

Summer Training Report

By

Rituparna Das

MBA (Hospital and Health Management)

2019-21



ACKNOWLEDGEMENT

I take this opportunity to express my profound gratitude and deep regards to my faculty mentor Dr. JP Singh for his constant encouragement, and feedback throughout the entire course of this summer training designated to me as a curriculum for the degree MBA Hospital and Health Management. I am very thankful for the golden opportunity to do this wonderful project on the topic **Prevalence, Risk factors, diagnosis and adverse outcomes associated with Gestational Diabetes Mellitus in mother and offspring in low-and-middle income countries: A systematic Review**. This project has helped me in gaining knowledge about research. With his continuous help, and effective guidance I was able to complete my work.

I would also like to thank my college Dean Professor Mr. P.R Sodani and academics for their cordial support, variable information and guidance, which helped me in completing the task successfully.

I express my deep sense of gratitude to my dear friends and family for their moral support during various stages of this Summer training work from assignment.

IIHMR University, Jaipur

Date: 24.07.20

TABLE OF CONTENTS

1. Introduction.....	5-6
2. Rationale.....	7
3. Research question.....	7
4. Objectives.....	7
5. Abbreviations.....	7-8
6. Methods.....	8
6.1 Data sources and search strategy.....	8
6.2 Inclusion and exclusion criteria.....	8-9
6.3 Data collection and extraction.....	.9-10
7. Results.....	10
Literature search.....	10-11
Characteristics of study.....	12-15
Prevalence of GDM.....	15-16
Risk factors associated with GDM.....	16-17
Perinatal/Neonatal outcomes associated with GDM.....	17-19

Discussion.....	19-20
Conclusion.....	21
References.....	21-23

Part –II

Course Description.....	24
Objectives.....	24
Course contents.....	25
Methodology.....	25-26
Key Learnings.....	26-32

“Prevalence”, “Risk Factors”, “Diagnosis”, and “Adverse outcomes associated with GDM” in mother and offspring in “low- and- middle income countries”. “A Systematic Review”.

1. INTRODUCTION

“Gestational Diabetes Mellitus is a medical condition which is defined as any degree of glucose intolerance with onset or recognition of first pregnancy”. It is a global health concern which has alarmingly increased over the few years and have severe implications that can pose a prolonged effect on the mother and the child. According to International Diabetes Federation, approximately 223 million women aged between 20-79 years have known to suffer from Diabetes. This number is supposedly to be increased to 343 million by the year 2045. 20 million or 16% of live birth had hyperglycaemia in pregnancy. Out of these, 84% were due to GDM. Although, GDM remains one of the most overlooked health issues, that can have consequences on mother and the child. Hence, this needs more research. Advanced health care for women diagnosed with GDM are not widely available. Evidence suggests, pregnancy with an increased level of glycemia escalates the risk of short term foetal and “neonatal complications” such as “macrosomia” or “intra uterine growth

retardation”, “premature birth”, “congenital defects”. “Short term maternal complications” include “late miscarriage”, “pregnancy induced hypertension” and “preeclampsia”, “polyhydramnios”, “diabetic ketoacidosis”, “birth trauma” and “postpartum haemorrhage”. Women have more chances of exposure to “GDM”, who have had a previous history of glycemia during first pregnancy resulting in type II “Diabetes” later in life. Offspring’s born to mothers with GDM poses a greater risk of obesity and type 2 diabetes, “impaired glucose tolerance”, dyslipidaemia to name a few. Factors that contribute to developing GDM includes a family history of Diabetes, age and BMI above 25, high parity, sedentary lifestyle, dietary factors, ethnicity (Ethnic groups such as Hispanic, African, African American, Asian) shown to have more prevalence of GDM. The South-East Asia region has the highest hyperglycaemia prevalence at 25% in contrast with North America and Caribbean Region which has a prevalence of 10.4%. The criteria to diagnose GDM have evolved constantly over a period of time. The standard test to diagnose “GDM” is the “oral glucose tolerance test (OGTT)” which is executed at “24-28 weeks gestation” period. The general method used to screen GDM is done by administering a 75g “OGTT for two-hours. It is carried out using a “capillary glucose testing”, that is a standard glucometer (HemoCue Glucose B-201+) according to the latest guidance by “International Federation of Gynaecology and Obstetrics”. On the basis of “American Diabetes Association” 2017 criteria or the 2013 WHO criteria, plasma glucose levels in pregnant women ranging more than these “(fasting: ≥ 92 mg/dl, 1h: ≥ 180 mg/dl; 2h: ≥ 153 mg/dl)” were categorize to have diagnosed with GDM. ADA recommends the prevention of GDM to be undertaken at the first prenatal visit. Due to an increased prevalence of GDM with pregnancy complications in the mother as well as the offspring, there is a dire need to treat and prevent GDM. Although, GDM and its contribution to the burden of mortality is not well reported in the “low-and-middle income countries”. This systematic review focuses on the prevalence, risk factors and “antenatal/perinatal and neonatal outcomes” in women diagnosed with GDM in “low- and - middle income countries”.

2. RATIONALE:

“Gestational Diabetes Mellitus” is a severe threat to maternal and child health. The prevalence is increasing due to delayed motherhood, the rising cases for obesity, and unhealthy lifestyles. Approximately, 1 in 6 live births is affected by gestational diabetes. According to the previous research, most of the cases of hyperglycaemia were reported in “low-and-middle-income countries” where there was lack of limited access of maternal health. “Gestational diabetes mellitus” is correlated with several “neonatal and antenatal/perinatal complications”, where the offspring as well as the mother is at a higher risk of metabolic abnormalities. Diagnosing and reducing GDM can reduce these complications.

3. RESEARCH QUESTION:

- What is the current prevalence of GDM among woman in “low-income and middle-income countries”?
- What are the risk factors associated with it?

4. OBJECTIVE:

- To identify adverse outcomes of maternal and neonatal complications associated with GDM.

5. ABBREVIATIONS:

“ADA”, “American Diabetes Association”; “ANC”, “Antenatal Care”; “aOR”, “adjusted Odds Ratio”; “ARR”, “Adjusted Relative Risk”; “BMI”, ; “CI”, “Confidence Interval”; “FPG”, “Fasting Plasma Glucose”; “IADPSG”, “International Association of the Diabetes and Pregnancy Study Group”; “IGT”, “Impaired Glucose Tolerance” ; “GDM”, “Gestational Diabetes Mellitus”; “LGA”, “Large for gestational age”; “MUAC”, “Mid-Upper arm circumference”; “OGTT”, “Oral Glucose Tolerance Test”; “OR”, “Odds ratio”; “PIH”, “Pregnancy Induced Hypertension”; “PRISMA”, “Preferred Reporting Items for

Systematic Reviews and Meta- analysis”; “SD”, “Standard Deviation”; “UTI”, “Urinary Tract Infection”; “WHO”, “World Health Organization”.

6. METHODS:

A systematic approach was being carried out using the covenant framed according to the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement”.

6.1 Data sources and search strategy

We performed the search to identify articles that reported the risks in mothers with respect to GDM. The following electronic database were searched to locate the prevalence, risks, diagnosis with respect to GDM in mothers followed by its complications in the mother and offspring. Search strategy that contained key terms are following- Gestational Diabetes OR GDM, Risk factors, Neonatal outcomes, maternal outcome, pre-eclampsia, “macrosomia” OR “fetal macrosomia” OR “large for gestational age”, congenital abnormality, Maternal OR Infant mortality, Diabetes Mellitus, postpartum follow-up, insulin, pregnancy outcomes, IADPSG, glycemic control, fetal outcome, C-section OR caesarean section, Low- and – middle income countries. Mesh terms were used for each database and the search was confined to English. In addition, articles and reviews were manually searched to locate any further relevant study which met the inclusion criteria. This “systematic review” comprise of experiments conducted from 2010 to 2020.

6.2 Inclusion and Exclusion criteria

Observational, Experimental studies that showed the occurrence of outcomes affiliated with GDM in mothers or the offspring as well, were included for detailed study. Research

that were carried in low-and-middle income countries were only counted. Those participants who were classified as pregnant and or postpartum women having outcomes correlated with GDM at the age of ≥ 18 or who were at risk were counted. Infants born to mothers with "GDM" who had/ were at risk of one of the mentioned neonatal complications (Table 1) were included. This "systematic review" will only study settings that were carried out in "low-and-middle income countries". The exclusion criteria consisted of the following a) They included women with current or past history of "type" 1 or "type 2 diabetes". b) There were no exclusions made based on the ethnicity of the participants. c) All the articles that comprised of human data were studied. d) Letters, Abstracts, Editorials, comments were not counted. Also, the study must mention at least one of the study objectives that is the prevalence, risks, diagnosis and outcomes associated with GDM.

"Maternal outcomes"	"Neonatal outcomes"
"Cesarean delivery"	Still birth
"Pre-eclampsia"/" pregnancy induced hypertension"	"Shoulder dystocia"
Polyhydramnios	Jaundice, "Low birth weight"
Post-partum hemorrhage	Congenital malformation
Vaginal candidiasis,	"Small and Large for gestational age"

Abruptio placentae	Macrosomia, “Intrauterine growth restriction”
	“Respiratory distress syndrome”

Table 1. “Adverse maternal/neonatal associated with GDM”

6.3 Data collection and extraction

The fundamental idea was to screen the abstract of the articles generated by the search and identify the eligible studies based on the inclusion criteria. If eligibility was not clear from the review of the title, full text was obtained and assessed. The data that was extracted and mentioned the following: the “first author’s surname”, “year of publication”, “study design”, “duration of the study”, “participant’s age”, “gestational age”. From each trail, data on prevalence percentage and the outcomes of interest with adjusted and or odds ratio were extracted. In addition, the data on short and long outcomes of GDM rate of “caesarean section”, “still-birth”, number of new born with “macrosomia” (birth weight >4 kg) and the preterm birth were obtained.

7. RESULTS

7.1 Literature Search

A PRISMA flowchart depicts the search results of databases and the final included articles. A total 168 citations were identified from EMBASE, PubMed (1045), Cochrane Library (23). After screening ,43 full-text articles were removed and 7 studies that met the inclusion criteria were included. Articles were excluded mainly due to the studies which took place

in high income countries, and the studies which described the study participants suffering from either type1 or type 2 Diabetes Mellitus.

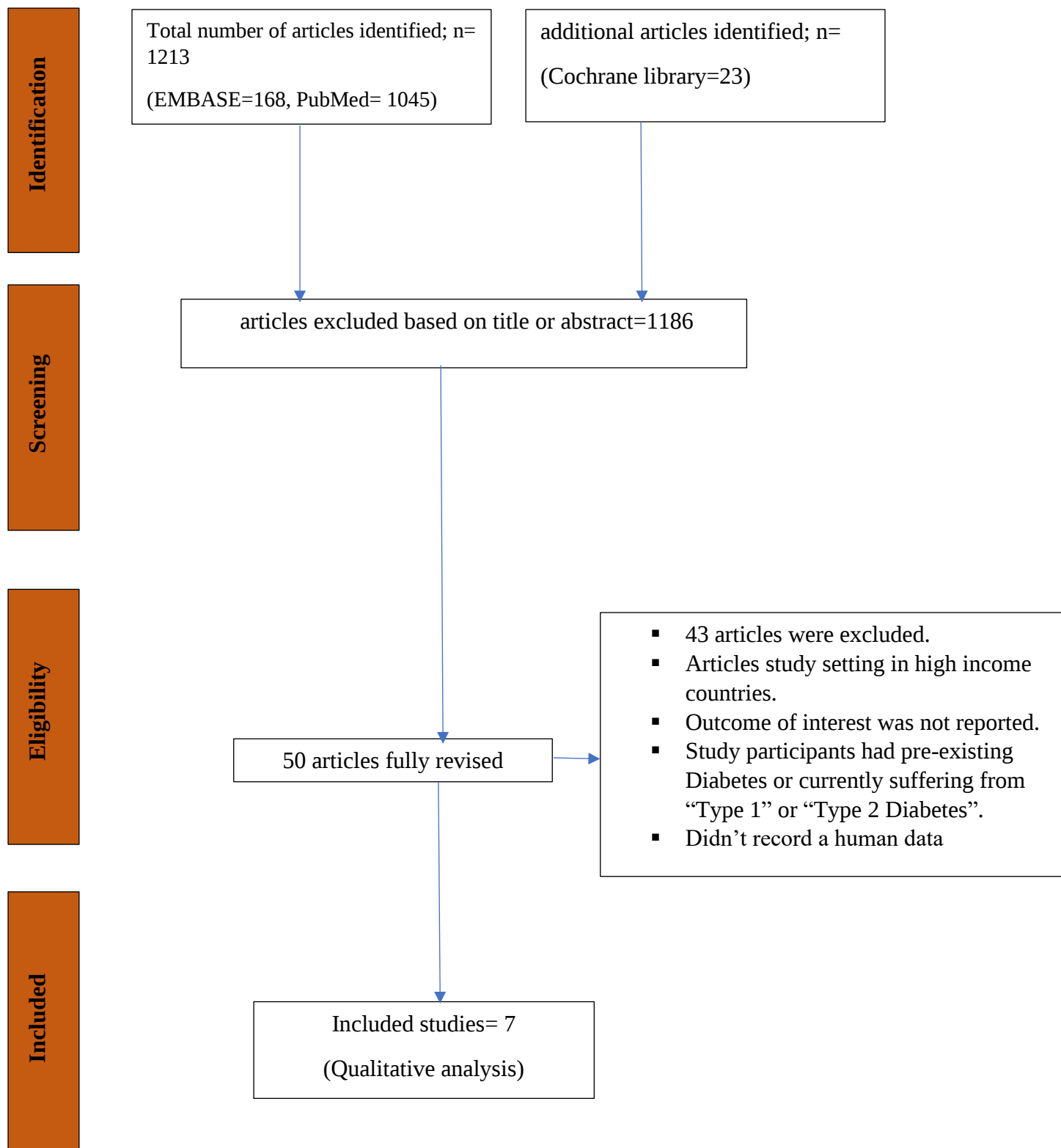


Fig 1. "PRISMA flow diagram"

7.2 Characteristics of Study

The components of the 7 studies are shown in “Table 3”. The experiments were conducted in “low- and middle-income countries”. The trials were conducted in Brazil, India, Northwest Ethiopia, 2 in Rural Tanzania, South Africa, and Srilanka. All the studies are aimed at assessing the “prevalence”, “diagnosis” and “risk factors” in the offspring and the mother with cases of GDM. Most of the studies used WHO 1999, 2013 and IADSPG criteria for GDM screening. Anthropometric measurements such as height, weight, BMI, Blood Pressure, systolic blood pressure, MUAC were reported in some of the included studies.

Reference, country	Study design	Participants Characteristics	Diagnostic method	Outcome	Statistical analysis
Nicolosi <i>et al.</i> (2020) Brazil	Cohort	A total of 569 patients, including control (229) and 340 (GDM and MGH) patient.	100 g- OGTT, 75 g -OGTT was administered	Association of maternal factors with “hyperglycemia in pregnancy” and its “perinatal outcomes”.	The presence of “HIP” was associated with the following: “age $\geq$ 25 years [1.81, 1.44-2.27], number of prenatal visits were less than 6 [1.33, 1.11-1.60]”, multiparity (pregnancy $\geq$ 2) [1.82, 1/43-2.31] ^[9]
Mohan <i>et al.</i> (2015) India	Prospective observational	“Pregnant women of gestational age of $\geq$ 24 weeks were included”.	Study subjects administered a glucose challenge test, participants with “plasma glucose level $\geq$ 140 mg/dl were subjected to OGTT”.	“Prevalence” and “risk factors” of “GDM” were evaluated. GDM hypertension: 28.1%	“Significant difference was reported between two groups”. The distribution of various complications between two groups

				Vaginal Candiiasis: 25% Abruptio placentae: 12.5%.	($p=0.01$, $\chi^2= 38$. ($p=0.001$, $\chi^2 =38.184$)^[5]
Muche <i>et al.</i> (2020) Northwest Ethiopia	Prospective cohort	Pregnant women aged 18 or above, had single pregnancy of “20-23 ⁺⁶ weeks of gestation”.	“Two-hour 75 g OGTT” was performed at “24-28 weeks” using a HemoCue.	Risk of adverse neonatal outcomes	207 women out of 684 that is, “(30.3%, 95% CI: 26.9, 33.6)” had at least one types of adverse “neonatal outcome”. “Composite neonatal outcomes” in GDM patient (ARR=1.72; 95% CI; 1.35, 2.19) ^[6]
Mwanri <i>et al.</i> (2014) Tanzania	Cross-sectional study	“Pregnant women aged 20 years or more and 20 weeks” of gestational age or more attending “ANC” during the survey period.	“Blood samples were collected at fasting at 2h after 75 g glucose load”, measured using a “HemoCue.” WHO 1999 diagnostic criteria were used.	Prevalence of GDM in “urban and rural Tanzania”	Women with previous “still birth” had a higher prevalence of “GDM”(95% CI= 1.5-5.4). ^[8]
Grunnet <i>et. al</i> (2020) Rural Tanzania	Not specified	One group, n= 383 aged 18-40 years, was enrolled before pregnancy conceived during study period.	Based on fasting Blood glucose from OGTT, which was performed after 12-h of overnight fasting. (diagnosed	High “prevalence” of “GDM” among women in rural Tanzania	GDM diagnosis based on, fasting sample, (n=144), %(95%-CI) = 94.1(94.0,94.2) ^[7]

			according to the WHO 2013 criteria.		
Macaulay <i>et.al</i> (2017) South Africa	Cross-sectional study	Women with singleton pregnancies, aged ≥ 18 and ≤ 20 weeks pregnant were studied.	Screening done based on the OGTT test, participants were administered 75g glucose mixed in 250 ml of water. Diagnosis was done using the WHO criteria (FPG- 5.1-6.9 mmol/l)	“Prevalence” of “GDM” amongst south African women, describe “GDM” “associated risk factors and clinical management”.	83% of women (145/174) had abnormal fasting glucose reading. “fasting plasma glucose test” had a “sensitivity” 83% (95% CI 77.0,88.5) and “specificity” 100% (95%CI 99.8,100) of diagnosing “GDM”. ^[10]
Sudhasinghe <i>et. al</i> (2018) Srilanka	Prospective cohort study	Women diagnosed with “GDM” were called for study, (n=194). And women with non-GDM were included.	Data until “one-year postpartum”, “BP”, “post-partum 75g OGTT and cholesterol”; “anthropometry” were obtained.	“Long and short-term outcomes of GDM” among South Asian women- “A community-based study”.	At “two months postpartum”- one in 10 women “(17/169)” with “GDM” had “Diabetes” while one in three women “(55/169)” in GDM group had “abnormal glucose tolerance”. Outcomes at “2 months postpartum”, of singleton deliveries: “4 still births”, “PIH (18.9%, 32/169)”, “premature delivery in GDM group (15.4%, 26/169)”. At “one year

					postpartum”, “one-fifth(11/59)” in the women developed, “abnormal glucose tolerance in the GDM group (28/59)”.
--	--	--	--	--	---

Table 3: Characteristics of the included studies

7.3 Prevalence of GDM

There were 4 studies that evaluated the prevalence of GDM among the sample population. **Mwanri et.al** estimated the “prevalence” of “GDM” and associated reasons in “**Urban and Rural Tanzania**”. He conducted a “cross-sectional study” in which (609 urbans, 301rural) pregnant women who didn’t have “diabetes”, participated during “ante-natal clinic visits”. Blood glucose was measured using HemoCue Glucose B-201. “Capillary blood samples” were collected at “fasting and 2h after 75 g glucose load”. The study showed an “overall prevalence” of “GDM” “n=54” was “5.9% (95% CI: 4.5-7.7) with 8.4% (95% CI: 6.3-10.9) and 1.0% (95% CI: 0.2-2.9)” in “urban and rural areas” respectively. According to the IADPSG, when lower cut-off points were used for “fasting glucose levels”, the overall prevalence of “GDM” recorded at “(n=108) was 13.1% (95% CI: 11.4-15.4), with 17.7% (95% CI: 14.9-20.9) in urban area and 3.7% (95% CI: 2.0-6.5)” in rural areas^[7] Another study conducted in **Northeast Tanzania** included 538 women, of whom 392 women were screen with an OGTT, mainly during weeks 32-34 of gestation. The OGTT was performed after 12h of overnight fasting. Venous fasting blood samples were taken, glucose was

measured using HemoCue. The study reported that 392 women underwent an OGTT. Using the OGTT, 153 women were diagnosed with GDM, that is a prevalence of 39.0% (95% CI: 34.2 - 44.1).^[8] While, the majority of women (n= 144, 94.1%) were screened based on fasting blood sample. The study also demonstrated, seven women, all in GDM group had type 2 diabetes diagnosed based on the OGTT during pregnancy.

The next study evaluated by **Mohan et. al** reported the prevalence of GDM. It is a “prospective observational study” which was implemented in **Kerala, India**. It was continued for a span of 10 months. Women pregnant with a “gestational age of 24 weeks and above” who didn’t have “Diabetes mellitus” were included. The study involved the “identification and documentation” of the “risk factors and complications” between “GDM” and “non GDM” group. The study subjects were given a Glucose challenge test and subjects with “plasma glucose level” $\geq$ “140mg/dl” were exposed to “OGTT”. The patients were then classified into “GDM” and “non- GDM” groups based on the WHO criteria. The data obtained determines that, among 201 participants enrolled, 32(15.9%) were diagnosed with GDM.^[5]

Macaulay et al. performed a “cross sectional study” in **Johannesburg** (South Africa). The study included 1906 pregnant women who went through an “OGTT” test which involved “two- hour 75 g oral glucose tolerance test” at “24-28 weeks gestation” for which” WHO 2013” criteria was used for diagnosing “GDM”. They observed among 1906 women, “174((CI) 7.9, 10.5))” women were diagnosed with GDM which resulted in a “prevalence” of “9.1% (95% CI 7.9, 10.5)”. They also observed, these women had significantly more “body weights” and “body mass indexes”.^[10] Using the WHO 1999 criteria IADPSG criteria, “107/1906” women were categorized as having “GDM” reporting a “prevalence” of “9.4% (95% CI 8.2, 10.8)”.

7.4 Risk factors associated with GDM

Nicolsi *et.al* studied the “maternal factors” associated with hyperglycaemia in “pregnancy” and “perinatal outcomes” which was conducted in Brazil. The study group included 569 “singleton pregnant women” and divided into three groups by “glucose status”;

GDM(n=207), “mild gestational hyperglycaemia” (MGH; n=133) and control (n=229). It was examined by a “100 g - or- 75 g oral glucose tolerance test” and a “glucose profile” at “24-28 weeks”.^[9] “Maternal characteristics” were analysed to predict “H1P “and its perinatal outcomes. As our interest study group is women with GDM. “Maternal and perinatal outcomes” related to it has been studied. The reoccurrence of first “C- section” was lowest in the “GDM group (37.14%)”. The frequency of LGA new born was “(GDM=9.71%, “MGH” =17.19%, control= 6.17%; p=0.0007)”. “Macrosomia” “(GDM=8.21% MGH=14.39%, control=5.68%; p=0.0171)” ^[9]

Among the women, the presence of “H1P” was associated with “age $\geq$ 25 years” “[1.81, 1.44-2.27]”, “number of prenatal visits $<$ 6 [1.33, 1.11-1.60]”, “multiparity” “(pregnancy $>$ 2) [1.82, 1.43- 2.31]”, “no exercise/sedentary lifestyle e[0.77,0.68-0.88]”, “not working [1.17, 1.01-1.34]”, “family history of DM [1.35, 1.18-1.54]”, “hypertension [1.21, 1.06-1.38]”, and pre pregnancy “BMI $\geq$ 25 kg/m² [1.82, 1.47-2.27]”. ^[9]

7.5 Antenatal/Perinatal and Neonatal outcomes

Three studies provided information described the outcomes of “Antenatal/Perinatal” and “neonatal outcomes”. One study comprised two groups- women exposed to GDM and non-exposed, compared for pregnancy outcomes. “Significant outcomes” were observed until “two-months postpartum” and one year postpartum and when modified for “age”, “parity” and “first trimester” “BMI”, outcomes like “vaginal moniliasis”, “breast engorgement”, “birth weight $\geq$ 3.5 kg”, prematurity of new born, presence of “maternal IGT” and “abnormal glucose intolerance”. remained significant. There were 4 still births reported in the “GDM” group but none among the “non- GDM” group, because of which relative risk was not reported. The most common complications seen in the “GDM group” was “PIH (18.9%, 32/169)”. “Premature delivery” was more recurrent among women with “GDM (15.4%, 26/169)” than in “non GDM women (10.7%, 19/178)”. Although it reported, this association was not “statistically significant” (RR=1.4; 95% CI= 0.8-2.5). “Antenatal/natal maternal complications” like foetal movements, anaemia, urinary tract infection, shoulder

dystocia, haemorrhage, UTI, infected episiotomy, infected “caesarean scar”, “venous thrombo embolism”, “congenital malformations of offspring”, “neonatal morbidity” and “neonatal” death failed to show “statistically significant difference”. At one year postpartum, approximately “one-fifth of the women (11/59) in the GDM group developed diabetes”, whereas one in twenty (3/57) women in the “non GDM group” had “diabetes” at one year^[1]

A study conducted in **Kerala** evaluated the prevalence, identification, documentation of risk factors and complications among the 201 participants. Distribution of subjects based on age, their residence (urban and rural), socio-economic status, education among the “GDM” and “non GDM” groups were studied. The distribution of women residing in “rural (18.8%)” and “urban area (81.3%)” was found to be significant “(p value ,0.05)”. The comparison between the risk factors subjected to GDM was differentiated. It was found that percentage of “Gestational hypertension” was more prevalent in the “GDM group (28.1%)” than in “non GDM group (13.1%)”. Similarly, Vaginal candidiasis showed more number in the “GDM group” (25%) than in “non-GDM” group (6.5%). The other complications such as “abruptio placentae” and “premature rupture of membranes” appeared to be “12.5%”, “18.8%” in ‘GDM’ women and “4.1%”, “4.7%” in “non GDM women”. The statistical analysis suggests a significant difference in the distribution of the two groups “(p=0.0001, $\chi^2 = 38.184$)”. Also, the caesarean section showed a higher percentage in GDM women (81.3%) in contrast with the non GDM women (30.2%), whereas recurrent “vaginal delivery” was more “prevalent” “(15.6% in GDM vs 69.2% in non GDM)”. This remarked difference was statistically significant with “p value < 0.05”.

This study was performed by **Muche et. al** who determined the effects of “GDM” on “risk” of “adverse neonatal outcomes” in “Ethiopia”. To determine the risk of these “adverse outcomes” that include, “macrosomia”, “Low birth weight”, “LGA”, “SGA”, and preterm birth, a “multivariable log binomial model” was used. The study group comprised of 1027 pregnant women, among which 684 (118 new-borns of mothers with “GDM” and 566 new-borns of mother without GDM were available. The remaining 343 were lost to follow up due to some reasons. The “mean age” in women with “GDM” was “30.1 (SD $\pm$ 5.01)” and “non- GDM” “27.05 (SD $\pm$ 5.04) years”. It was observed that the fraction of anaemia and “overweight and/or obesity” was higher in women with “GDM” in contrast with those who didn’t have “GDM”. It was associated with the fact that women with “GDM” had “low

level of physical activity”, inadequate diet and “antenatal depression”. Among the 684 newborns, “207 (30.3%, 95% CI: 26.9, 33.6)” had at least one type of “adverse neonatal outcomes”. The percentage of “composite adverse neonatal outcome” was found more in mothers with GDM (51.7%) than in mothers without GDM (25.8%).

This study shows that, GDM is associated with an increased risk of “macrosomia” “(ARR=3.81; CI: 1.95, 7.45)”, “LGA (ARR= 2.38; 95% CI: 1.41, 4.03)”. However, there was no significant difference found between new born of women with GDM and without GDM regarding the “risk” of “LBW (ARR= 0.59; 95% CI: 0.29, 1.22)” and “SGA (ARR=0.61; 95% CI: 0.24, 1.57)”. Mostly, it was found that “risk of neonatal adverse outcome” was “72%” more among new born from women diagnosed with GDM in contrast with women who had no “GDM (ARR=1.72; 95% CI: 1.35, 2.19)”.

8. DISCUSSION

Health systems are insufficiently compounded, and hence don’t provide required care and facilities for pregnant women with “GDM” in “low-and-middle income countries”. This has resulted into an increased burden of disease with “adverse health outcomes”, more ‘prevalent’ in “low-and-middle income countries” than “high income countries”. The evidence from the 7 studies included, indicates the prevalence, risk factors and, diagnosis method and “adverse outcomes” associated with GDM in mothers and offspring. Although, the previous reported data which has been compared on outcomes of GDM in “low-and-middle-income countries” is difficult because of the given reasons, the first one being the use of different diagnostic method for screening. Secondly, studies showing an association of adverse outcomes and GDM in mothers raise a question whether it is due the maternal factors or contributed by the socioeconomic factors. ^[6] Previous systematic reviews and studies have highlighted the risk imposed by GDM is less prevalent in high income

countries. For instance, A review article published in 2013, was similar to this review in terms of findings. They studied the “incidence” of “adverse outcomes” associated with GDM in “low- and middle-income countries”. Such as c-section, PIH, Pre-eclampsia, Preterm labour, macrosomia, LGA, Stillbirth, Hypoglycaemia, and Shoulder dystocia. With USA being the highest in terms of caesarean section (30.0) ^[12] and LGA (35.0). ^[14]. On the other hand, an “Iranian study” reported a highest rate of “c-section” that is (87.1%). ^[4], which shows the outcomes are much worse in the “low-and-middle income countries”. A study included in this systematic review has reported GDM related outcomes till two months postpartum and one year postpartum. It has shown that, Diabetes mellitus is a significant adverse outcome in the long run that is in one-year post-partum ^[1]. Two- three studies that has been included in this systematic review has explained the prevalence in a particular study area. In a study conducted in rural Tanzania, the prevalence in rural as well as urban area has been compared and studied the prevalence of GDM whether it was associated with “mothers’ age”, “level of physical activity”, “gestational age”, “gravidae”, “birth weight” of the previous child or previous “c- section”. Although, it didn’t show any significant association. A study conducted by “Nilofer et al” demonstrates “obesity” as a risk factor in “88.89%” of GDM patients ^[15]. Most of the study shows that the increased prevalence of GDM has been found in groups with higher socioeconomic status, and people residing in urban areas.^[16]

A systematic review by Allehdan et. al studies the dietary and exercise interventions and glycaemic control in women diagnosed with GDM. Generally, the most used interventions that are used to treat is by giving insulin. Although, treatments related to GDM has been controversial. But it can be managed using nutrition intervention and exercise. They elaborated the diet characteristics such as low carbohydrate diets, mindful eating, non-energy restricted diet. The exercise characteristics ranged from aerobic exercise, resistance exercise, yoga, structured aerobic and resistance exercise.^[11] It was followed by the maternal and neonatal outcomes in intervention vs the control group. It found out that these interventions resulted into reduced fasting and postprandial blood glucose concentrations compared with the conventional intervention.^[11]

9. CONCLUSION

Serious efforts should be made to improve the maternal and child health. As seen from the previous research, health systems are not properly framed, or even if framed not properly implemented in “low-and -middle income countries”. Maternal mortality has consequently reduced over the few years due to better facilities, reproductive health and socioeconomic factors. But still, a lot has to be changed in the coming years. Although communicable diseases such as HIV, malaria and diabetes contribute to the burden of maternal mortality, obstetric complications are one of these few conditions that need improvement. It can be properly managed using timely antenatal check-ups, monitoring of blood glucose levels, proper diet and exercise interventions. Further research on the long- term effects of GDM and how can it be managed in a “low-and-middle income” country should be documented in order for better health of mother as well as the child.

10. REFERENCES

- [1] Sudhasinghe, BH., Wijeyaratne, CN., & Ginige, PS. (2018). Long and short-term outcomes of Gestational Diabetes Mellitus (GDM) among South Asian women- A community-based study. *Diabetes Research and Clinical Practice*, <https://doi.org/10.1016/j.diabres.2018.04.013>
- [2] Maiti, A., Nandi, K., & Chatterjee S. (2011). [Management of gestational diabetes mellitus in a public hospital setting in India: Lessons from a minimalist approach.](#) *Diabetes Research and Clinical Practice*, 95, e34-e36.
- [3] Goyal, A., Gupta, Y., Kalaivani, M., Sankar, MJ., Kachhawa, G., Bhatla, N., Gupta, N., & Tandon, N. (2018). Long term (>1 year) postpartum glucose tolerance status among Indian women with history of Gestational Diabetes Mellitus (GDM) diagnosed by IADPSG criteria. *Diabetes Research and Clinical Practice*, <https://doi.org/10.1016/j.diabres.2018.05.027>
- [4] Keshavarz, M., Cheung, NW., Babaee, GR., Moghadam, HK., Ajami, ME., & Shariati M. (2005). Gestational diabetes in Iran: incidence, risk factors and pregnancy outcomes. *Diabetes Research and Clinical Practice*, 69(3), 279-86.

- [5] Mohan, MA., & C, A. (2015). Evaluation of Prevalence and Risk Factors of Gestational Diabetes in a Tertiary Care Hospital in Kerala. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, <http://dx.doi.org/10.1016/j.dsx.2015.09.002>
- [6] Muche, AA., Olayemi, OO., & Gete, YK. (2020). Gestational diabetes mellitus increased the risk of adverse neonatal outcomes: A prospective cohort study in Northwest Ethiopia. *Midwifery*, 87, 102713.
- [7] Grunnet, LG., Hjort, L., Minja, DT., Msemo, OA., Møller, SL., Prasad, RB., Groop, L., Lusingu, J., Nielsen, BB., Schmiegelow, C., Bygbjerg, IBC., & Christensen, DL. (2020). *International Journal of Environmental Research and Public Health*, 17, 3109, doi:10.3390/ijerph17093109
- [8] Mwanri, AW., Kinabo, J., Ramaiya, K., & Feskens, EJM. (2013). Prevalence of gestational diabetes mellitus in urban and rural Tanzania. *Diabetes Research and Clinical Practice*, 103, 71-78.
- [9] Nicolosi, BF., Vernini, JM., Costa, RA., Magalhães, CG., Rudge, MVC., Corrente, JE., Cecatti, JG., & Calderon, IMP. (2020). Maternal factors associated with hyperglycaemia in pregnancy and perinatal outcomes: a Brazilian reference center cohort study. *Diabetology and Metabolic Syndrome*, 12, 49.
- [10] Macaulay, S., Ngobeni, M., Duner, DB., & Norris, SA. (2018). The prevalence of gestational diabetes mellitus amongst black South African women is a public health concern. *Diabetes Research and Clinical Practice*, <https://doi.org/10.1016/j.diabres.2018.03.012>
- [11] Allehdan, SS., Basha, AS., Asali, FF., & Tayyem, RF. (2019). Dietary and exercise interventions and glycemic control and maternal and new-born outcomes in women diagnosed with gestational diabetes: Systematic review. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 13, 2275-2784.
- [12] Wang, Z., Kanguru, L., Hussein, J., Fitzmaurice, A., & Ritchie, K. (2013). Incidence of adverse outcomes associated with gestational diabetes mellitus in low- and middle-income countries. *International Journal of Gynecology and Obstetrics*, 121, 14-19.
- [13] Balut, CA., Torre, NG., Dura, NJ., & Fuentes, M. (2017). A Mediterranean diet with additional extra virgin olive oil and pistachios reduces the incidence of gestational diabetes

mellitus (GDM): A randomized controlled trial: The St. Carlos GDM prevention study. *PLOS ONE*, <https://doi.org/10.1371/journal.pone.0185873>

[14] Casey, BM., Lucas, MJ., McIntire, DD., Leveno, KJ. (1997). Pregnancy outcomes in women with gestational diabetes compared with the general obstetric population. *Obstetrics Gynaecology*, 90(6), 869-73.

[15] Nilofer, AR., Raju, VS., & Zaki, SA. (2012). Screening in high-risk group of gestational diabetes mellitus with its maternal and foetal outcomes. *Indian journal of Endocrinology Metabolism*, 16(7), 74-78.

[16] Rajput, R., Yadav, Y., Nanda, S., & Rajput, M. (2013). Prevalence of gestational diabetes and associated risk factors at a tertiary care hospital in Haryana. *Indian Journal of Medical Research*, 137(4), 728– 733.

PART-II (ONLINE COURSE REPORT)

“INTRODUCTION TO GLOBAL HEALTH”

1. COURSE DESCRIPTION:

Global Health has been defined as “area of study”, research and practice that prioritize on improvement of “health” and enables equity in health for all across the globe. It has focused on the determinants and distribution of health in various regions of the world. It’s requires an understanding of several aspects such as medicine, economics, sociology, medicine, epidemiology and demography.

Learning platform: Coursera

University: University of Copenhagen

Efforts level: 21

2. OBJECTIVES:

- To gain an insight into what are the most important health challenges and how it has changed over time.
- To study the determinants of such changes and examine the future projections.
- To understand the successful international strategies and programs that promote human health.
- To learn about the global health governance structures.

3. COURSE CONTENTS:

The course is distributed into 7 weeks which comprises of various segments of global health. Following are the course contents starting from-

1. Defining and measuring global health which gives an overview of the overall concepts and definitions of global health.
2. The second module of this course concentrates on the concept of Infectious diseases These infectious diseases were - Malaria, Diarrheal disease and HIV in global health.
3. The third module gives an outline of the Non- communicable diseases, The module also comprises of mental health challenge and injuries which are ignored when dealing with NCDs.
4. The fourth module deals with Maternal and child health. It is directed on the “sexual and reproductive health and right”, components of sexual and reproductive health, which is followed by mChild Health and continuum of care.
5. The course also covers global crises that impacts the population’s health mainly environment, climate and migration. It has examined the mega trends of health aspects and how it influencing the health systems, policies and an individual’s health in both “low- and high-income countries”.
6. The sixth module deals with the fundamental needs of health that is access to nutritious food and clean water, sanitation.
7. The last module includes Health Systems and Global Health Governance which explains the “role of health systems”, “UN Sustainable Development Goals” and the impact of policies.

4. METHODO LOGY:

The course provided learning through video lectures and ppts which was taken by Dan Meyrowitsch, an epidemiologist from Faculty of Health Sciences, University of Copenhagen.

The lectures are explained using data sets, graphs, theories, presentation which enables a more preferable understanding. The data used are authenticated and taken from sources such as WHO, UNICEF. At the end of every session, there was a set of questions that has to be answered to understand the concept better. The course consists of reading materials that were provided at the end of each session/module. Abstracts, blog posts on access to contraceptives as well as access to articles are available. At the end of each module, a graded quiz/practice exercise was assigned that has to be completed. The required pass percentage mostly was 80%. It was based on the lectures and reading material.

5. KEY LEARNING FROM THE COURSE:

- ❖ **Defining and measuring Global Health** being an introductory lecture, thoroughly defines global health as comparison of health status across countries irrespective of any geographical area. It is a combination of local, national and international action governance to address all the issues such as a pandemic, climate change etc. It is then followed by a case study of a country Uganda explained in the lecture, to as how changing policies impacted population's health. In the early 1990s, issues like the infectious diseases were most common, until the governance played a vital role in changing the lives of people in Uganda. As AIDS came into recognition, all the attention was being focused on the training of health workers and also, antiviral treatment was made free and accessible to every citizen on a large scale.

The major demographic factors such as life expectancy, fertility rates have been changed with the past decade as lifestyle and socioeconomic status have been improved. Despite these changes, poverty, lack of amenities, access to food and sanitation, reproductive health are still the challenges that need to be dealt with.

- ❖ **Measuring the global health** had been made understand using the **demographic and epidemiological transition**. It has been addressed well by graphs and figures as to the shift of disease burden from infectious to non-infectious. The reason being, lifestyle, diet changes and physical

inactivity has led to an increase in the burden of NCDs. The second concept that was taught was the demographic transition. It was elaborated with the help of age composition of US in the year 1990 and 1995, that depicts similar trends shown by many low- income countries today. It predicts an increased life expectancy; proportion of population comprises more of old age in contrast with infants and working population

- ❖ For measuring and comparing the disease burden, **concept of DALYs (Disability Adjusted Life Years) has been elaborated. It is also called as Health Gap Measure. It combines YLL's (Life Lost due to early death) and YLD's (life lost to disease or disability).** For a better understanding, the disease risk factors have to be understood. It includes lifestyle, excess consumption of junk food, alcohol intake and sedentary lifestyle which are the most common, and hence are the reasons for NCDs like diabetes and cardiovascular diseases. It also gives a mere idea of how comorbidities exist in a population and affect each other. The reason being two diseases having the same sets of risk factors. For example- Tuberculosis and HIV, DM type 2 and tuberculosis or hypertension. The determinants of a disease risk can be socioeconomic status, education, and urbanization, geographical area
- ❖ Next comes the **Infectious diseases which are Diarrheal diseases, Malaria, and HIV.** Estimates show that diarrheal diseases are still the third most leading causes of mortality in children. Studies indicate that unsafe water, “poor sanitation and hygiene” can be ascribed to malaria and “diarrhea”. The key learnings from this session were the causes (bacterial, parasite, viral) of the mentioned diseases, symptoms, prevention, treatment and management of the diseases. Although, no antiviral drugs are available to treat rotavirus(diarrhea) infection, it is managed by rehydration.
- ❖ **NCDs** are a group of diseases that share common risk factors, causes and determinants and hence share the common mitigation, opportunities and prevention. For example; diabetes, heart disease, cancer and respiratory diseases. **The assessed factors associated can “tobacco use”, “unhealthy diet”, “physical inactivity” “harmful use of alcohol”.** Diabetes causes severe complications like retinopathy, end-stage renal disease, heart attacks, strokes and amputation. Mental health is the

most neglected issue and a global burden of disease resulting into **mental disorders such as depression, anxiety, bipolar disorders etc.** The reason being high unemployment, potential use of alcohol is increasing suicide rates. Health spending on mental health is considerably low in countries where people are already dealing with HIV and malaria. The data has reported that only 10% with mental disorders receive adequate treatment. As the prevalence of mental disorders are alarmingly increasing, awareness and proper management of it is really essential. The course also describes the global burden caused by mental health and trauma including road “traffic accidents”. A case study has been discussed where increased use of pesticides led to an increase levels of suicides in srilanka. Although, due to successful implementation of ban on pesticides led to a decrease in self-harm rates.

- ❖ **“Sexual and reproductive health rights”** I have been introduced with important milestones in sexual health and reproductive rights. **Among that, use of modern conception, family planning, right to reproductive health, maternal mortality, transmission of STDs, Abortion stigma has been thoroughly addressed.** With the **adoption of Sustainable development 2015**, sexual reproductive health and rights has been included which was not earlier considered an agenda for **Millennium Development Goals.**

United Nations Populations Fund: The mission of UNFPA is to ensure every pregnancy is wanted and safe, and that the potential of every young person is fulfilled. UNFPA ensures that people can do family planning, and that’s why contraceptives are the need of a family. UNFPA promotes different types of contraceptives based on the medical condition of a women. For example, a mother who is breastfeeding can’t use a contraceptive which has a high dose of hormone, because it can be harmful for the child. Hence, contraceptives are classified by degree of effectiveness. One of the r roles of UNFPA is to send contraceptives to the ministry of health, and then work with NGOs to distribute it. The other activity done is to train the health workers, so that they are knowledgeable with the contraceptives and the cultural barriers as well.

Child Health: In a global context, two of the major challenges; reproductive and child health is access to health services and the quality of the services provided in a health system. A woman while having a child, needs to be taken care of by a skilled health worker such as a midwife or a doctor who can provide adequate care, so that the mother and the newborn is safe. It has well elaborated the use of mHealth as how can it be used by mobiles. In a low-and-middle income country the use of **mhealth** is diverse. It includes the collection of clinical health data to increase accuracy and timeliness, direct provision of care to populations to those who are deprived of by telemedicine. Trials for the same has been conducted in Zanzibar, Ethiopia, Ghana. The aim is to use the low-tech mobile phone technology to link pregnant women to the health system through “pregnancy”, “childbirth” and “postpartum period”. Women are made to register at the first antenatal care visit with date, phone no, and gestational age. A **designed software** creates an individual pregnancy timeline for each woman and automatically sends texts to the registered phone number. “The messages focus on health educations, on important topics such as danger signs in pregnancy and the importance of skilled delivery attendants, as well as appointment reminders for next antenatal care visit”. The continuum of care refers to the idea of a continuity of care for the individual at different time points in life at community level. In outpatient and outreach services, and at higher health facilities. Proper healthcare requires high coverage of intervention and high quality of care throughout the continuum in time. So, care should be available whenever it is needed. But it also requires functional linkages between different level of care in the health system.

- ❖ **Environmental Health and climate Change:** “Environmental health consists of aspects of human health, including quality of life that is determined by physical, chemical, biological, social and psychological factors in the environment”. **It is also related with “assessing”, “controlling” and “preventing” those factors that can potentially harm the health of an individual. Poor quality water, insufficient access to water, lack of appropriate sanitation and poor personal hygiene, such factors greatly increased intestinal worm infections, skin and eye diseases and**

a number of other water and hygiene related problems. Increasing the access to appropriate water and sanitation is regarded a human right. The world seems to be untracked to meet the “millennium development goals” for water supply. “With 89% of the world population having access to safe drinking water”. Air quality pose a great risk to human health. Of all the risk factors identified, indoor household pollution from solid fuels is a global burden added by burden caused by outdoor air pollution. Often children and women are most exposed to it. The increased use of vehicles, burning of plastics, fuels for heating sold fossil results in elevated levels of air pollution are mostly in urban areas. These are the very few factors result in respiratory impairment. Some of the interventions include solid waste disposal, waste water management, provision of safe water, sanitation, noise.

Migration and Health in a Scandinavian Context: Migration is not only a geographical movement from one place to another but also a socioeconomic, psychological and environmental life event. Migration and health are closely related as a number of risk factors for ill health is associated to the different phases of the migration process. Pre- Migration risk factors are related to the origin of the country such as war, trauma and problems of accessing healthcare. Migrants may experience lack of access to water, food and medical care. Post migration risk factors for ill health include limitations to accessible healthcare due to political grounds as well as language barriers, marginalization, discrimination etc.

- ❖ **Food and Nutrition:** Nutrition and infections coexist in low- and middle-income countries. Its determinant of poverty and also reflects that undernutrition may lead to infectious diseases as it makes the immune system potentially weak.

NAIDS (Nutritionally Acquired Immune Deficiency Syndrome) is a widespread immunosuppressive disorder globally. Access to food, sometimes remain inadequate to maintain micronutrient stores to maintain the growth in children and weight in adults and thus, there's a requirement of balanced diet with proper micro as well as macro nutrients. **Micronutrient supplementation** is the most effective intervention. The lecture has widely addressed the requirement of diet to treat tuberculosis.

Diabetes is a contributor to maternal morbidity and mortality. Some women develop a form of diabetes during their pregnancy names as Gestational Diabetes mellitus. It is a serious health concern as it disturbs the foetal development and develops a high risk of developing Macrosomia, Obesity, increased glucose tolerance, and type

2 diabetes later in life. It also increases the risks of adverse pregnancy outcomes. It can be prevented and delay diabetes during the period of pregnancy. The intervention includes continuous follow up and lifestyle modifications.

In the next lecture, diseases caused due to poor sanitation, hygiene and unsafe water is discussed. **Diseases that are caused due to poor sanitation, hygiene, unsafe water called as water-borne and faecal-oral diseases. There are a large variety of micro-organisms like rotavirus that causes diarrhoea in children, Hepatitis A and E viruses and bacteria or cholera that causes typhoid fever.** Skin diseases such as **scabies and trachoma; infectious eye and skin disease.** The prevalence of these diseases can reduce if people follow personal hygiene and clean water is accessible to everyone. **Malaria** is decreasing but still, annually children under age 5 dies of it. Poorly designed irrigation systems, poor water disposal, storage, biodiversity is contributing factors of malaria. The other vector borne disease are dengue and **filariasis**. An understanding of poisoning by arsenide and fluoride has been elaborated, since effects of arsenide poisoning causes cancer and skin lesions. On the other hand, Fluoride causes skeletal deformities. Installing filters in tube wells to remove arsenic and fluoride can reduce its severe effects on health. Thus, water quality must be improved and safe hygiene should be practiced.

- ❖ **Health Systems:** It has given an outline as to how WHO works with UN agencies (UNFPA, UNDP, UNICEF) in global level, and those global policies are turned into actionable programs at regional level. At country level, much of work is focused on planning, monitoring and evaluating the public health programmes.

“Universal Health Coverage” is “the strategy to ensure that all the people obtain health services that they need, without the suffering financial hardship when they pay for it”. It is promoted by WHO, and was set as a global agenda for health in 2015. It is a separate target under goal 3 to ensure healthy lives. In the world, extremely poor people don’t have access to effective healthcare, diagnostics, drugs. UHC must address the global inequities and ensure quality services so that the user doesn’t face a financial hardship.

According to WHO World Health Report, called Financing for UHC from 2010, which suggests, in order **to meet millennium development goals** for health countries would on average need to spend a little more than 60 U.S dollars per capita per year.

The strategies to increase the efficiency: can be done by raising the revenue collection through tax systems. The second strategy is to reprioritize its budget for health, implement sin taxes, that are levied on certain goods deemed harmful to society such as alcohol and tobacco, advocate for more development assistance for health.

Global Health Governance: This deals with managing those solutions in attempt to create an organized response to health at a global level. The **foundation of World Health Organization** in 1948 has led to the division of shared governments of the response to health challenges, finding issues, aggregating on common approaches, **bringing political attention, raising necessary funding, adequate workforce capacity.** For example, global health action on **small pox** led to its eradication in 1979, which was a joint and successful action.

