Maternal Mortality
in Lebanon A Story of Success

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Preface

Every day close to 830 women die from pregnancy or childbirth-related complications around the world with reported 303,000 maternal deaths in 2015. According to the World Health Organization (WHO), healthy life years in women of childbearing age are partly lost due to maternal morbidity and mortality factors besides two other medical conditions (sexually transmitted infections including HIV/AIDS and gynecological cancer). This is because every pregnancy - depending where it is happening - can embody different levels of risk for mother and baby which make maternal mortality (MM) as one of the major women's health problems worldwide with unacceptable high numbers of preventable mortality. Unfortunately, most of these deaths occur in low-resource settings with six countries (from Africa and Asia) account for over half of maternal deaths. Evaluation of performance of countries to meet the Millennium Development Goal 5 (MDG5) on improving maternal health was neither encouraging nor satisfactory.
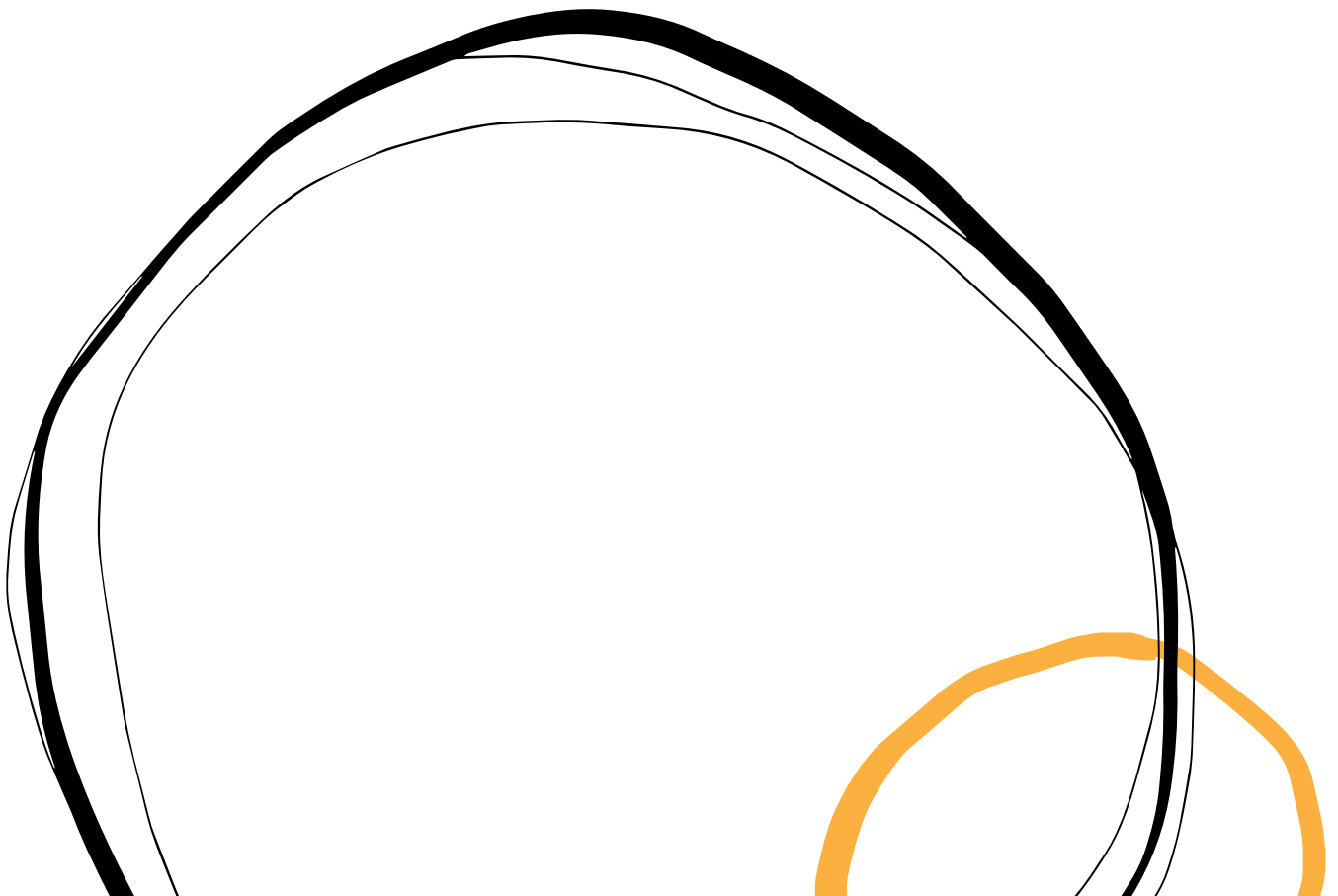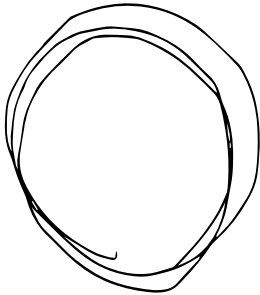
Lebanon stood out among the few countries which successfully dropped maternal mortality ratio (MMR) by more than three quarters over the past fifteen years. The efforts leading to the reduction of MM in the country were collective and laborious and effectively led by the Ministry of Public Health (MOPH). The latter encouraged research related to MM, composed and activated the National Committee on Safe Motherhood in collaboration with the Lebanese Society of Obstetrics and Gynecology (LSOG) and the United Nations Population Fund (UNFPA), supported training activities with WHO and UNFPA, and outreached to academic centers and hospitals, all orchestrated towards meeting MDG5. In order to face the challenges posed recently by the Syrian crisis, MOPH is supporting and speeding up efforts to enhance the health system reform mainly by taking and implementing concrete policies, creation of a referral system for high risk pregnancies, development of clinical protocols and standards, rolling out a series of capacity development, and closer monitoring of maternal health and emergency obstetric care issues. It remains of primary importance to continue working to drop MM further by working with concerned partners at different levels. In this regard, this document represents the first attempt to report in details on the efforts conducted to reduce MM in Lebanon looking at trends, preventable causes, and interventions, as well as recommending future actions to promote maternal health and well-being.
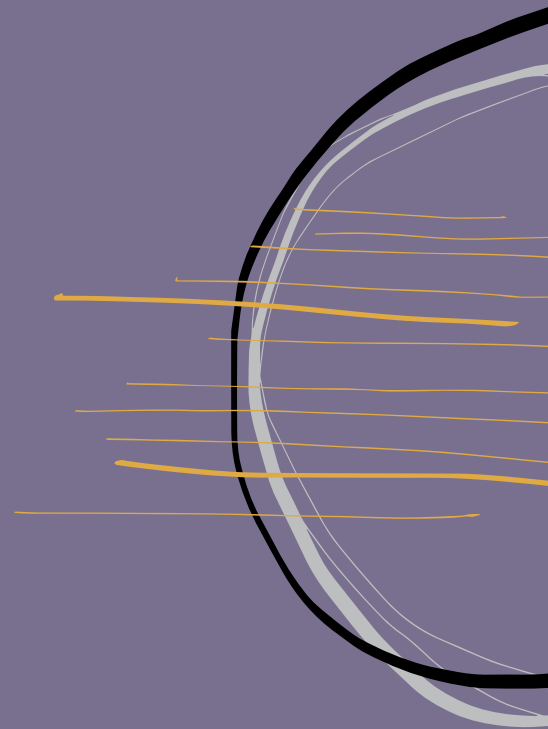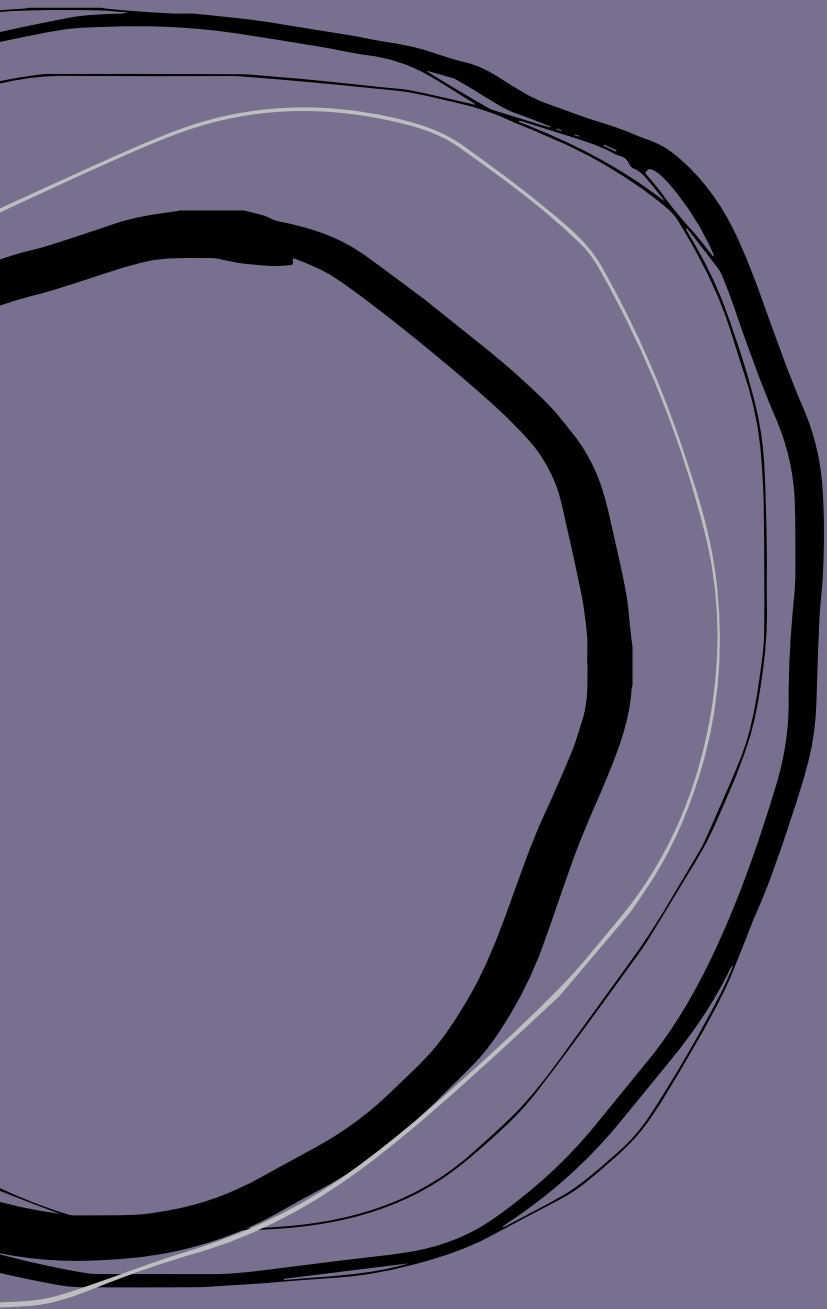
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Acknowledgement

Outline

List of Acronyms

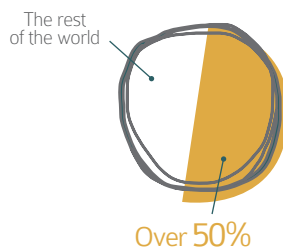|	
AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
AUB	American University of Beirut
AUBMC	AUB Medical Center
CCCC	Choices and Challenges in Changing Childbirth
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CRC	Convention on the Rights of the Child
EmOC	Emergency Obstetric Care
ESCWA	United Nations Economic and Social Commission for Western Asia
FHS	Faculty of Health Sciences
HCPs	Health Care Providers
HELLP	Hemolysis - Elevated Liver Enzyme and Low Platelet levels
HIV	Human Immunodeficiency Virus
ICPD	International Conference on Population and Development
LDCs	Least Developed Countries
LICs	Low Income Countries
LSOG	Lebanese Society of Obstetrics and Gynecology
MDGs	Millennium Development Goals
MDG5	Millennium Development Goal 5
MDG 10+	Millennium Development Goals 10+
MENA	Middle East and North Africa
MICs	Middle Income Countries
MM	Maternal Mortality
MMR	Maternal Mortality Ratio
MNMNS	Maternal and Neonatal Mortality Notification System
NCSM	National Committee on Safe Motherhood
MOPH	Ministry of Public Health
PAPCHILD	Pan Arab Project for Child Health
PAPFAM	Pan Arab Project for Family Health
PHC	Primary Health Care
RAMOS	Reproductive Age Mortality Study
RH	Reproductive Health
UN	United Nations
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
WHO	World Health Organization

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I. BACKGROUND

a. Burden of maternal mortality

Maternal mortality (MM) constitutes one of the major health problems facing women worldwide with unacceptable high numbers of preventable mortality. Every day close to 830 women die from pregnancy or childbirth-related complications around the world with reported 303 000 maternal death in 2015 according to WHO. Almost all of these deaths occurred in low-income countries (LICs), and most could have been prevented [1]. Six countries account for over half of maternal deaths around the world (India, Nigeria, Pakistan, Afghanistan, Ethiopia and the Democratic Republic of Congo). This discrepancy is manifested in the substantial variation in the maternal mortality ratio (MMR) by country, from 956.8/100 000 (685·1–1262·8) in South Sudan to 2.4/100 000 (1·6–3·6) in Iceland [2].

According to WHO, over 20% of all healthy life years lost in women of childbearing age are due to 3 factors: maternal morbidity and mortality, sexually transmitted infections including HIV/AIDS, and gynecological cancer [3].It is well known that every pregnancy can embody risks for mother and baby, but these risks vary among communities, countries and regions. Unfortunately, those risks are higher in countries with poor resources and week dysfunctional health services, with the largest gap between wealthy and impoverished observed in MM levels. Out of all the global maternal deaths, 99% occur in low-resource countries (284 000 maternal death), the majority of which are in sub-Saharan Africa (162 000 maternal death) and Southern Asia (83 000 maternal death) [4].

The MMR, being an indicator of development as well as quality of life in a population, is 15 times higher in low-resource regions than in high resource regions [5]. Among countries classified in the "low resource regions", sub-Saharan Africa ranks lowest with the highest MMR, at 500 maternal deaths per 100 000 live births, while Eastern Asia ranks highest with the lowest, at 37 maternal deaths per 100 000 live births. Looking at the ratings of MMR in all the "low resource regions", Western Asia where Lebanon belongs ranks 2nd after and Caucasus and Central Asia [5]. The overall ranking according to MMR (shown in brackets) is as follows: Southern Asia (220), Oceania (200), South eastern Asia (150), Latin America and the Caribbean (80), Northern Africa (78), Western Asia (71), and Caucasus and Central Asia (46).The adult lifetime risk of MM in women from sub-Saharan Africa was the highest at 1:39, in contrast

Every day close to 830 women die from pregnancy or childbirth-related complications around the world in 2015
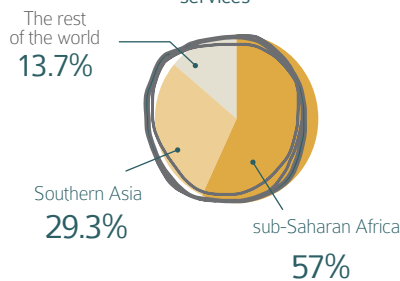
The rest of the world

Over 50%

Six countries account for over half of maternal deaths around the world (India, Nigeria, Pakistan, Afghanistan, Ethiopia and the Democratic Republic of Congo)

The risks are higher in countries with poor resources and week dysfunctional health services

The rest of the world
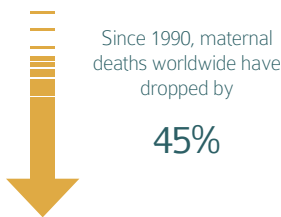13.7%

Southern Asia
29.3%

sub-Saharan Africa
57%

The discrepancy is manifested in the substantial variation in the MMR by country in 2013

2.4
Iceland

956.8
South Sudan

Since 1990, maternal deaths worldwide have dropped by

45%

Between 1990 and 2010, a decline in MMR was observed worldwide

69% Eastern Asia
66% Northern Africa
64% Southern Asia
41% sub-Saharan Africa
41% Latin America and the Caribbean
38% Oceania
35% Caucasus and Central Asia

between the years 1990 and 2013, the global MMR dropped by

2.6% per year

18 countries had achieved MDG5 by 2013

Maldives
Belarus
Cambodia
Bhutan
Equatorial Guinea
Poland
Lao People's Democratic Republic
Estonia
Bulgaria
Romania
Eritrea
Timor-Leste
Oman
Latvia
Cabo Verde
Nepal
Lebanon
Rwanda

to 1:130 in Oceania, 1:160 in Southern Asia, 1:290 in South-eastern Asia, and 1:3800 among women in high-resource countries [4].

MM is closely linked to several health and socioeconomic conditions such as total fertility rate, HIV, and gross domestic product. It is important to keep this in mind when looking at the variation in reported MM numbers and indicators across countries.

b. Overview of the progress

In 2000, the international community adopted the Millennium Development Goals (MDGs) in a strategic endeavor to address development in a holistic and multidisciplinary manner. The MDGs' aim is to improve the social and health conditions of the poorest and Middle-Income Countries (MICs) including joining efforts among countries and organizations to help improve socioeconomic and health aspects of the population at risk, and generally at large. One of these major tasks is to improve maternal health which constitutes one of the eight goals, MDG5. Under MDG5, countries are committed to reducing MM by three quarters between 1990 and 2015. Since 1990, maternal deaths worldwide have dropped by 45% and suboptimal to moderate progress has been made. For example, since 1990, in sub-Saharan Africa, levels of MM have halved in a number of countries. In Asia and North Africa, even greater progress has been made, and still other countries (like Lebanon) were able to achieve the MDG5 target by 2015.
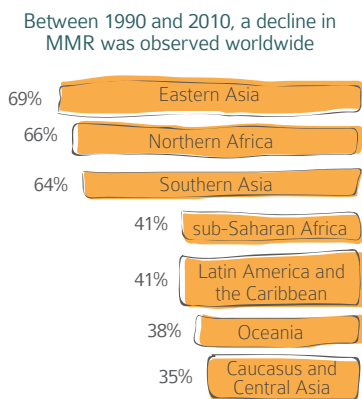
Between 1990 and 2010, a decline in MMR was observed worldwide, with the highest reduction over the 20-year period being in Eastern Asia (69%), followed by Northern Africa (66%), Southern Asia (64%),sub-Saharan Africa (41%), Latin America and the Caribbean (41%), Oceania (38%), and finally Caucasus and Central Asia (35%). The lowest decline noticed in Caucasus and Central Asia is due to the already low MMR of 71 in 1990 making it difficult to achieve comparable decline in other regions with higher MMR for the same year [5].
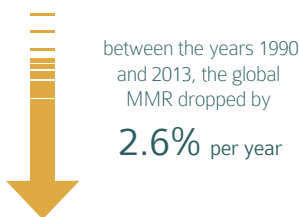
At the country level,18 countries had achieved MDG5 by 2013 and specifically in relation to MMR reduction, and these are: Belarus (96%); Maldives (93%); Bhutan (87%); Cambodia (86%); Equatorial Guinea (81%); Poland (81%); Lao People's Democratic Republic (80%); Romania (80%); Bulgaria (78%); Estonia (78%); Timor-Leste (78%); Eritrea (77%); Cabo Verde (77%); Latvia (77%); Oman (77%); Lebanon (76%); Nepal (76%) and Rwanda (76%). Among these, 11 had a baseline of MMR ≥100 in 1990, and are indicated as 'on track 'to achieve MDG5. Further, 63 countries were characterized as 'making progress' while 13 countries have made 'insufficient progress' [6].

However, between the years 1990 and 2013, the global MMR dropped by only 2.6% per year. This decline remains far from the annual decline of 5.5% required to achieve MDG5.

As of 2013, progress towards the goals was uneven; few countries achieved several goals, while others failed to be on the required track. In 2010, a United

Nations conference, Millennium Development Goal+10 (MDG+10), reviewed progress to date and adopted a global plan to achieve the eight goals by their target date. In this regard, new commitments targeting women's health were made, where MDG5 was revised and endorsed to include MDG5 A and B whereby the latter was meant to "Achieving universal access to reproductive health" by 2015 [7].

This commitment came after a longtime advocacy and understanding of the crucial role of reproductive health (RH) quality care in reducing MM. Other revised initiatives focused on poverty, hunger, and disease worldwide [8].

Overall MDGs' progress of developing countries are shown in the Figure 1 below. The red color represents the least progress whereas the dark green represents the best [9].

Figure 1. MDGs' progress of developing countries

OVERALL MDG PROGRESS SCORE

- 1A Poverty
- 1C Hunger
- 2 Education
- 3 Gender
- 4 Infant Mortality
- 5 Maternal Mortality
- 6 HIV/AIDS
- 7 Water

PROGRESS SCORES 0 — 8
Countries colored white have no data for this view
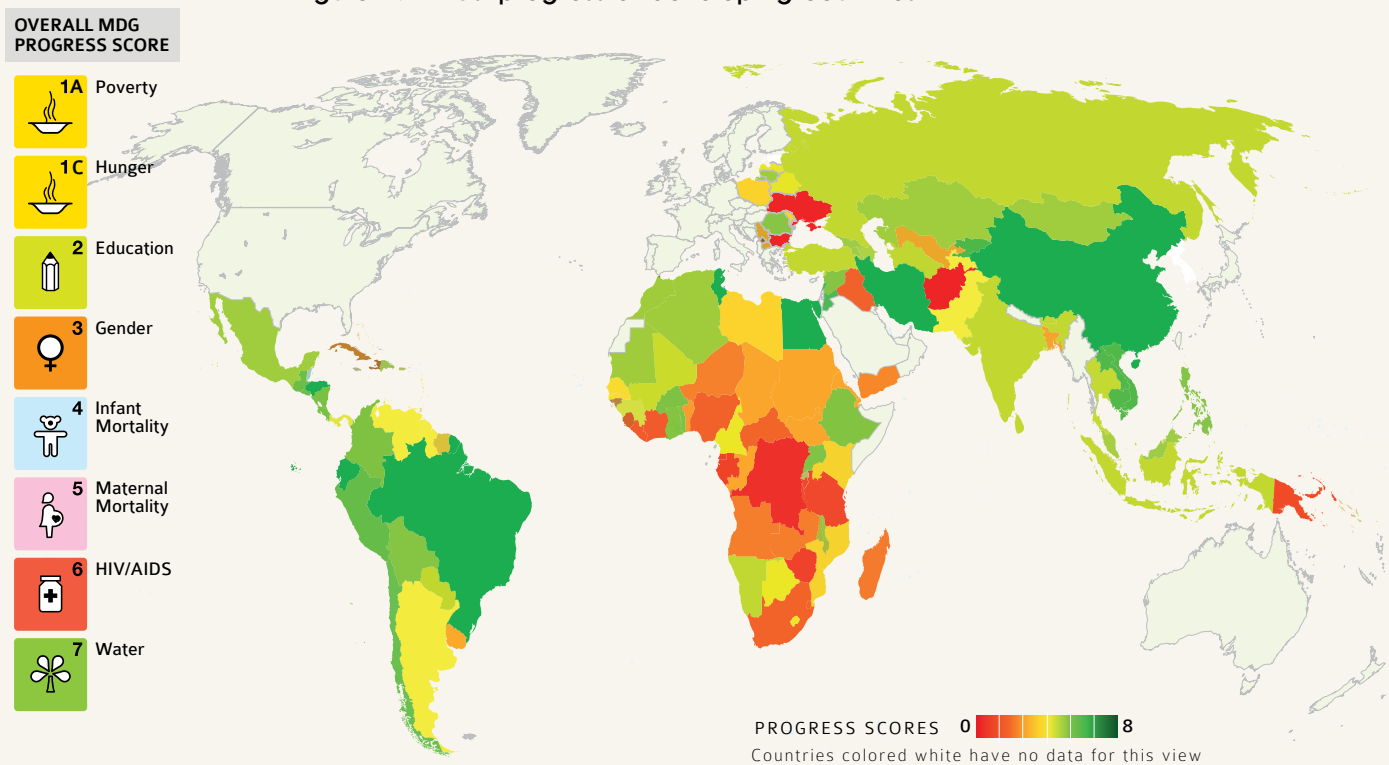
The failure to achieve the desired MMR during 2 decades of the Safe Motherhood movement (1987-2007) has been "one of the most deforming scars on the body of global health". The importance of funding and political commitment in achieving this goal is frequently emphasized as confounding factors for that failure, in addition to others like conflicting priorities in maternal health and poor evidence of certain interventions [10].

Policy makers and political agendas failed or ignored to place maternal and women's health issues on the priority list, despite advocacy and international calls [11]. According to the editor of Lancet commentary, "*the significant lack of progress in maternal mortality reduction despite MDG5 importance is both puzzling and embarrassing to global health leaders and workers alike*" [12].

II. REGIONAL AND COUNTRY CONTEXT

a. Place of the Middle East and North Africa (MENA) within MM trends

The countries of the MENA region fall on different socioeconomic and political gradient and as a result their MMR vary widely. The region continues to rank on the top third of the world regions regarding MM where MMR was around 145 (1990), dropping to an average of 69-74 (2013), with a -50% change in MMR over 23 years [13].

Obstacles like lack of access to antenatal care (ANC), poor obstetrical care, absent emergency responsiveness system (in conflict areas), weak referrals, and unattended home deliveries remain to be major barriers to further improve maternal health outcomes and to reduce MMR. Most recently the political and military turmoil which is destabilizing the region is seriously affecting the health care systems among other aspects of the lives of the people. There is a grave interruption of maternal health care and increased vulnerability of pregnant women to medical complications and risks of pregnancies (prematurity, bleeding, infections, violence) increasing maternal morbidity and mortality [14]. In fact, obstacles facing progress towards MDG5 set goals are closely related to the existin g policies and procedures governing maternal health care in different countries. These obstacles are mainly related to: health priorities in the countries of the region, weak commitment to reproductive and sexual rights agenda (not adopted at a large scale, despite the MDG+10 endorsement of MDG5B) ,lack of regulated health systems, and political instability. At the same time, many encouraging experiences from Tunisia, Egypt, Saudi-Arabia, Oman, and Lebanon have proved to be adequate opportunities to help reduce MM and morbidity in relation to Emergency Obstetric Care (EmOC) and antenatal complications.

Political commitment, knowledge transfer, and women involvement are essential triad for improving maternal health in the MENA region. Most recently, the high level ministerial meeting (Dubai 2013), issued and adopted the Dubai declaration where countries in the MENA region agreed to develop and execute national plans to improve maternal and child health; to take measurable steps to strengthen their health systems; and to mobilize domestic and international resources to establish sustainable financing mechanisms [15]. In a United Nations Economic and Social Commission for West Asia (ESCWA) meeting of the Arab High Level Forum on Sustainable Development (Amman, 2-4 April 2014) to discuss sustainable development goals relevant to the Arab Region context, health received a notable attention. In this regard, it was recommended that it is important for countries in the Arab region to provide increased access to quality health care services, including RH. Reducing infant and maternal deaths, particularly in the least developed countries (LDCs), and increasing vaccination coverage as well as reducing the burden of diseases such as tuberculosis and HIV/AIDS and diseases related with modern sedentary life-style are pre-conditions for ensuring healthy life. Prevention of both infectious and chronic diseases is cheaper than treating them after they are full blown [10].

It is essential to adopt an integrated public health approach which recognizes the complex interactions between social, environmental, ecological and health factors. Stronger advocacy on the relationship between environment and health can help promote environmental protection action [16].

b. Context of Lebanon and the MM trends

Lebanon has suffered long years of civil unrest that affected all aspects of governmental and public administration and private agencies and institutions leaving the country without good quality vital statistics and essential data. However, the civil society emanated to help building health and social support under crisis times and developed strength and resilience during those war times. International agencies working on health issues, and in view of scarcity of data, assigned Lebanon to the group H of countries with "no national data on maternal mortality"[21]. In view of the fact that the civil registration and vital statistics system which is expected to report on MM figures in Lebanon is not efficient, attempts were undertaken to estimate MMR using different methodologies.

Earlier reports dating back to 1970's/80's, and based on hospital-based samples and on convenient samples indicated an MMR estimate at 128 [17] and 63 [18]. In the 1990s, various governmental institutions, among them the MOPH and the Ministry of Social Affairs, took the lead in reconstructing the picture of wellbeing in Lebanon. The Pan Arab Project for Child Health (PAPCHILD) survey, conducted in 1996 with the support of the League of Arab States and UNFPA to look at the health status of Arab families, estimated the MMR for Lebanon to be 104 (calculated based on sisterhood method); a figure that came astounding. (PAPCHILD report) [19], Table 1. Although the data on MMR was reported by an official evidence- based source like the PAPCHILD report, it was strongly believed that it is not commensurate with the existing type for health system and maternal health services, in Lebanon [20].

Table 1.Sources and reports on MMR for Lebanon (El kak 2004, presentation)

SOURCE	METHOD	POPULATION	MMR per 100,000	DATE OF ESTIMATE
UNFPA, 2003	Model	National	126	2000
WHO, 2001	Model	National	130 (43-350)	1995
WHO et al 1996	Model	National	300	1990
Mahaini 2004	Vital stats.	National	13	2002
MOSA & UNFPA 1996	Survey direct approach	National	9	1994-6
MOPH & Arab League 1995	Sisterhood	National	104, also 130-155	1984
Deeb et al 1997	Sisterhood	Beirut	63	1981
Mashini et al 1984	Hospital based RAMOS	AUH Hospital	128	1971-82

As Lebanon began to stabilize, to build and regain its institutions with the support of development agencies and banks, research and surveys on health and socioeconomic issues began. In 2004, the the Pan Arab Project for Family Health (PAPFAM) for Lebanon reported an MMR of 86.3, dropping from 104 in 1996 [21]. The 2005 global MM neglected to include the PAPFAM 2004 or other national results due mostly to

many factors (Maternal mortality in 2005, WHO, 2007). On the basis of the existing 2004 PAPFAM, Lebanon should be classified at least as a group G country in which punctual MMR reports exist [3].The results of the review are expected to set grounds for an on-going hospital-based surveillance system for reproductive age causes-of-death. This will help Lebanon to have better maternal health indicators and lower MMR that are more appropriate to its context.

In 2009, a Reproductive Age Mortality Study (RAMOS) was conducted to provide a valid and "appropriate" MMR figure for Lebanon. According to that study, there were 84,823 live births in Lebanon (in 2008) with a numerator of 13 confirmed pregnancy related deaths, the estimated ratio was 15.3 per 100,000 [22]. Most of the birth in Lebanon happens in hospitals under skilled attendance (close to 95% PAPCHILD). Based on RAMOS methodology explained above, this estimation became the lower limit of an uncertainty interval, with an upper limit of 30.6. Therefore, the mean of the interval which is 23/100,000 (15.3-30.6) becomes the national MMR figure for Lebanon in 2008 [23] and was adopted by the MOPH. After that study, negotiations with the WHO followed which moved Lebanon from category H of "no data on maternal mortality", to category B of "countries lacking good complete registration data but where other types of data are available".

Most recently, and over the past five years of the Syrian military unrest (2011), Syrian refugees had crossed borders seeking safer spaces in Lebanon. The UN High Commissioner for Refugees (UNHCR) estimates that Lebanon hosts the largest number of refugees from Syria, over 1.2 million people, representing more than one-fourth of Lebanon's pre-crisis population [24].

Among many challenges that this refugee crisis presented to Lebanon, the challenge imposed on the health care system and on to the maternal and child health care was overwhelming. With a rough estimate of 42.000-50.000 pregnant Syrian refugees over mid 2013-2014 (unpublished journalistic sources) and a compromised unregulated system of health financing and antenatal coverage, it is expected that the risk of maternal morbidity and mortality might be higher. In a recent study done on antenatal coverage among pregnant Syrian refugees in Lebanon, it was found that among pregnant women registered with UNHCR, only 12.6% had not received ANC compared to 25.9% of unregistered refugees. The proportion of women having received ANC was lowest among the high risk pregnant women (defined as age >35 years): 65.9% of the women aged 35 and above had prior antenatal care compared to over 80% in every other age group [14]. So far, the reported numbers of MM cases neither show any increase nor a trend in relation to pregnant Syrian refugees as will be mentioned afterwards.

III. MM REDUCTION: THE CASE FOR LEBANON

a. MOPH endeavor to reduce MM

In the year 1997, a study was conducted by the MOPH in collaboration with UNICEF on midwives in small clinics and houses showed that 267 midwives and 171 midwifery clinics cover around 13% of births in Lebanon. At that time, the MMR for Lebanon was reported to

be 104 per 100,000 in the PAPCHILD study through sisterhood method, but was considered even higher by the international literature whereby Lebanon was well thought-out among the countries having no official figures on maternal deaths. Consequently training material was produced and training programs for midwives were initiated in 1999 covering best practices around maternity and child birth.

In the same year, the efforts made by the MOPH in conducting the National Study on Perinatal Morbidity and Mortality (1999-2000) in collaboration with UNICEF, and the Lebanese Society of Perinatal Medicine, revealed the importance to attribute to the perinatal period all the attention it deserves by focusing on the situation of mother and child. MOPH adopted the recommendations of the study and in particular those related to the right of every woman to have access to the services of perinatal care stipulated in the Convention on the Rights of the Child (CRC) and the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), both ratified by the Lebanese Government. This study constituted an important milestone in the efforts exerted to improve the health status of mothers and children in Lebanon.

Along the same agenda, and as a measure of the government of Lebanon to commit itself to the International Conference on Population and Development (ICPD) 1994, the RH program at the MOPH supported by UNFPA was built under the primary health care (PHC) umbrella with a clear strategy extending between 1998 and 2001, and various goals were set among which to decrease the MMR to 64 per 100,000 and to decrease neonatal and under five mortality rates to less than 24 per 1,000, and less than 30 per 1,000, respectively. The program still continues to date, and the goals were over achieved. The PHC network is widening year after year with 225 PHC centers, all delivering good quality RH services and thus contributing highly to the drop in MMR all over the country.

By 2004, it was clear that the MMR was decreasing at national level as was shown by the PAPFAM to be 86.3 per 100,000. This national average was hiding discrepancies between districts with the highest rates in Akkar. Accordingly, the MOPH initiated the what became later on to be known as "the Wadi Khaled initiative". The area is considered a poverty pocket in the North of Lebanon. The initiative consisted of an agreement between the MOPH and a local NGO (Makassed) to deliver essential health care to the population of 31 villages housing around 23,000 persons, with a focus on mother and childcare services. This area has been suffering the most from the lack of health services and its population was mainly relying on neighboring Syria for healthcare.

b. National Committee on Safe Motherhood (NCSM) and the Maternal and Neonatal Mortality Notification System (MNMNS)

Following the UN documentation and reporting of what is believed to be "unacceptable" MMR figures, the MOPH decided to undertake several measures to look at maternal health indicators and ensure an accurate MMR. In 2004, a ministerial decree to form the NCSM was issued (Annex 1). The committee included former MOPH minister, academicians and pertinent specialized maternal health experts who are chairpersons of the departments of Obstetrics and Gynecology in teaching hospitals. The committee is chaired by the Director General of MOPH, Dr. Walid Ammar, with H.E. Dr Adnan Mroueh (Former Minister of Public Health) as vice chair.

The main tasks of the NCSM were basically to document cases of maternal death and understand the circumstances leading to it in the health environment and in the community, as well as the direct and indirect causes of maternal death. The committee held 2-3 meetings per year to overview and assess MM cases and to understand better the situation regarding maternal death in Lebanon. In 2005, the committee, in collaboration with Choices and Challenges in Changing Childbirth (CCCC) at the Faculty of Health Sciences (FHS)/ American University of Beirut (AUB), held its first national meeting on MM in Lebanon to reflect on the efforts undertaken to improve maternal health indicators and reduce MM.

In an attempt to activate a notification system at the national level to get accurate data on MM, the name and the mandate of the national committee was officially changed by a ministerial decree in 2009 from NCSM to Maternal and MNMNS. The committee was expanded to include representatives from relevant scientific societies of Obstetrics/ Gynecologists, pediatricians/neonates, head of syndicate of private hospitals, representative from public hospitals, representative from order of midwives, representatives from WHO, UNICEF, UNFPA, Italian Cooperation and representative from civil society. The new mandate includes having an active collection of maternal and fetal mortality and stillbirths data from hospitals all over Lebanon (both public and private).

To activate the notification system the following was accomplished between mid-2009 and end of 2010: development of data collection sheets where 3 different forms were developed (Maternal Death Notification Form, Neonatal Death Notification Form, and Monthly Form for total number of deliveries and cases of maternal and neonatal deaths), distribution of the data collection sheets to all the hospitals in the country (around 160 hospitals) identification of focal points in each hospital in charge of data collection and notification, development of data structure and data entry within the MOPH to facilitate data analysis and generation of reports, and development of training packages to focal points at the hospitals.

Once all the preparatory work was finalized, the official launching of the MNMNS started in early 2011 based on a Memo no. 112 (Annex 2) that was issued by the Director General of the MOPH that included: a call of commitment to all hospitals in Lebanon to report monthly the total number of births and neonatal and maternal deaths in accordance with a notification procedure that was identified and detailed in a document attached to the Memo letter, a request for each hospital to identify a focal person stipulating the tasks assigned to the focal person, and a claim of adherence to six requirements including emphasis on reporting deaths in accordance with the MOPH updated definitions for Still Birth, Intra Uterine Fetal Death and Neonatal Death. The commitment to credible reporting in accordance with the Memo no. 112 was proclaimed as a standard of hospital accreditation.

Two sets of trainings were conducted for the focal points at the hospitals. The first set of trainings (Introductory training) was done in March 2011 after pilot testing the forms in hospitals during the months of January and February 2011. Five training sessions were conducted; one for each Mouhafaza (district). The objectives of this training were to inform all focal persons (who have been identified by the administration of each hospital) on the objectives of the MNMNS, stipulate the role of the focal point person as a coordinator with the other departments of the hospital (Neonatal-Pediatrics-Emergency-Delivery and Postnatal care), in identifying mortality cases, causes, and the reporting of these cases,

establish a data-base attending to accuracy in figures and explain the reporting system including preparing monthly reports and completing notification forms on maternal and neonatal mortality.

The second set of trainings was conducted as a follow up and evaluation of responsiveness of reporting, review mortality cases reported as case studies and presentation of determinants of the deaths identified based on the reported cases. This set of trainings was conducted between October and November 2011. Seven sessions were given and they were attended by the hospital focal points in addition to other relevant staff at the hospital.
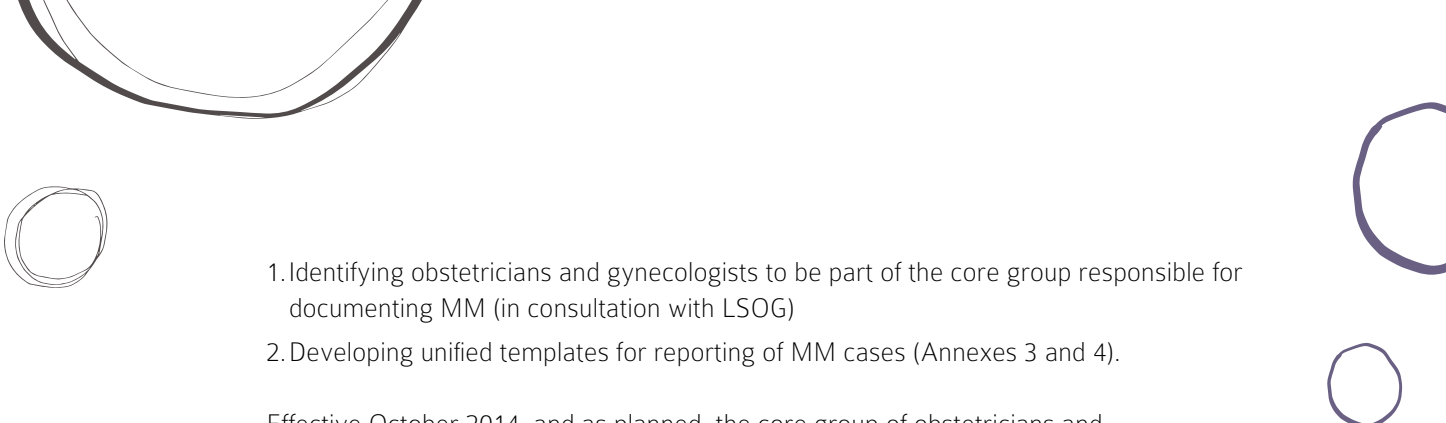
The MNMNS functions are as follows: Once a maternal death case is reported to the MOPH, the national committee designate an independent expert from LSOG to go and investigate the case of death. The notification program at the ministry is required to enter all reported data into the data structure that was developed and forward entered and cleaned data to the statistics department at the MOPH for further analysis. In addition, the statistics department is also responsible to collect all the reports of investigations from the independent experts, once ready, to generate a unified comprehensive report about maternal death in Lebanon with identified causes and determinants on an annual basis and submit it to the national committee. Currently, the reporting between the hospitals and the MOPH is done online, and all the forms are filled on monthly basis using an application based program with built-in quality check.

c. Operationalization of NCSM and the MNMNS

With the advancement of reporting of vital data in MOPH and the strengthening of various units and departments, supported by UN agencies and in collaboration with scientific groups and societies, the performance of the NCSM was potentiated. In 2011, in collaboration with LSOG, and with support from UNFPA, MOPH has now a robust and reliable MM notification system for each and every hospital-based maternal death. It is worth noting that close to 95% of pregnant women in Lebanon attend to antenatal care and deliver in hospitals under skilled attendance, despite very low percentages of deliveries occurring at home, making reporting of MM difficult or invisible. In relation to NCSM process, focal points (around 140 who are part of the staff of public and private hospitals) MNMNS are assigned by MOPH to report on every hospital- based maternal death using a form already prepared by the MOPH. Once the cases are reported, then LSOG is notified which in return asks one of the members to look at the case and prepare a medical/ technical report to be kept at the NCSM. The collected cases will be studied and assessed during regular meetings of the NCSM (usually every 4-6 months or upon request from the chairperson), where members will delve into the causes of maternal death and come up with recommendations to avoid future incidence whenever possible. So, about 5 meetings were held over the past 2 years.

Moreover, and in consultation with MOPH and UNFPA, and based on the performance of NCSM, it was decided to standardize all the MM reporting tools and work towards institutionalizing the reporting between MOPH and LSOG with the support of UNFPA. Several meetings were held that addressed the following:

1. Identifying obstetricians and gynecologists to be part of the core group responsible for documenting MM (in consultation with LSOG)
2. Developing unified templates for reporting of MM cases (Annexes 3 and 4).

Effective October 2014, and as planned, the core group of obstetricians and gynecologists were identified in consultation with LSOG and MOPH. A technical meeting, chaired by Dr. Walid Ammar, was held for the core group where the prepared standardized forms of MM reporting were shared and the procedure of reporting of MM cases using these forms were also discussed. By the end of the meeting, the new templates were finalized and adopted. The meeting was supported by UNFPA.

IV. MM TRENDS AND ANALYSIS

a. Burden of MM in Lebanon

Lebanon ranks currently first among countries in MENA, in terms of annualized rate of change in MMR, who actively worked to reduce significantly the MMR to meet the MDG5 requirements. MMR moved from an average of 65 (1990), to 23 (2003), to 15 (2015) with a MMR of 18.1 (11.9-26.0) according to the review by Lancet in 2014, with an annualized rate of change in MMR of -7.5% from 1990-2013 (Table 2); better than Oman and Morocco.

As of 2010 till the writing of this document, an estimated number of 74 MM cases are reported in Lebanon averaging around 12.2 per year (10 cases per year), with the MMR falling within the officially reported number of 26 as mentioned earlier. These cases are distributed as follows: Beirut (10 cases), South Lebanon (12 cases), Mount Lebanon (13 cases), Bekaa (21 cases), and North Lebanon (18 cases). There might be additional cases not reported in the document - as they are under medico-legal investigation or in court - or cases of maternal death happening outside the hospitals or even not reported (3-5 cases estimated in total). Based on the process of reporting of MM, and up till the end of 2015, each obstetrician gynecologist of the core group assigned a case within her/his respective geographical region, reports the mortality case based on the interview conducted with the team in charge of the mortality case and the administration in the hospital where it occurred. An in-depth revision of the chart, which will be used to describe the full medical events, takes place. As of 2015, cases are reported using standardized templates developed by the workshop organized by LSOG, UNFPA and MOPH (Annexes 3 and 4).

Table 3 shows the distribution of MM cases from 2010-2015 by governorates. The highest number of MM case is in Bekaa governorate, followed by the North Lebanon, Mount Lebanon, South Lebanon and the capital city Beirut. Although, more than 95% of pregnant women in Lebanon deliver in hospitals or maternities, it is known that the North and Bekaa governorates are less developed and may be at a disadvantage in relation to access to and provision of quality care services at both primary and tertiary care centers. However, the MM numbers are small and comparable across governorates except for Beirut.
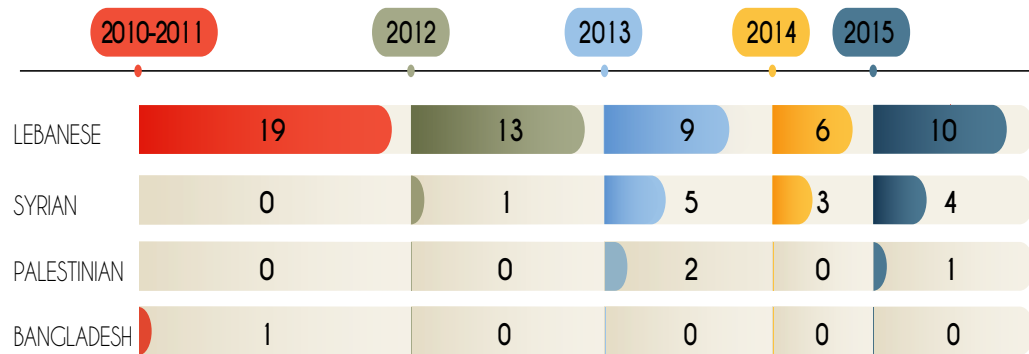
Table 2. Snapshot of MMR numbers of maternal deaths, and annualised rates of change for 21 Global Burden of Disease regions and 188 countries

	MATERNAL MORTALITY RATIO (PER 100 000 LIVE BIRTHS)			NUMBER OF MATERNAL DEATHS			ANNUALISED RATE OF CHANGE IN MATERNAL MORTALITY RATIO (%)		
	1990	2003	2013	1990	2003	2013	1990-2003	2003-13	1990-2013
Worldwide	283.2 (258.6 to 306.9)	273.4 (251.1 to 296.6)	209.1 (186.3 to 233.9)	376034 (343483 to 407574)	361706 (332230 to 392393)	292982 (261017 to 327792)	-0.3% (-1.1 to 0.6)	-2.7% (-3.9 to -1.5)	-1.3% (-1.9 to -0.8)
Developed countries	24.5 (23.0 to 26.1)	16.0 (14.9 to 17.0)	12.1 (10.4 to 13.7)	3827 (3596 to 4076)	2341 (2178 to 2490)	1811 (1560 to 2053)	-3.3% (-3.8 to -2.8)	-2.9% (-4.2 to -1.5)	-3.1% (-3.7 to -2.5)
Developing countries	317.6 (289.9 to 344.5)	305.4 (280.3 to 331.5)	232.8 (207.3 to 260.6)	372207 (339780 to 403753)	359365 (329892 to 390100)	291171 (259299 to 325923)	-0.3% (-1.2 to 0.6)	-2.7% (-4.0 to -1.5)	-1.4% (-1.9 to -0.8)
North Africa and Middle East	131.0 (115.4 to 147.8)	101.8 (85.1 to 121.3)	78.1 (63.1 to 97.6)	13106 (11543 to 14783)	10370 (8672 to 12351)	8907 (7204 to 11135)	-2.0% (-3.2 to -0.9)	-2.7% (-4.3 to -1.0)	-2.3% (-3.2 to -1.3)
Algeria	126.1 (87.6 to 170.4)	81.0 (59.8 to 107.0)	51.5 (37.2 to 70.1)	949 (655 to 1283)	575 (424 to 759)	470 (340 to 641)	-3.4% (-6.5 to 0.1)	-4.5% (-8.6 to -0.5)	-3.9% (-5.8 to -2.0)
Bahrain	55.4 (40.7 to 73.4)	32.7 (24.9 to 41.9)	21.4 (15.5 to 29.0)	7 (5 to 10)	5 (4 to 6)	4 (3 to 6)	-4.0% (-6.9 to -1.1)	-4.3% (-8.0 to 0.1)	-4.2% (-6.1 to -2.2)
Egypt	83.7 (69.9 to 100.1)	44.8 (39.1 to 51.9)	32.6 (24.5 to 42.3)	1385 (1157 to 1656)	765 (668 to 888)	619 (465 to 803)	-4.8% (-6.5 to -3.0)	-3.2% (-6.2 to -0.3)	-4.1% (-5.5 to -2.8)
Iran	40.1 (27.0 to 57.2)	26.6 (21.9 to 31.6)	13.5 (9.4 to 18.3)	651 (439 to 929)	333 (275 to 396)	197 (137 to 266)	-3.1% (-6.2 to 0.2)	-6.9% (-10.9 to -3.1)	-4.7% (-7.0 to -2.6)
Iraq	110.6 (68.7 to 157.0)	88.0 (62.0 to 126.8)	65.8 (40.4 to 110.7)	736 (457 to 1045)	816 (574 to 1175)	695 (427 to 1170)	-1.7% (-5.6 to 2.5)	-3.1% (-8.1 to 2.3)	-2.3% (-4.8 to 0.7)
Jordan	102.2 (79.1 to 128.7)	60.2 (46.2 to 78.8)	29.8 (20.3 to 41.4)	112 (87 to 141)	92 (71 to 120)	57 (39 to 79)	-4.1% (-6.9 to 1.3)	-7.1% (-11.8 to -2.2)	-5.4% (-7.2 to -3.5)
Kuwait	17.8 (14.4 to 21.6)	11.4 (9.6 to 13.6)	9.5 (7.5 to 12.0)	6 (5 to 7)	5 (5 to 7)	7 (5 to 8)	-3.4% (-5.4 to -1.4)	-1.8% (-4.4 to 0.8)	-2.7% (-4.0 to -1.4)
Lebanon	101.4 (74.8 to 135.1)	42.4 (30.8 to 56.8)	18.1 (11.9 to 26.0)	65 (48 to 87)	23 (16 to 30)	12 (8 to 17)	-6.7% (-9.5 to -3.9)	-8.6% (-12.7 to -4.9)	-7.5% (-9.7 to -5.5)
Libya	41.8 (25.7 to 64.6)	30.7 (22.8 to 40.5)	27.0 (18.0 to 40.5)	46 (28 to 71)	37 (27 to 49)	33 (22 to 50)	-2.3% (-6.0 to 1.6)	-1.4% (-6.5 to 3.7)	-1.9% (-4.5 to 0.8)
Morocco	279.5 (236.0 to 338.9)	98.3 (75.2 to 120.8)	63.9 (45.1 to 85.8)	1971 (1664 to 2390)	603 (462 to 741)	472 (334 to 635)	-8.1% (-10.2 to -6.0)	-4.4% (-7.5 to 1.3)	-6.5% (-8.1 to -5.0)
Oman	47.0 (26.7 to 76.6)	20.4 (14.2 to 29.4)	12.8 (8.4 to 20.6)	30 (17 to 49)	11 (7 to 15)	9 (6 to 15)	-6.3% (-10.8 to -1.7)	-4.8% (-10.8 to 1.2)	-5.6% (-8.5 to -2.8)
Palestine	21.1 (12.3 to 34.3)	11.3 (8.7 to 14.4)	9.0 (5.5 to 13.2)	22 (13 to 35)	13 (10 to 17)	12 (7 to 17)	-4.6% (-9.0 to -0.4)	-2.5% (-7.5 to 2.3)	-3.7% (-6.8 to -0.7)

Table 3 . Distribution of MM cases in Lebanon from 2010 till 2015 by mohafaza

	North Lebanon	Bekaa	Mount Lebanon	South Lebanon	Beirut	Total
2015	6	2	4	2	1	**15**
2014	2	2	3	2	0	**9**
2013	1	7	3	5	0	**16**
2012	4	6	2	1	1	**14**
2010-2011	7	3	3	2	5	**20**
Total	18	21	13	12	10	**74**

Figure 2 . Distribution of MM cases in Lebanon from 2010 till 2015 by nationality

	2010-2011	2012	2013	2014	2015
LEBANESE	19	13	9	6	10
SYRIAN	0	1	5	3	4
PALESTINIAN	0	0	2	0	1
BANGLADESH	1	0	0	0	0

Looking at the distribution of MM cases by nationality (Figure 2 and 3), it obviously shows that 79% of them are Lebanese, 16% are Syrians, and 4% are Palestinians. The distribution of cases reveal an increasing number, not yet a trend, of Syrian MM cases over the past 3-4 years following the Syrian crisis and the entry of more than 1.2 million Syrian refugees to Lebanon to date [25]. It was expected by many international and local agencies that the Syrian crisis will burden the health system in Lebanon and there is a risk that maternal death may increase significantly among Syrian women. Fortunately this was not the case mainly due to the resilience of the health system and the maternity services in Lebanon and their capacity in handling the increasing load of pregnancy and delivery of the Syrian women refugees. (Around 140 hospitals and close to 1,000 obstetricians and 800 midwives work in Lebanon).

Figure 3 . Distribution of MM cases in Lebanon from 2010 till 2015 by nationality

LEBANESE 79%

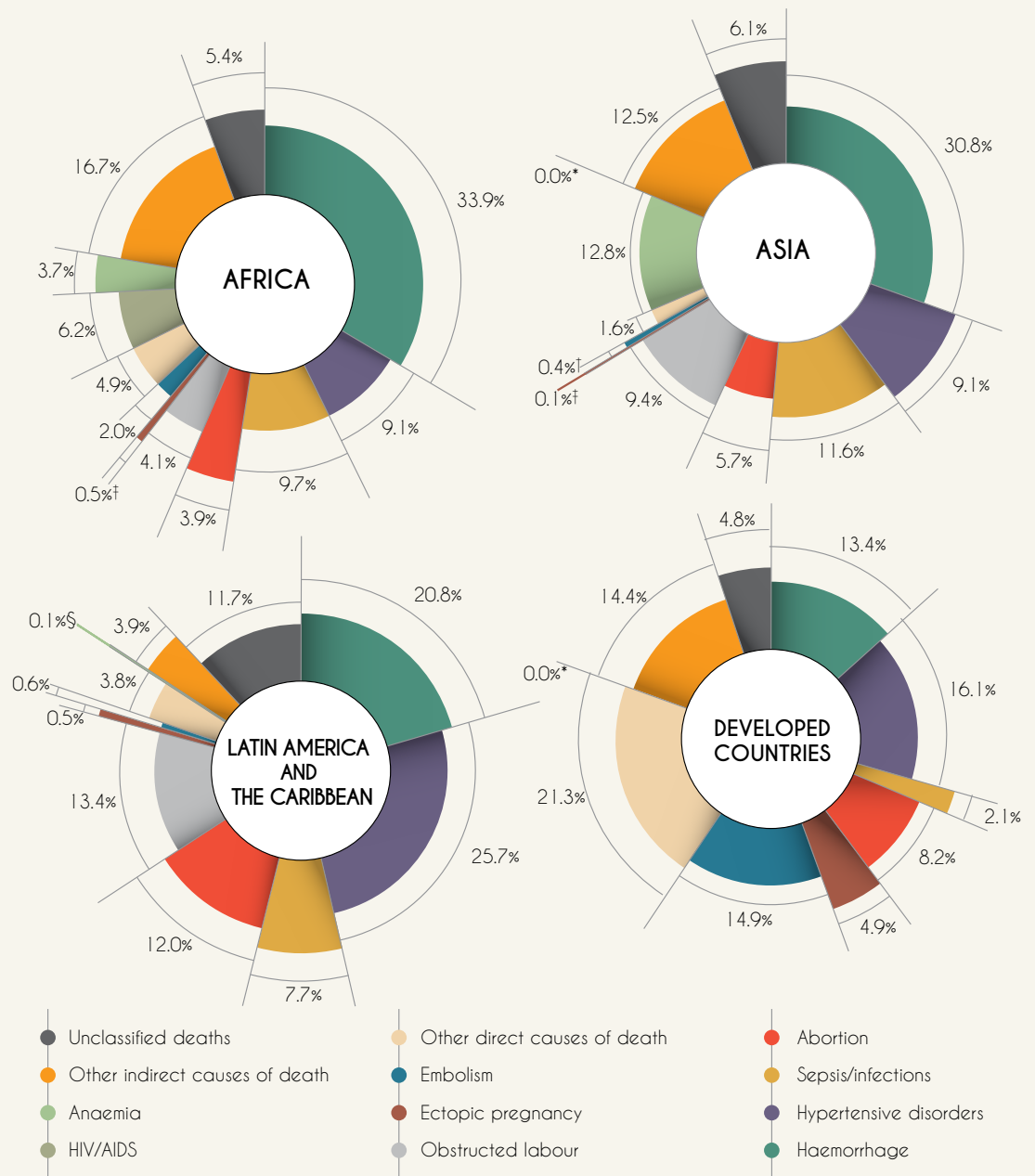SYRIAN 16%

4% PALESTINIAN

1% BANGLADESH
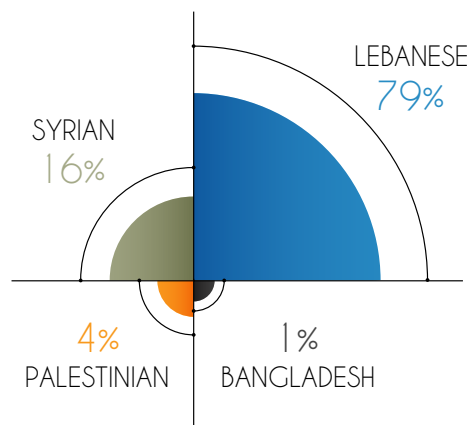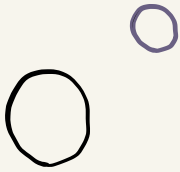
The current MMR for Lebanon, including deaths among displaced Syrian women, is confirmed by an effective and comprehensive MNMNS to be of 15 per 100,000 live births compared to 70 per 100,000 in Syria before the war. It is an irony of fate that Syrian women escaping war to Lebanon are experiencing lower rates of maternal deaths than those that used to prevail in Syria in peace times.

b. Causes of MM

It is well known that the causes of maternal mortality are biological, cultural, and social in addition to the medical causes of direct and indirect etiologies. From a biomedical perspective, the major direct causes of maternal death are hemorrhage, pregnancy-induced hypertension, infection, abortion, and obstructed labor (Figure 4). Hemorrhage is the leading cause of maternal complications, particularly during delivery, together with postpartum complications that could easily be avoided with immediate attention [26].

Figure 4: Geographical variation in distribution of causes of maternal deaths

Legend:
- Unclassified deaths
- Other indirect causes of death
- Anaemia
- HIV/AIDS
- Other direct causes of death
- Embolism
- Ectopic pregnancy
- Obstructed labour
- Abortion
- Sepsis/infections
- Hypertensive disorders
- Haemorrhage

There are large disparities between countries, with few countries having extremely high MMR reaching 1,000 per 100,000 live births. There are also large disparities within countries, between women with high and low income and between women living in rural and urban areas.
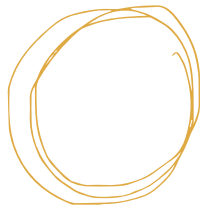
The risk of MM is highest for adolescent girls under 15 years old and complications in pregnancy and childbirth are the leading cause of death among adolescent girls in developing countries. Women in developing countries have on average many more pregnancies than women in developed countries, and their lifetime risk of death due to pregnancy is higher. A woman's lifetime risk of maternal death – the probability that a 15 year old woman will eventually die from a maternal cause – is 1 in 3,700 in developed countries, versus 1 in 160 in developing countries.

In Lebanon, the main cause of maternal death according to NCSM records remains postpartum hemorrhage due to uterine atony or abnormal placentation, followed by hypertensive disorders of pregnancy (Preeclampsia & HELLP), followed by (in very low numbers) medical and chronic conditions complications like cancer (Figures 5 and 6).

Figure 5 . Distribution of MM cases in Lebanon from 2010 till 2015 by cause of death
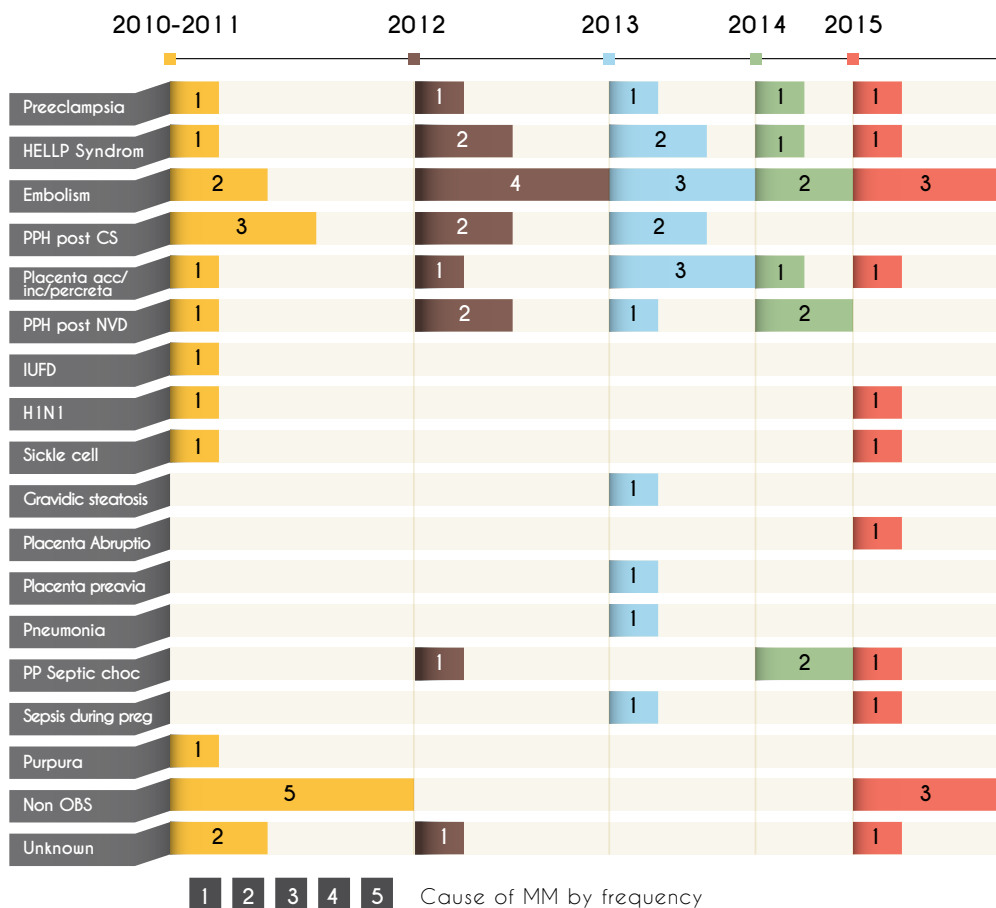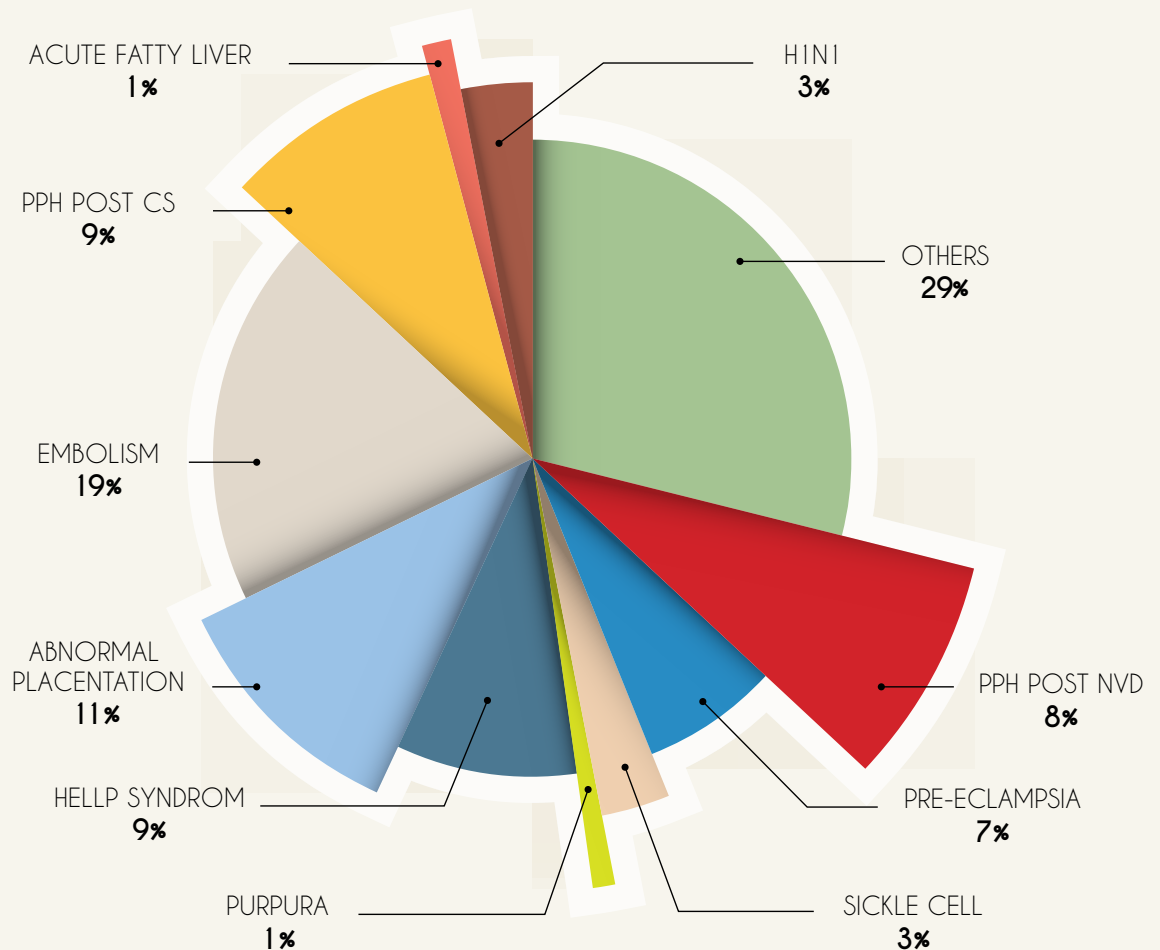
Cause	2010-2011	2012	2013	2014	2015
Preeclampsia	1	1	1	1	1
HELLP Syndrom	1	2	2	1	1
Embolism	2	4	3	2	3
PPH post CS	3	2	2		
Placenta acc/inc/percreta	1	1	3	1	1
PPH post NVD	1	2	1	2	
IUFD	1				
H1N1	1				1
Sickle cell	1				1
Gravidic steatosis			1		
Placenta Abruptio					1
Placenta preavia			1		
Pneumonia			1		
PP Septic choc		1		2	1
Sepsis during preg			1		1
Purpura	1				
Non OBS	5				3
Unknown	2	1			1

1 2 3 4 5   Cause of MM by frequency

Figure 6 . Percent of MM cases in Lebanon from 2010 till 2015 by cause of death

ACUTE FATTY LIVER
1%

H1N1
3%

PPH POST CS
9%

OTHERS
29%

EMBOLISM
19%

PPH POST NVD
8%

ABNORMAL
PLACENTATION
11%

PRE-ECLAMPSIA
7%

HELLP SYNDROM
9%

SICKLE CELL
3%

PURPURA
1%

In general, the causes why women are dying during pregnancy and childbirth in Lebanon seem to follow the below trends that fall within the 3-delays model [27]:

1. Women who arrive in a moribund state too late to benefit from emergency care, either because their high risk condition was not identified, or they failed to seek routine care.

2. Women who arrive with complications who could have been saved if they had received timely and effective interventions, either because of lack of skills, or inadequate diagnosis of the emergency condition.

3. Women admitted for normal delivery who subsequently develop serious complications, either naturally or through iatrogenic factors, and die.

Documentation of MM cases show that the most common causes of mortality are generally common across all regions of Lebanon (Figure 7).

Figure 7. Distribution of MM cases in Lebanon from 2010 till 2015 by region
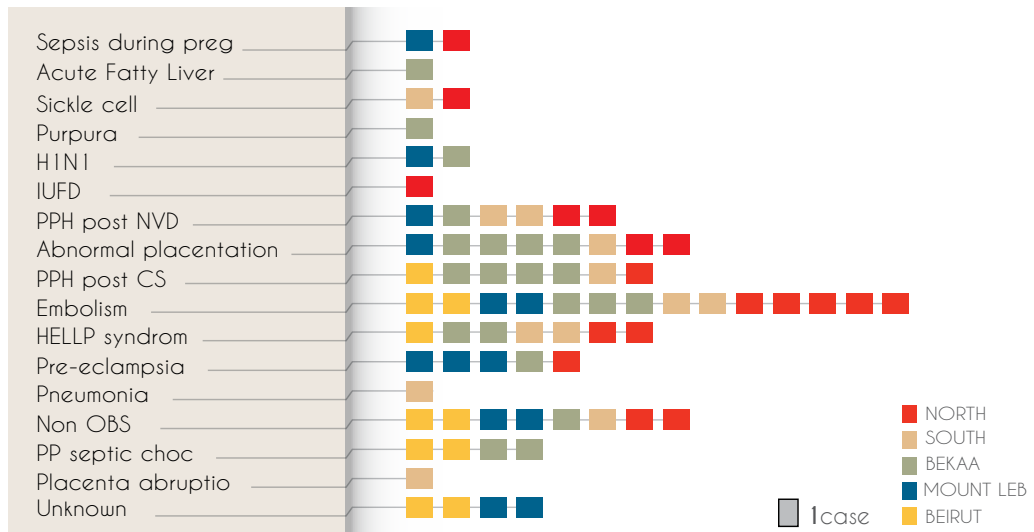
The pattern of MM in Lebanon is mixed in its etiology and determinants between HICs and LICs, suggesting a transition towards better care and better promotion of maternal health which should be captured and strengthened. The MM causes in Lebanon are common to Central Europe and some developing countries with a mixture of one type of "Delay" and health system (environment) derangement.

Based on the revisions of MM cases by the NCSM, few interventions were identified. In 2013, a national meeting on MM was held at AUB Medical Center (AUBMC) where MM cases were reviewed and discussed. Abnormal placentation and its complications leading to maternal death were identified as a serious preventable cause of MM. One of the main outcomes/interventions of the meeting was to develop policy guidelines on early detection of abnormal placentation in pregnancies with previous history of two previous cesarean sections with current previa, using magnetic resonance imaging. Once the diagnosis of abnormal placentation is made, the case will be transferred to either one of the 3 teaching medical centers for full management and safe delivery: 1) Rafic Hariri University Hospital, 2) AUBMC, or 3) Hotel Dieu hospital. This policy is fully supported by MOPH. Following the implementation of this policy, and after a series of close to 56 pregnant cases operated for abnormal placentation between 2013 and 2015, there was no reported MM case.

V. WAY FORWARD

a. Reaching vulnerable women

The 2015 Countdown report shows that some countries are moving more quickly than others, reporting wide differences in coverage levels for key interventions and services across countries where data is available (2007-2012)[28]. Lebanon enjoys excellent indicators in terms of antenatal coverage, skilled attendance at delivery, and referral to tertiary care centers. However, privileged women, richer families and more educated couples are more likely to have better access to care and better more skilled attendance at pregnancy care and delivery which can help identify risk factors for maternal morbidity or mortality and manage it earlier. According to the Countdown 2015 report, in every country studied, women with secondary or higher education are more likely than uneducated women to be followed up properly during pregnancy and to give birth with a skilled attendant. Greater attention is needed to providing universal access to care by reaching the poorest, and to educating girls

and women on the risks of adolescent's pregnancies and on the importance of seeking routine antenatal care espcially among the refugees settlements.

b. Role of health system (MOPH, HCPs, others)

MOPH has come about to intervene more seriously and constructively in regulating maternal health care, though more work is still needed in collaboration with health care providers (HCPs) and scientific committees of Lebanese Order of Physicians, Lebanese Order of Midwives, Order of Nurses in Lebanon, etc. In relation to patient safety, there is a need to eliminate variability in the provision of care through the development of standard protocols. In this regard, it is compelling to increase the reliance on checklists instead of memory for critical procedures. The aforementioned collaboration should work on an approach to peer review and quality improvement that emphasizes systems change to prevent error, rather than a punitive approach to those involved in adverse outcomes. The following suggestions might be of help:

1. Aggressive identification of developing problems before the patient becomes critically ill. Example of abnormal placentation

2. Involvement and empowerment of all HCPs to identify potentially lethal complications and initiate independent corrective action using standardized protocols and guidance. Example of cases of abnormal placentation, post-partum hemorrhage, hypertensive disorders of pregnancy with special focus on reducuing cesarean section rates

3. Reduction in process variation, ensuring that in critical situations, all team members will know what each other provider has done, is doing, and is about to do. Example of team formation

4. Specificity in treatment protocols: Eliminating the need to rely on memory, and reduction in the "normalization of deviance," rather than evidence-based medicine. HCPs have to abide by the agreed upon package of antenatal care (routine measurement of blood pressure, urine test, identification of suggestive signs and symptoms, imaging of the placental location when indicated

5. Ready use of multidisciplinary specialized experts (both within and outside of a given specialty): No implication of incompetence of primary provider, but rather recognition of the fallibility of any single human, regardless of intelligence or experience, in the face of an uncommon and potentially catastrophic situation (2 heads are often better than 1)

6. Strengthening the role of RH services at PHC level in terms of reproducing the Wadi Khaled initiative and continue on training the medical doctors at PHC level while strengthening referral services to specialized care

7. Continue on improving the Maternal Mortality Observatory and widen its umbrella through better collaboration between all health service providers, including midwives and midwifery clinics, and the MOPH

8. Greater attention to be directed to antenatal care during the last trimester among pregnant refugees, to compliance with visits, and to early identification of risks for early referral.

c. Advocacy and promotion

Efforts at different levels must continue through a series of combined interventions including, among others: awareness raising and maternal health promotion; universal access to health services; proper nutrition before, during, and after delivery; access to family planning services and counseling; skilled attendance at delivery care and access to quality obstetric services in obstetric emergencies; and implementation of policies aimed at raising the economic and social status of women keeping in mind the burdening issues
of refugees [5]. This can only be achieved through national commitment to honor the right to life of women. It is worth remembering Professor Mahmoud Fathalla, who said that MM is reduced when countries agree that this is worth doing [29].

Recommendations

The MOPH continues its commitment towards achieving the MDG5 targets, specifically, targets 3.7 and 3.8 of SDG 2030 that are instrumental in reducing MM. Target 3.7 states: *"By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes"* while target 3.8 states: *"Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all."* Lebanon has since ICPD showed satisfactory results towards ensuring universal access to sexual and reproductive health and towards ensuring quality access to essential health services.

Efforts should focus on regulation of the environment of maternal health care. To better understand the quality of care issues in provision of maternal health care and the burden of mortality and morbidity, there is a need to structure recommendation around the WHO six core components which include: (i) service delivery; (ii) health workforce; (iii) health information systems; (iv) access to essential medicines; (v) financing; and (vi) leadership/governance. These components will contribute to health system strengthening in many ways including reducing MM, promoting maternal health and quality care, as well as improving efficiency and social and financial risk protection. The availability of RH SDGs at the level of PHC has contributed to standardized practices in relation to identification of high risk obstetrical cases and means to refer them which in turn contributed to the reduction of maternal morbidity and risk of mortality as evidenced by the setting the practice of identifying and referring cases of abnormal placentation. Evidence-based RH care policies and programs at national levels need the following:

a. Strengthening MM reporting to include possible cases that might be happening outside the hospitals by involving the "Mukhtar" and other local authorities especially in relation to refugees community

b. Identifying of high risk cases/near miss cases through developing an identification guidelines for such cases and develop a network referral system to advise and manage them

c. Developing and strengthening interventions and response system that will help reduce delays (related to the three delays model), in collaboration with LSOG, MOPH, UNFPA, WHO, Syndicate of Hospitals, Lebanon Order of Midwives and other agencies working with refugees

d. Centralizing management and referral of high risk/near miss cases

e. Continuing training on EmOC modules and other skills, including drills

f. Conducting qualitative and quantitative and operational research to better understand pregnancy care and childbirth environment and health care capacities and resilience, as well as women engagement in birth care plans

g. Improving the national civil registration and vital statistics system to enhance –among other- quality, timely and efficient reporting on all deaths including on maternal death.

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Annexes