Basic characteristics of study population are presented in table 1. A total of 10834 persons were screened for diabetes; out of whom 43.9% were males and 56.1% were females. More than half of persons (53.5%) had at least primary level education. Almost, a third (30.2%) of the population had positive family history of diabetes and 14.5% were tobacco users. Mean BMI of participants was almost similar in all Provinces with an overall mean of  $27.2 \pm 6.0$  kg/m<sup>2</sup>. Highest mean blood pressure was seen in Baluchistan and lowest in Khyber-Pakhtunkhwa.

Table 1: Baseline characteristics of the study participants

Description	Punjab	Sindh	Khyber Pakhtunkhwa	Baluchistan	Overall
Number of participants	6221	2531	1544	538	10834
Age (years)	43.5 ± 14.1	45.5 ± 14.2	40.3 ± 12.9	48.4 ± 12.81	43.8 ± 14.0
Gender					
Male	2457 (39.5)	1192 (47.1)	835 (54.1)	257 (47.8)	4756 (43.9)
Female	3764 (60.5)	1339 (52.9)	709 (45.9)	281 (52.2)	6078 (56.1)
Primary education or more	2675 (49.6)	1353 (61.3)	759 (55.6)	278 (54.9)	5065 (53.5)
Tobacco addiction	614 (11.2)	493 (22.2)	117 (8.9)	152 (29.1)	1376 (14.5)
Positive family history of diabetes	1509 (27.8)	760 (37)	240 (22.2)	236 (43.9)	2745 (30.2)
Body mass index (kg/m <sup>2</sup> )	27.5 ± 6.1	26.5 ± 5.6	27.2 ± 6.1)	26.7 ± 5.0	27.2 ± 6.0
Male	91.7 ± 14.5	92.3 ± 12.1	98.0 (12.4)	96.7 ± 11.7	93.1 ± 13.8
Female	92.4 ± 15.0	94.3 ± 13.4	82.3 (11.7)	101.1 ± 15.6	93.2 ± 14.5
Blood pressure (mmHg)					
Systolic	126.0 ± 19.8	127.3 ± 18.5	121.3 (14.1)	135.7 ± 17.6	126.1 ± 18.9
Diastolic	84.5 ± 15.1	82.8 ± 11.8	79.8 (11.5)	89.0 ± 11.2	83.7 ± 14.0

### 3.1.1 Age and gender

The age distribution is shown in table 2. Overall, 26.5% were between 40-49 years followed by 21.5% were between 30-39 years. In women, majority were between 30-39 years whereas, in men it was 60+ years.

**Table 2: Age and gender distribution of respondents**

Age groups (years)	Men	Women	Both genders
	%	%	%
<b>20-29</b>	44.2	55.8	16.7
<b>30-39</b>	39.8	60.2	21.5
<b>40-49</b>	40.9	59.1	26.5
<b>50-59</b>	44.1	55.9	19
<b>60+</b>	52.8	47.2	16.3
<b>Overall</b>	43.8	56.2	100

### 3.1.2 Education Level

Educational level showed that 38.6% were illiterate and only 9.3% had completed graduation (Table 3).

**Table 3: Educational level of respondents**

Age groups (years)	Level of education					
	Illiterate %	Can read/ write %	Primary %	Intermediate %	Graduate %	Post-graduate %
<b>20-29</b>	20.8	6.8	9.8	18.2	18.5	6.5
<b>30-39</b>	32.7	8.4	14.3	10.2	9.4	5.6
<b>40-49</b>	41.5	7.9	12.8	8.1	7.9	4
<b>50-59</b>	43.6	8.4	16.6	6.1	6.7	3.4
<b>60+</b>	53.8	7.4	13.6	3.9	5.3	2.3
<b>Overall</b>	38.6	7.8	13.5	9.1	9.3	4.4

### 3.1.4 Marital Status

Majority of participants were married (84.8%) followed by never married (12.9%) as given in table 4.

**Table 4: Marital status of the respondents**

Age groups (years)	Marital status			
	Single %	Married %	Divorced/ Separated %	Widow %
<b>20-29</b>	54.4	44.8	0.6	0.1
<b>30-39</b>	9.2	90.2	0.3	0.2
<b>40-49</b>	3.7	94.6	0.5	1.2
<b>50-59</b>	2.8	94.3	0.6	2.3
<b>60+</b>	2.5	90.8	0.5	95
<b>Overall</b>	12.9	84.8	0.5	1.8

### 3.1.5 Tobacco Addiction

The proportion of current tobacco users was 14.5%. The prevalence of tobacco addiction increased with age and was highest (20.7%) in those aged 60 years or above (Table 5).

**Table 5: Tobacco addiction among respondents**

Age groups (years)	Current tobacco users %	Ex- tobacco users %	Non- tobacco users %
<b>20-29</b>	9.8	0.9	89.3
<b>30-39</b>	11.8	1.8	86.3
<b>40-49</b>	13.5	3.1	83.4
<b>50-59</b>	17.9	3.9	78.2
<b>60+</b>	20.7	5	74.2
<b>Overall</b>	14.5	2.9	82.5

## 3.2 Measurements

### 3.2.1 Body Mass Index (BMI)

Table 6 presents the BMI score according to Asian cutoff. About 27.7% respondents had normal weight (BMI <23), 14.2 % were overweight (BMI 23-24.9) and 58.1% were obese (BMI  $\geq$  25).

Using WHO criteria, 14.2% were overweight (BMI 25-26) and 43.9% were obese (BMI > 27). Most obese population was seen in those aged between 40-49 years (Table 7).

### 3.2.2 Hypertension

Overall, 46.2 % population had hypertension. The prevalence of hypertension increased with age and was highest (65.7%) in age group 60 years or above (Table 8).

**Table 6: BMI classification of the respondents by Asian cutoff**

Age groups (years)	Body mass index		
	Normal <23 kg/m <sup>2</sup> %	Over-weight 23-24.9 kg/m <sup>2</sup> %	Obese $\geq$ 25 kg/m <sup>2</sup> %
<b>20-29</b>	42.6	14.1	43.3
<b>30-39</b>	21.8	15.4	62.8
<b>40-49</b>	16.1	12.2	71.7
<b>50-59</b>	17.7	14.3	68.0
<b>60+</b>	26.5	15.3	58.2
<b>Overall</b>	27.7	14.2	58.1

**Table 7: BMI classification of the respondents by WHO criteria**

Age groups (years)	Body mass index (BMI)		
	Normal <23 kg/m <sup>2</sup> %	Over-weight 23-24.9 kg/m <sup>2</sup> %	Obese ≥25 kg/m <sup>2</sup> %
<b>20-29</b>	56.7	13.6	29.8
<b>30-39</b>	37.2	13.2	49.5
<b>40-49</b>	28.3	14.7	56.9
<b>50-59</b>	32.0	16.4	51.6
<b>60+</b>	41.8	15.4	42.8
<b>Overall</b>	41.9	14.2	43.9

**Table 8: Hypertension status of the respondents**

Age groups (years)	Hypertensive %	Non-hypertensive %
<b>20-29</b>	29.5	70.5
<b>30-39</b>	43.5	56.5
<b>40-49</b>	58.3	41.7
<b>50-59</b>	64.3	35.7
<b>60+</b>	65.7	34.3
<b>Overall</b>	46.2	53.8

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### 3.3 Diabetes

#### 3.3.1 Normal glucose tolerance

Overall prevalence of normal glucose tolerance was 60.09%. Normal glucose tolerance was higher in men than women. The prevalence of normal glucose tolerance with respect to age stratification showed a declining pattern (Table 9).

#### 3.3.2 Pre-diabetes

Overall, 14.4% respondents were pre-diabetic. Pre-diabetes was more prevalent in women who were aged between 30-39 years (Table 10).

#### 3.3.3 Prevalence of newly diagnosed diabetes mellitus

Overall, prevalence of newly diagnosed diabetes was 7.1% with slightly more preponderance (7.3%) in men than women (6.9%). Most newly diagnosed diabetics were aged 50 and above in both genders (Table 11).

#### 3.3.4 Prevalence of known diabetes

Table 12 shows that almost 19.2 % of the respondents already knew that they were diabetics. Its prevalence was higher in women and older age.

#### 3.3.5 Prevalence of diabetes mellitus

Overall prevalence of diabetes was 26.3% (Table 13). The prevalence increased with age and was maximally seen in 50-59 years' age (50.3% men and 49.3% women).

#### 3.3.6 Prevalence of diabetes and pre-diabetes, by Province and area of Pakistan

Using the oral glucose tolerance test (OGTT) criteria, highest prevalence of diabetes was seen in Sindh followed by Punjab. Highest prevalence of pre-diabetes was seen in Baluchistan as compared to other provinces (Table 14).

#### 3.3.7 Age, gender and area specific prevalence of pre-diabetes and diabetes in four provinces of Pakistan:

Urban women showed significantly higher prevalence of diabetes than rural women above the age of 40 years whilst in men these trends was seen in the age group of 60 years and above ( $p<0.05$ ). On the other hand, urban men in the age group 30-39 years showed significantly ( $p<0.05$ ) lower prevalence of diabetes than rural men (Figure 5).

Rural men showed significantly higher prevalence of pre-diabetes than urban men for the age group of 40-49 years whilst for women, significant difference was seen in urban as compared to rural population for the age group of 30-39 years (Figure 6).

**Table 9: Prevalence of normal glucose tolerance**

	Gender	Age (years)	Weighted Prevalence (%)	Weighted Prevalence (%)	Overall Prevalence (%)
OGTT	Male	20-29	82.4	61.6	60.09
		30-39	64.6		
		40-49	50.1		
		50-59	35.8		
		60+	34.9		
	Female	20-29	79.6	58.9	
		30-39	60.6		
		40-49	46.3		
		50-59	35.9		
		60+	35.3		
HbA1c	Male	20-29	85.6	63.4	64.525
		30-39	65.6		
		40-49	50.6		
		50-59	36.7		
		60+	38.2		
	Female	20-29	89.8	65.3	
		30-39	67.7		
		40-49	47.7		
		50-59	39.2		
		60+	40.4		



Table 10: Prevalence of pre-diabetes

	Gender	Age (years)	Weighted Prevalence (%)	Weighted Prevalence (%)	Overall Prevalence (%)
OGTT	Male	20-29	9.7	12.8	14.4
		30-39	13.4		
		40-49	13.2		
		50-59	14		
		60+	16.9		
	Female	20-29	13.1	15.6	
		30-39	17.3		
		40-49	14.7		
		50-59	14.8		
		60+	16.3		
HbA1c	Male	20-29	2.1	5.1	5.5
		30-39	5.9		
		40-49	5.5		
		50-59	7.7		
		60+	9.5		
	Female	20-29	2.5	5.9	
		30-39	7		
		40-49	7.2		
		50-59	8.3		
		60+	9.6		

**Table 11: Prevalence of newly diagnosed diabetes mellitus**

	Gender	Age (years)	Weighted Prevalence (%)	Weighted Prevalence (%)	Overall Prevalence (%)
OGTT	Male	20-29	3.6	7.3	7.1
		30-39	5.8		
		40-49	9.6		
		50-59	13.4		
		60+	11.4		
	Female	20-29	4.2	6.9	
		30-39	6.3		
		40-49	8		
		50-59	9.2		
		60+	12.2		
HbA1c	Male	20-29	6	8.5	7.4
		30-39	7.8		
		40-49	10.6		
		50-59	12.5		
		60+	10.4		
	Female	20-29	3.9	6.7	
		30-39	6.6		
		40-49	9.6		
		50-59	7.9		
		60+	9.6		

Table 12: Prevalence of known diabetes

	Gender	Age (years)	Weighted Prevalence (%)	Weighted Prevalence (%)	Overall Prevalence (%)
OGTT	Male	20-29	4.3	18.9	19.2
		30-39	16.3		
		40-49	27		
		50-59	36.9		
		60+	36.9		
	Female	20-29	3.1	19.4	
		30-39	15.8		
		40-49	31		
		50-59	40.1		
		60+	36.1		
HbA1c	Male	20-29	6.2	22.9	22.4
		30-39	20.7		
		40-49	33.3		
		50-59	43.2		
		60+	42		
	Female	20-29	3.9	22.1	
		30-39	18.6		
		40-49	35.6		
		50-59	44.7		
		60+	40.4		

Table 13: Prevalence of diabetes mellitus

	Gender	Age (years)	Weighted Prevalence (%)	Weighted Prevalence (%)	Overall Prevalence (%)
OGTT	Male	20-29	7.9	26.2	26.3
		30-39	22		
		40-49	36.6		
		50-59	50.3		
		60+	48.3		
	Female	20-29	7.3	26.3	
		30-39	22		
		40-49	39		
		50-59	49.3		
		60+	48.3		
HbA1c	Male	20-29	12.3	31.5	29.9
		30-39	28.5		
		40-49	43.9		
		50-59	55.6		
		60+	52.3		
	Female	20-29	7.7	28.8	
		30-39	25.2		
		40-49	45.1		
		50-59	52.6		
		60+	50		

Table 14: Prevalence of diabetes and pre-diabetes; by province and areas of Pakistan

Description	Punjab	Sindh	Khyber Pakhtunkhwa	Baluchistan
Overall (urban and rural)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Diabetes				
Known diabetes	23.7 (22.6-24.7)	23.6 (21.9-25.2)	10.2 (8.7-11.7)	19.1 (15.7-22.4)
Fasting glucose (FG)	3.3 (2.8-3.7)	3.6 (2.8-4.3)	1 (0.5-1.5)	3.1 (1.6-4.5)
2 hours glucose tolerance (2hGT)	1.1 (0.8-1.3)	1.4 (0.9-1.8)	0.4 (0.1-0.7)	4.7 (2.9-6.4)
Both FG and 2hGT	2.1 (1.7-2.4)	3.7 (2.9-4.4)	1.6 (0.9-2.2)	2.6 (1.2-3.9)
Newly diagnosed diabetes	6.5 (5.8-7.1)	8.7 (7.6-9.8)	3 (2.1-3.8)	10.4 (7.8-12.9)
Total diabetes	30.2 (29.0-31.3)	32.3 (30.4-34.1)	13.2 (11.5-14.8)	29.5 (25.6-33.3)
Pre-diabetes				
Fasting glucose (FG)	1.8 (1.4-2.1)	1.8 (1.2-2.3)	1.1 (0.5-1.6)	0.4 (0.1-0.9)
2 hours glucose tolerance (2hGT)	11.2 (10.4-11.9)	8.4 (7.3-9.4)	2.9 (2.0-3.7)	42.4 (38.2-46.5)
Both FG and 2hGT	2.1 (1.7-2.4)	1.5 (1.0-1.9)	0.5 (0.1-0.8)	8.7 (6.3-11.0)
Total Pre-diabetes	15.1 (14.2-15.9)	11.7 (10.4-12.9)	4.5 (3.4-5.5)	51.5 (47.2-55.7)

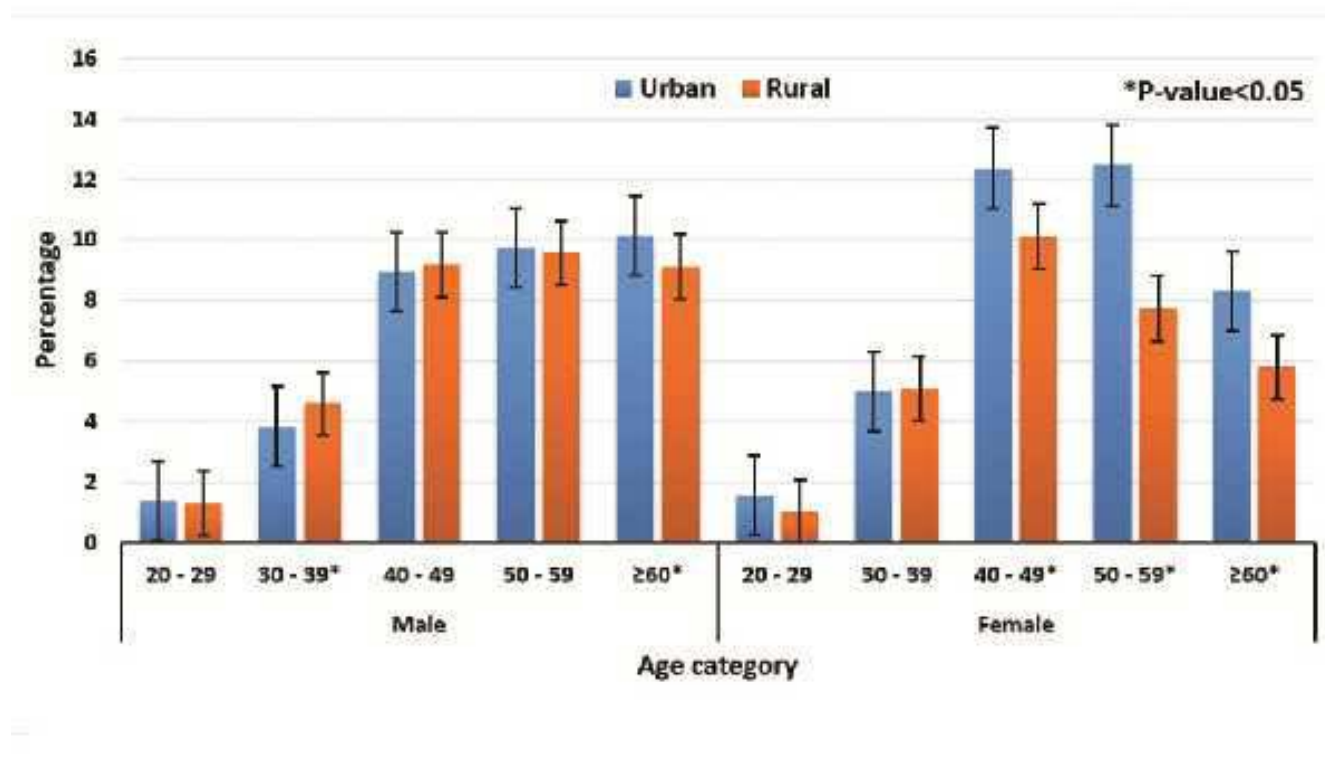
Description	Punjab	Sindh	Khyber Pakhtunkhwa	Baluchistan
<b>Urban</b>				
<b>Diabetes</b>				
<b>Known diabetes</b>	21.7 (19.8-23.5)	21.5 (19.2-23.7)	7.4 (4.5-10.2)	17.4 (11.8-22.9)
<b>Fasting glucose (FG)</b>	5.5 (4.4-6.5)	2.5 (1.6-3.3)	1.2 (0.0-2.4)	1.9 (0.0-3.8)
<b>2 hours glucose tolerance (2hGT)</b>	1.8 (1.2-2.4)	1.6 (0.9-2.2)	1.1 (0.0-2.2)	5.7 (2.3-9.0)
<b>Both FG and 2hGT</b>	2.6 (1.8-3.3)	2.7 (1.8-3.5)	0.6 (0.2-1.4)	0.9 (0.4-2.2)
<b>Newly diagnosed diabetes</b>	9.9 (8.5-11.2)	6.8 (5.4-8.1)	2.9 (1.0-4.7)	8.5 (4.4-12.5)
<b>Total diabetes</b>	31.6 (29.4-33.7)	28.3 (25.8-30.7)	10.3 (6.9-13.6)	25.9 (19.5-32.3)
<b>Pre-diabetes</b>				
<b>Fasting glucose (FG)</b>	2.1 (1.4-2.7)	1.9 (1.1-2.6)	0.2 (0-0.6)	0 (0-0)
<b>2 hours glucose tolerance (2hGT)</b>	11.9 (10.4-13.3)	7.7 (6.2-9.1)	1.7 (0.2-3.1)	45.9 (38.6-53.1)
<b>Both FG and 2hGT</b>	2.8 (2.0-3.5)	1 (0.4-1.5)	0.2 (0-0.6)	13.4 (8.4-18.3)
<b>Total Pre-diabetes</b>	16.8 (15.1-18.5)	10.6 (8.9-12.2)	2.1 (0.5-3.6)	59.3 (52.1-66.4)

Description	Punjab	Sindh	Khyber Pakhtunkhwa	Baluchistan
<b>Rural</b>				
<b>Diabetes</b>				
<b>Known diabetes</b>	21.4 (20.1-22.6)	19.4 (17.0-21.7)	10.3 (8.5-12.0)	15.1 (11.3-18.8)
<b>Fasting glucose (FG)</b>	2.3 (1.8-2.7)	6.4 (4.9-7.8)	1.7 (0.9-2.4)	5.1 (2.8-7.3)
<b>2 hours glucose tolerance (2hGT)</b>	0.6 (0.3-0.8)	1.5 (0.7-2.2)	0.7 (0.2-1.1)	5.7 (3.3-8.1)
<b>Both FG and 2hGT</b>	1.7 (1.2-2.1)	4.8 (3.5-6.0)	2.7 (1.7-3.6)	4.4 (2.2-6.5)
<b>Newly diagnosed diabetes</b>	4.6 (3.9-5.2)	12.7 (10.7-14.6)	5.1 (3.8-6.3)	15.2 (11.4-18.9)
<b>Total diabetes</b>	26 (24.6-27.3)	32.1 (29.3-34.8)	15.4 (13.3-17.4)	30.2 (25.4-34.9)
<b>Pre-diabetes</b>				
<b>Fasting glucose (FG)</b>	1.4 (1.0-1.7)	1.6 (0.8-2.3)	1.7 (0.9-2.4)	0.3 (0.0-0.8)
<b>2 hours glucose tolerance (2hGT)</b>	10.7 (9.7-11.6)	9.1 (7.3-10.8)	4.4 (3.2-5.5)	37.1 (32.0-42.1)
<b>Both FG and 2hGT</b>	1.4 (1.0-1.7)	2.2 (1.3-3.0)	0.9 (0.3-1.4)	6.4 (3.8-8.9)
<b>Total Pre-diabetes</b>	13.5 (12.4-14.5)	12.9 (10.9-14.8)	7 (5.5-8.4)	43.8 (38.6-48.9)

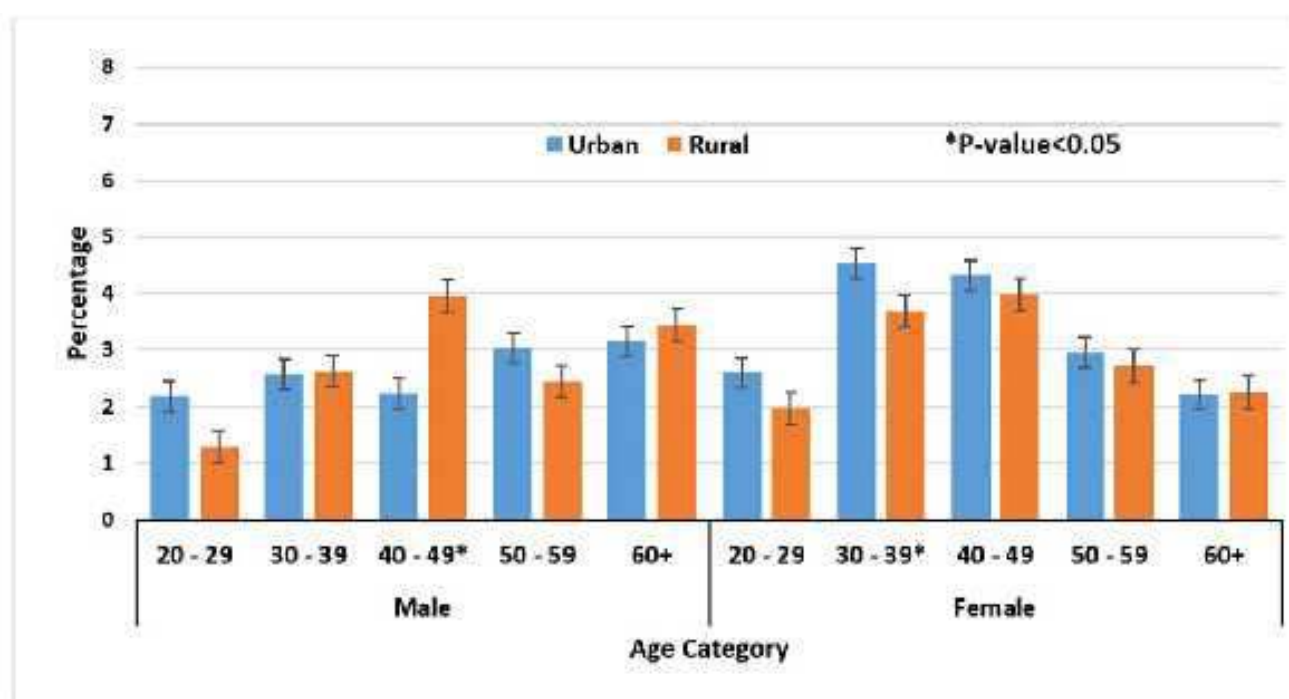
OGTT criteria for diagnosis of diabetes; Fasting  $\geq 126$ mg/dl and/or 2-hours  $\geq 200$ mg/dl

OGTT criteria for diagnosis of pre-diabetes; Fasting 110 – 125 mg/dl and/or RBS 140 – 199 mg/dl

**Figure 4: Age-stratified prevalence of diabetes among men and women with urban and rural distribution**



**Figure 5: Age-stratified prevalence of pre-diabetes among men and women with urban and rural distribution**





### 3.4 Dyslipidemia

#### 3.4.1 Raised cholesterol

About, 39.3% population had raised cholesterol levels (>200mg/dl). Deranged cholesterol was mostly seen in people aged between 50-59 years followed by those aged 40-49 years (Table 15).

#### 3.4.2 Hyper triglyceride

High triglycerides were seen in 51.5% respondents and this was mostly seen in individuals who were between 50-59 years of age followed by those who were between 40-49 years (Table 16).

#### 3.4.3 High low-density lipoprotein

Overall, 39.7% respondents had high levels of low density lipoprotein. Majority of such respondents were aged between 40-49 years followed by 50-59 years (Table 17).

#### 3.4.4 Low high-density lipoprotein

Majority of the population had low values of high density lipoprotein (83.5% men, 90% women). Among men, highest percentage of low high-density lipoprotein was seen in age group 40-49 years, while in women it was seen in age group 60+ years (Table 18).

**Table 15: Hypercholesterolemia status of the respondents**

Age groups (years)	Cholesterol	
	% ≤200 mg/dl	% >200 mg/dl
<b>20-29</b>	70.7	29.3
<b>30-39</b>	58.3	41.7
<b>40-49</b>	53.4	46.6
<b>50-59</b>	51.3	48.7
<b>60+</b>	58.8	41.2
<b>Overall</b>	60.7	39.3

Table 16: Hypertriglyceridemia status of the respondents

Age groups (years)	Triglyceride	
	% ≤150 mg/dl	% >150 mg/dl
20-29	67.0	33.0
30-39	48.8	51.2
40-49	38.6	61.4
50-59	37.0	63.0
60+	48.0	52.0
Overall	51.1	48.9

Table 17: Status of high low-density lipoprotein of the respondents

Age groups (years)	LDL	
	% ≤130 mg/dl	% >130 mg/dl
20-29	66.4	33.6
30-39	59.1	40.9
40-49	54.8	45.2
50-59	55.0	45.0
60+	59.9	40.1
Overall	60.3	39.7

Table 18: Low high-density lipoprotein of the respondents

Age groups (years)	HDL			
	Men		Women	
	% >40 mg/dl	% ≤40 mg/dl	% >50 mg/dl	% ≤50 mg/dl
20-29	15.7	84.3	13.7	86.3
30-39	17.1	82.9	8.5	91.5
40-49	15.2	84.8	8.3	91.7
50-59	17.0	83.0	8.0	92.0
60+	20.0	80.0	7.3	92.7
Overall	16.5	83.5	10	90



# Risk Factors





### 3.5. Risk Factor Analysis

#### 3.5.1 Risk factor of diabetes, dyslipidemia, hypertension and obesity

Table 19 shows the multivariable logistic regression for identifying the associate risk factors for diabetes, pre-diabetes, hypertension, obesity and dyslipidemia. Age (greater than or equal to 43 years), family history of diabetes, hypertension, obesity and dyslipidemia were significant risk factors for diabetes ( $p \leq 0.0001$ ). Similar were the risk factors for pre-diabetes including education with the exception of obesity ( $p \leq 0.05$ ). Significant association was found between diabetes, hypertension, obesity and dyslipidemia ( $p \leq 0.05$ ).

**Table 19: Risk factor of Diabetes, Dyslipidemia, Hypertension and Obesity**

Risk Factors	Diabetes		Pre-diabetes		Dyslipidemia		Hypertension		Obesity	
	Adjusted Odds ratio	P-value	Adjusted Odds ratio	P-value	P-value	P-value	Adjusted Odds ratio	P-value	Adjusted Odds ratio	P-value
Location (Rural)										
Age ( $\geq 43$ years)	3.3 (2.9-3.8)	<0.0001	1.8 (1.5-2.2) <0.0001	0.55 (0.4-0.7)	<0.0001		2.3 (2.0-2.6)	<0.0001	1.1 (1.0-1.3)	0.032
Gender (Female)				0.53 (0.4-0.7)	<0.0001		1.6 (1.4-1.9)	<0.0001	1.4 (1.2-1.6)	<0.0001
Education (primary or more)			0.8 (0.7-0.9) 0.034	0.70 (0.6-0.9)	0.004					
Family history of diabetes	1.9 (1.7-2.2)	<0.0001	1.5 (1.2-1.8) <0.0001				1.3 (1.2-1.5)	<0.0001	1.2 (1.0-1.4)	0.001
Diabetes				1.84 (1.3-2.4)	<0.0001		2.2 (2.0-2.6)	<0.0001	1.4 (1.2-1.6)	<0.0001
Dyslipidemia	1.8 (1.3-2.4)	<0.0001	1.5 (1.1-2.1) 0.011	-	-		1.3 (1.1-1.8)	0.019	1.7 (1.3-2.1)	<0.0001
Hypertension	2.2 (1.9-2.5)	<0.0001	1.2 (1.0-1.4) 0.009	1.3 (1.1-1.7)	0.008		-	-	1.7 (1.5-1.9)	<0.0001
Obesity	1.4 (1.3-1.6)	<0.0001		1.7 (1.3-2.1)	<0.0001		1.7 (1.5-2.0)	<0.0001	-	-







# **Conclusion & Recommendations**







## **4. CONCLUSION**

The Survey revealed that overall prevalence of diabetes was 26.3%. This shows that there are 27.4 million people aged 20 and above with diabetes. The prevalence was slightly high in urban (28.3%) than rural area (25.3%). Similarly, overall glycemic dysregulation (diabetes, pre-diabetes) was also high (43.8%) in urban areas as compared to rural area (39.2%).

The Survey also revealed that 43.9% were obese (44.6 million), 46.2% (48.1 million) were hypertensive and 39.3% had high cholesterol level (41.3 million).

These findings of the Survey imply that diabetes and its associated conditions i.e. obesity, hypertension and dyslipidemia have reached to epidemic proportions.

## **5. RECOMMENDATIONS**

Diabetes is one of the major leading causes of morbidity and mortality. Its prevalence in the country was 8.7% in 1<sup>st</sup> National Diabetes Survey which is now 26.7%; indicating a massive increase in the burden. Keeping in view this, it is important to take immediate measures for its prevention and control.

The following are suggestions which may be considered for future planning.

- There is a need to create awareness among masses about the causes and risk factors of the diseases i.e. unhealthy diet and lack of physical activity. To achieve this task, print and electronic media may be used. Similarly, community elders, religious leaders may also be encouraged to play their role for creating awareness among common people to adopt healthy life styles.
- Education departments (Federal and Provincial) need to be involved for promoting physical activity in schools and colleges so that next generation may adopt healthy lifestyle. Similarly, information about the risk factor and prevention of diabetes may be added in the curriculum of primary and secondary level. Besides this, the administrations of educational institutions must ensure availability of place for physical activity of the students as well as the availability of healthy food items in the cafeteria.
- Effective interventions are required at general population level to increase intake of fruits, vegetables and avoid intake of junk food as well as promotion of physical activities.

- Health care providers may be trained on the diagnostic and treatment of diabetes mellitus especially in primary health care units. Besides this, the facilities for early diagnosis and treatment of diabetes must be available at all levels including primary, secondary and tertiary health care.
- The non communicable diseases (NCDs) unit working at the Ministry of National Health Services, Regulation and Coordination may coordinate with the Provincial Health Departments for formulation of National Action Plan to prevent and control this deadly disease.

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## 7. APPENDICES

## Appendix I

## Cluster (district) and sub-clusters (tehsils/towns) distribution

Urban (3711)		Rural (6986)	
District	Tehsils/town	District	Tehsils/town
Attock (60)	Attock (30)	Islamabad (40)	Zone-IV (40)
	Fateh Jung (30)		
Rawalpindi (390)	Rawalpindi (195) Gujar Khan (195)		
Islamabad (80)	Zone-I G6 (80)		
Lahore (1110)	Nishtar town (555)	Gujranwala (1090)	Khilaishahpur (545)
	Iqbal town (555)		Aroop town (545)
Multan (290)	Mumtazabad (145)	Hafizabad (390)	PindiBhattiyan (390)
	Shershah (145)	Sahiwal (990)	Okara (495)
			Chichawatni (495)
		Muzaffargarh (1480)	Kotaddu (1000)
			Alipur (480)
Larkana (70)	Larkana (70)	Khairpur (510)	Nara (255)
Nawabshah (40)	Nawabshah (40)		Kotdiji (255)
		Tharparkar (380)	Mithi (190)
			Chachoro (190)
		Badin (440)	Talhar (220)
			Matli (220)
Karachi (1191)	Orangi town (397)		
	North Nazimabad (397)		
	Korangi town (397)		
Charsadda (40)	Charsadda (40)	Buner (290)	Daggar (145)
Peshawar (220)	Town-I (110)		Gagra (145)
	Town-II (110)	Mansehra (630)	Balakot (630)
Kohat (40)	Kohat (40)	Nowshera (370)	Risalpur (124)
			Nizampur (124)
			Rashakai (124)
Mastung (40)	Mastung (40)	Sibi (84)	Lehri (84)
Lasbella (140)	Hub City (70)	Lasbella (258)	Hub Goth (86)
	Bela (70)		Bella Goth (86)
			Gadani Goth (86)
		Khuzdar (34)	Nall (34)

## Appendix II

**Informed consent (English)****Information and agreement paper between the participant and the researcher**

Dear Sir/Madam,

**Baqai Institute of Diabetology and Endocrinology (BIDE)** has planned a nationwide survey to determine the prevalence of type 2 diabetes in Pakistan. The survey will be called Diabetic registry of patients with type 2 diabetes (DROP-2).

This letter of information is to invite you to participate in this survey. This project is being carried out with the permission from the ethical committee of our institute. You are selected randomly as a possible participant in this study. The result of the study will serve as the baseline data for further research regarding diabetes care in Pakistan. Moreover, the main aim of this survey is to find the prevalence of diabetes in Pakistan. To do this, we have to collect some information from you and also need to conduct some physical and clinical examinations which will help to fulfill the objectives of the project with your kind permission.

From every consented participant, 7ml blood will be collected in fasting condition for biochemical analysis (HbA1c, FBG and lipid profile). Additional 2ml blood (RBG) will be drawn after 2 hours of 75gram oral glucose intake. You are free to choose either to participate or not to participate in this project. You can trust that any information you will give us, including the results of your examinations, will all be treated very confidentially and will only be used for research purpose only. For that reason, it is important that the information you give be as correct and truthful as possible. You also have the right to withdraw from the project at any time during the study without providing reasons. This will have no negative consequences on you.

Maybe you cannot receive too much direct benefit from taking part in this research, but it will have a favorable impact on public health in future. Your participation will contribute greatly to our research. We thank you in advance for agreeing to help us out. If you have any question or concern about the study, please contact with us without hesitation.

I have received the information about the study. I hereby consent to participate in it.

\_\_\_\_\_  
Signature of the participant

Dated: \_\_\_\_\_

Signature of the Principal investigator

Dated: \_\_\_\_\_

\_\_\_\_\_

Signature of the person obtaining Consent

Dated: \_\_\_\_\_

- Any questions you may have will be answered by:

Name: **Dr. Asher Fawwad**

Phone Number: **021-36707179**

- In case of a research-related emergency, call:

Day Emergency Number: **021-36707179**

Night Emergency Number: **021-6688897**



## Informed consent (Urdu)

## فارم برائے تحریری رضامندی

محققین (researches) اور امیدوار کے درمیان میں مطالعاتی پروگرام

محترم جناب / محترمہ جناب عالیہ!

پاکستان میں بھائی انسٹیٹ آف ڈیابٹولوجی اینڈ انڈوکرائینولوجی نے قومی سطح پر ذیابیطس کی قسم دوم (Type II Diabetes) کا جائزہ لینے کا منصوبہ بنایا ہے۔ ذیابیطس کے مریض کا یہ جائزہ "قسم دوم ذیابیطس کا عمل اندراج (Diabetic Registry of Patient with Type II Diabetes) یا DROP-2 کہلایا جائیگا۔

اس فارم کے ذریعے آپ سے اس جائزے میں شرکت کی اجازت لی جاتی ہے۔ اور ساتھ ہی آپ کو آگاہ کیا جاتا ہے کہ یہ project ہمارے ادارے کے ethical committee کی اجازت سے لیا جا رہا ہے آپ کو بروقت اس study میں ممکنہ امیدوار کی حیثیت سے لیا جائیگا اس survey کا مقصد Type-II diabetes ذیابیطس کے متعلق معلومات جمع کرنا ہے تاکہ پاکستان میں ذیابیطس کی احتیاط کے حوالے سے مزید research کی جاسکے اور ذیابیطس کے پھیلاؤ (Prevalance) کو روکنے کیلئے ممکنہ اقدامات کئے جاسکے اسکے لئے آپ کے بھرپور تعاون سے ہمیں کچھ معلومات آپ سے حاصل کرنا ہوں گی اور آپ کے کچھ جسمانی (Physical) اور طبی (Clinical) test لینے ہوں گے آپ کا یہ تعاون ہمارے Project کے مقصد کو پورا کرنے میں مددگار ثابت ہوگا۔

ہر رضامند امیدوار سے نہار منہ 7 ml خون کو حیاتی کیمیائی تجزیہ (FBG, HbA1c, Lipid Profile) کے لیے جمع کیا جائے گا اور پھر 75 گرام گلوکوز کی مقدار پلانے کے 2 گھنٹے بعد مزید 2 ml خون (RBG) لیا جائے گا۔ آپ اس Project کے دوران آزاد رہیں گے کہ آپ حصہ لیں یا نہ لیں۔ آپ بھروسہ کر سکتے ہیں کہ آپ جو معلومات بھی ہمیں دیں گے جس میں آپ کے Bio Chemical Test Result بھی شامل ہیں۔ ان سب کو خفیہ طور پر صرف research purpose میں ہی استعمال کیا جائیگا۔ اس کی وجہ سے یہ ضروری ہے کہ جو معلومات بھی آپ ہمیں دیں وہ جہاں تک ممکن ہو سکے درست اور حق گو ہونی چاہئے۔ آپ کے پاس یہ اختیار بھی ہوگا کہ آپ جب چاہیں بغیر کوئی وجہ بتائے اس Project سے نکل سکتے ہیں۔ اس کا آپ پر کوئی منفی اثر نہیں پڑیگا۔ ہو سکتا ہے کہ بظاہر آپ کو اس Research سے کوئی فائدہ حاصل نہ ہو مگر مستقبل میں عام لوگوں پر اس کا مفید اثر پڑیگا۔ آپ کی شرکت ہمارے Project میں قابل احترام ہوگی۔ ہم آپ کی مدد کے بہت زیادہ شکر گزار ہیں۔ اگر اس project کے بارے میں کوئی سوال ہے تو مہربانی فرما کر بغیر کسی جھجک کے ہم سے رابطہ کریں۔

میں نے اس Project کے بارے میں تمام معلومات حاصل کر لی ہیں اور میں انہیں حصہ لینے کے لیے رضامند ہوں۔

نام امیدوار:

دستخط امیدوار:

تاریخ:

تاریخ:

پرنسپل انویسٹگیٹر کے دستخط:

رضامندی فارم لینے والے کے دستخط: تاریخ:

## موجودہ معلوماتی ذرائع

اس تحقیق سے متعلق مزید سوالات کے جواب کے لئے رابطہ کریں

نام: ڈاکٹر اشعر فواد

فون 021-36707179

تحقیق (Research) سے متعلق ایمرجنسی میں رابطہ کے لئے

دن کے وقت ایمرجنسی نمبر 021-36707179

رات کے وقت ایمرجنسی نمبر 021-36688897

## Data Collection Form (English)

## Appendix III

Punjab	<input type="checkbox"/>	Survey no.:	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Sindh	<input type="checkbox"/>	Date (dd-mm-yy):	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Khyber Pakhtunkhwa	<input type="checkbox"/>	District:	<input type="text"/>
Baluchistan	<input type="checkbox"/>		

## DEMOGRAPHY

Participant's name: \_\_\_\_\_ Father's name: \_\_\_\_\_

Address: \_\_\_\_\_

Date of birth (dd-mm-yy): ☐☐ - ☐☐ - ☐☐ Age ☐☐ (years):

Gender: Male 1; Female 2 ☐

Community: Urdu speaking 1; Punjabi 2; Sindhi 3; Pathan 4; Balochi 5; Pashtuns 6; Seraiki 7; Others 8 ☐

Education: Illiterate 1; Can read/write 2; Primary 3; Secondary 4; Intermediate 5; Graduate 6; Post graduate 7 ☐

Occupation: Administrative/professional 1; Business 2; Skilled labor 3; Manual labor 4; Home duties 5; Unemployed 6; Pensioner 7 ☐

Addiction: Tobacco: Yes 1; Ex-addict 2; No 3 ☐

Alcohol: Yes 1; Ex-addict 2; No 3 ☐

Exercise: Sedentary 1; Light 2; Moderate 3; Heavy 4 ☐

Marital status: Single 1; Married 2; Divorced/separated 3; Widowed 4 ☐

## FASTING STATUS

How many hours since last food or drink, except water? (in hours) ☐☐

## MEDICAL HISTORY

Has a doctor ever told you that you have diabetes? No 1; Yes 2; Don't know ☐

(If yes, year of diagnosis: \_\_\_\_\_)

Present, regular treatment of diabetes

None (y/n) ☐ Diet (y/n) ☐ Herbal(y/n) ☐ Oral drugs (y/n) ☐ Insulin (y/n) ☐

(if drugs or insulin, specify type: \_\_\_\_\_)

Have any of your first degree relatives ever had diabetes? No 1; Yes 2; Don't know 3 ☐

(Specify family member(s): \_\_\_\_\_)

Has a doctor ever told you that you have high blood pressure? No 1; Yes 2; Don't know 3 ☐

If yes, are you currently, regularly taking medication? No 1; Yes 2; Don't know 3 ☐

(Specify type: \_\_\_\_\_)

Have any of your first degree relatives ever had high blood pressure? No 1; Yes 2; Don't know 3 ☐

(Specify family member(s): \_\_\_\_\_)

Usual physical activity, occupational Sedentary 1; Light 2; Moderate 3; Heavy 4 ☐

Usual physical activity, leisure  
Never 1; less than once a week 2; 1 – 2 times/week 3; More than 3 times/week 4 ☐

## OBSTETRIC HISTORY (women only)

How many babies have you had born alive? number

How many babies have you had born dead (stillbirths)? number

How many miscarriages have you had? number

How many surgical abortions have you had? number

## EXAMINATION

Height (cm)  Weight (kg)

Waist circumference (cm)  Hip circumference (cm)

Blood pressure (mmHg)

Systolic First  Second

Diastolic First  Second

## BLOOD CHEMISTRY

GTT – Overnight fasting (mg/dl)  GTT – After 2hrs glucose (mg/dl)

Cholesterol (mg/dl)  Triglycerides (mg/dl)

Low density lipoprotein (mg/dl)  High density lipoprotein (mg/dl)

HbA1c (%)

## Data Collection Form (Urdu)

**ذیابیطس کا سروے ۲۰۱۶**

	چٹاپ سندھ بلوچستان اسلام آباد		سروے نمبر: تاریخ: ضلع:
--	--	--	------------------------------

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**ایموگرافی**

امیدوار کا نام: \_\_\_\_\_ والد کا نام: \_\_\_\_\_

شناختی کارڈ نمبر: \_\_\_\_\_ موبائل نمبر: \_\_\_\_\_

پتہ: \_\_\_\_\_ عمر: \_\_\_\_\_ تاریخ پیدائش: \_\_\_\_\_

**جنس:** مرد 1، عورت 2

**برادری:** اردو بولنے والے 1، پنجابی 2، سندھی 3، پشتان 4، بلوچی 5، پنجتون 6، سرائیکی 7، دوسرے 8

**تعلیم:** جاہل 1، لکھا پڑھ سکتا ہے 2، پرائمری 3، سینکڑری 4، انٹر میڈیٹ 5، گریجویٹ 6

**پست گریجویٹ 7**

**پیشہ:** پیشہ ور 1، کاروبار 2، ہنرمند مزدور 3، دفنی مزدوری 4، گھر کے کام کان 5، بیروزگار 6

**دلیند یا ب ملازم 7، طالب علم 8**

**لت:** تمباکو: ہاں 1، پیسلے تھی 2، نہیں 3

**شراب:** ہاں 1، پیسلے تھی 2، نہیں 3

**ازدواجی حیثیت:** غیر شادی شدہ 1، شادی شدہ 2، طلاق یافتہ / علیحدگی 3، بیوہ 4

**وزرش:** کچھ بھی نہیں 1، ہلکی 2، درمیانی 3، بھاری 4

**نہارمہ:** کتنی دیر پہلے آپ نے کھایا یا پیا ہے پانی کے علاوہ؟ \_\_\_\_\_

**طبی معائنہ:** کیا ابھی آپ کو ڈاکٹر نے بتایا کہ آپ کو شوگر ہے؟

(اگر ہے تو کب پتہ چلا۔۔۔۔۔)

کیا آپ مستقل علاج کرواتی ہیں؟

نہیں ☐ خوراک ☐ جزی بوٹی ☐ ادویات ☐ انسولین ☐

(اگر کوئی دوا یا انسولین ہے تو نام بتائیں۔۔۔۔۔)

کیا آپ کے فونی رشتے میں سے کسی کو شوگر ہے؟

(نام واضح کریں۔۔۔۔۔)

نہیں 1، ہاں 2، پتہ نہیں 3

<input type="checkbox"/>	نہیں 1، ہاں 2، پتہ نہیں 3	کیا آپ کو کسی ڈاکٹر نے بتایا کہ آپ کو بلڈ پریشر ہے؟
<input type="checkbox"/>	نہیں 1، ہاں 2، پتہ نہیں 3	اگر ہے تو آپ مستقل کون سی دوا لے رہے ہیں؟
		(نام / قسم بتائیں)-----
<input type="checkbox"/>	نہیں 1، ہاں 2، پتہ نہیں 3	کیا آپ کے خونی رشتے میں کسی کو بلڈ پریشر ہے؟
		(اگر ہے تو نام واضح کریں)-----
<input type="checkbox"/>	بیٹھے رہنا 1، ہلکا 2، اعتدال پسند 3، بھاری 4	عام طور پر کام کے وقت جسمانی سرگرمی کیا ہے؟
		فارغ وقت میں جسمانی سرگرمی کیا ہے؟
<input type="checkbox"/>	کچھ نہیں 1، ہفتے میں ایک دفعہ / کم 2، ہفتے میں 1-2 مرتبہ 3، ہفتے میں 3 سے زیادہ مرتبہ 4	کچھ نہیں 1، ہفتے میں ایک دفعہ / کم 2، ہفتے میں 1-2 مرتبہ 3، ہفتے میں 3 سے زیادہ مرتبہ 4
	(اختیاری)	حمل کے متعلق سوالات (سربازی شدہ مائیں کے لئے)
<input type="checkbox"/>	تعداد	آپ کے کتنے بچے زندہ ہیں؟
<input type="checkbox"/>	تعداد	آپ کے کتنے بچے پیدا ہوتے ہی فوت ہو گئے؟
<input type="checkbox"/>	تعداد	آپ کے کتنے بچے خود ضائع ہو گئے؟
<input type="checkbox"/>	تعداد	آپ نے کتنے بچے ضائع کروائے؟
		پیمائش
kg <input type="text"/>	وزن	cm <input type="text"/>
cm <input type="text"/>	ہپ	cm <input type="text"/>
		فشار خون
mmHg <input type="text"/>	دوسرا	mmHg <input type="text"/>
mmHg <input type="text"/>	دوسرا	mmHg <input type="text"/>
		سسٹولک
		ڈائسٹولک
		خون کے ٹیسٹ
<input type="text"/>	GTT گلوکوز کے دو گھنٹے بعد	<input type="text"/>
<input type="text"/>	ٹرائیگلیسرائیڈ (mg/dl)	<input type="text"/>
<input type="text"/>	ہائی ڈینسٹی لیپو پروٹین (mg/dl)	<input type="text"/>
		<input type="text"/>
		GTT نہار منہ
		کولیسٹرول (mg/dl)
		لو ڈینسٹی لیپو پروٹین (mg/dl)
		HbA1C (%)

## Appendix IV

**Specimen Collection and Handling**

1. Wash your hands before and after each sample collection.
2. Identify the patient.
3. Verify that the patient is fasting.
4. Assemble necessary supplies like vacutainer needle with holder, vacutainer tubes (Nafl for glucose, gel for lipid profile and EDTA for HbA1c), spirit or alcohol swab, gauze pad, bandage and gloves.
5. Reassure the patient. Be calm and confident.
6. Position the patient in a chair and explain the procedure to patient.
7. Verify paperwork and select the tubes.
8. Ensure the patient's hand is closed.
9. Select a vein site.
10. Cleanse the vein puncture site with spirit in a circular motion and allow drying.
11. Apply or tie the tourniquet (No longer than one minute).
12. Inspect the needle. Use safety equipment.
13. Perform vein puncture using the correct order of the draw i.e first gel, then EDTA and in last Nafl tube.
14. Rotate Nafl and EDTA tubes gently to mix.
15. Do not rotate or mix gel tube.
16. Ensure patient's hand is open.
17. Release and remove the tourniquet.
18. Place the gauze pad over the puncture site.
19. Remove the needle. Never recap needle.
20. Apply pressure to vein puncture site until bleeding has stopped.
21. Bandage the patient's arm.
22. Dispose of the needle unit in a puncture resistant container.
23. Label the tubes and record the date and time of collection; collector's initials, name of patient, and lab number.
24. Clean up all supplies and waste to discard in appropriate containers.

25. In case on non-diabetic patient, give a load of 75gms glucose in 250-300 ml of water orally to patient and note time with first sip.
26. Instruct patient to sit for two hours and do not perform any physical work.
27. Send properly labeled blood collection tubes to the laboratory with appropriate slips.
28. After 2 hours of oral glucose draw RBS sample with same precaution and procedure.
29. Leave patient courteously.
30. Send properly labeled blood RBS sample tube to the laboratory with appropriate slip.

### **Separation of Serum / Plasma**

1. Check the sample and enter in file/register.
2. Allow to clot the gel containing tube. 30 min at room temperature or 15 min in water bath at 37°C.
3. Centrifuge gel and Nafl tubes for 10-15 minutes at 3500-4000 rpm.
4. Then separate serum / plasma from cells in pre-labeled eppendorf tube.
5. Whole blood sample can be save in same tube or in eppendorf tube.

### **Specimen Storage**

1. Serum / plasma will be stable on ambient temperature for 2-3 hours, in refrigerator for 1 week, at -20°C for 60 days and at -80°C for 2-5 year.
2. Refrigerate EDTA tube immediately. Whole blood sample can be stored at 2-10°C for 1 week, at -20°C for 60 days and at -80°C for 2-5 year.



TEST	VACUTAINER	AMOUNT	INSTRUCTIONS	STORAGE
Glucose	Grey top (Vacutainer containing Sodium fluoride)	2 ml	Mix the tube contents by gently inverting the tube five times. Centrifuge for 10-15 minutes at 3500-4000 rpm. Then separate plasma from cells.	PLASMA: Ambient 2-3 hrs Refrigerated for 1 week –20°C for 60 days –80°C for 2-5 year
Lipid Profile	Yellow top (Gel containing Vacutainer)	3-5 ml	Allow to clot. ( <b>do not mix</b> ) Centrifuge for 10-15 minutes at 3500-4000 rpm. Then separate serum from cells.	SERUM: Ambient 2-3 hrs Refrigerated for 1 week –20°C for 60 days –80°C for 2-5 year
HbA1c	Purple top (Vacutainer containing EDTA)	2 ml	Mix the tube contents by gently inverting the tube five times.	Refrigerated immediately –20°C for 60 days –80°C for 2-5 year

### Transportation

1. **Primary receptacle:** Seal the lid of Eppendorf tube properly with the help of sticking tape.
2. **Secondary receptacle:** Place the sealed Eppendorf tube in durable, watertight, leak-proof rack. Several wrapped primary receptacles may be placed in one secondary receptacle. Seal the rack with lid.
3. **Tertiary receptacle or outer shipping package:** The secondary receptacle is placed in an outer shipping package with ice pack or dry ice which protects it and its contents from outside influences such as physical damage and water while in transit.

## Appendix V

## Testing Procedures

**Procedure for Glucose, Cholesterol, Triglyceride, Hdl–Cholesterol (Direct),  
LDL–Cholesterol (Direct) and HbA1c Testing**

**Glucose (fasting / random) by GOD PAP, Cholesterol by CHOD-PAP, Triglyceride by GPO-PAP, HDL–cholesterol by Direct and LDL–cholesterol by direct method as follow**

1. Perform everyday usage procedure of Selectra Pro S (Start up, calibration and controls).
2. Give sample ID to Selectra Pro S, select tests and allot a test number to specimen.
3. Place sample on sample tray at appropriate number.
4. Start analyzer and wait for results.
5. Note the result.

**HbA1c by HPLC method:**

1. Perform everyday usage procedure of D-10 (Start up, calibration and controls).
2. Set samples in sample rack.
3. Mix samples by gently inverting rack 3-5 times.
4. Insert samples in window of D-10.
5. Allow D-10 to scan samples.
6. Give sample ID according to position number in rack.
6. Start analyzer and wait for results.
7. Note the result.

**Glucose (fasting / random) by GOD PAP on semi automated analyzers:**

Take 4 test tubes and label as blank, standard, control and sample #

	<b>Blank</b>	<b>Std</b>	<b>Control</b>	<b>Test</b>
Reagent	1 ml	1 ml	1 ml	1 ml
Distilled water	10 µl	----	----	----
Standard	----	10 µl	----	----
Control sample	----	----	10 µl	----
Serum	----	----	----	10 µl

Mix & incubate for 10 min at 37°C or for 15 min at room temperature.

Read at appropriate program.

## Appendix VI

## Ethical Clearance

	<b>National Bioethics Committee (NBC) Pakistan</b>	
<b>Ref: No.4-87/17/NBC-226/NBC/2664</b>		<b>Date: 31<sup>st</sup> January, 2017</b>
<p><b>Patron</b> Minister of State, Ministry of National Health Services Regulations and Coordination</p> <p><b>Chairperson</b> Secretary, Ministry of NHR&amp;C, Government of Pakistan</p> <p><b>Vice Chairperson</b> Director General, Ministry of NHR&amp;C, Government of Pakistan</p> <p><b>Secretariat</b> Pakistan Health Research Council Members Ex-Officio President, College of Physicians and Surgeons of Pakistan President, Pakistan Medical and Dental Council, President President, Pakistan Association of Family Physicians</p> <p><b>Executive Director</b> Pakistan Health Research Council, Member/Secretary WHO Country Representative President, Supreme Court Bar Association DGMS (SG)/Surgeon General (Pakistan Army)</p> <p><b>Director General Health, Punjab</b> <b>Director General Health, Sindh</b> <b>Director General Health, Khyber Pakhtunkhwa</b> <b>Director Health Services, FATA</b> <b>Director General Health, Balochistan</b> <b>Director General Health, AJK</b> <b>Director Health Services, Gilgit Baltistan</b></p> <p><b>Registrar, Pakistan Nursing Council</b></p> <p><b>Members</b> Prof. Dr. Aasim Ahmad (Chairman REC)</p> <p><b>Prof. Dr. Farhat Muzammil</b> (Chairperson REC)</p> <p><b>Prof. Dr. Mushtaq Akhtar Baloch</b> <b>Prof. Dr. Abdul Hameed Sahib</b> <b>Dr. Asad Mustafa Jaffery</b> <b>Dr. Anwarullah</b> <b>Dr. Faruk Qadir</b> <b>Dr. Sohail Ahmed Tique</b> <b>Dr. Salim Farooq Iqbal</b> <b>Dr. Jamshed Akhtar</b> <b>Dr. Farukhanda Ghossein</b> <b>Dr. Inayatullah Memon</b> <b>Dr. Munir Anwar Khan</b> <b>Mr. Abdul Ghani Saadi</b></p>	<p><b>Prof. Dr. Abdul Basit</b> Baqai Institute of Diabetology and Endocrinology (BIDE) Baqai Medical University, Plot No.1-2, II B, Nazimabad No. 2 <u>Karachi.</u></p> <p><b>Subject: <u>Prevalence of type 2 diabetes in Pakistan.</u></b></p> <p>Dear Dr. Prof. Abdul Basit,</p> <p>This is with reference to your email dated 10<sup>th</sup> November 2016, requesting ethical review / approval of above cited project.</p> <p>I am pleased to inform you that the above mentioned project has been cleared by the "Research Ethics Committee" of "National Bioethics Committee" for a period of one year.</p> <p>For the continuation of project in the next years, you have to send a progress report and a formal request asking for continuation of projects (however, you do not need to submit REC application or pay any processing fee again).</p> <p>Kindly keep the National Bioethics Committee, Secretariat updated about the progress of the project and submit the formal final report on completion.</p> <p style="text-align: right;">Yours sincerely</p> <p style="text-align: right;">   <b>(Prof. Dr. Aasim Ahmad)</b>  <b>Chairman</b>  <b>NBC- Research Ethics Committee</b> </p>	
<p><b>NBC Secretariat:</b> Pakistan Health Research Council, Shahrah-e-Jamhuriat, Off Constitution Avenue, Sector G-5/2, Islamabad  <a href="http://www.nbc-pakistan.org.pk">www.nbc-pakistan.org.pk</a> e-mail: <a href="mailto:nbc-pakistan.org@gmail.com">nbc-pakistan.org@gmail.com</a> Tel: 92-51-9224325, 9216793, Fax 9216774.</p>		

## Gallery

## Appendix VII









