Maternal Mortality in the U.S.:
How does the U.S. compare to the rest of the world?

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Issue

When we think of maternal mortality[1], it would be reasonable to argue that immediate thoughts flee to countries such as Afghanistan where the World Health Organization (WHO) places the maternal mortality ratio (MMR) at 638 deaths per 100,000 live births (Trayler-Smith, 2022). But if most maternal deaths are preventable, why have they been steadily increasing in the United States since 2000 (Trayler-Smith, 2022)? The aim of this analysis is to compare maternal mortality rates in the U.S. with other countries around the world along with factors such as race, attendance of skilled professional at birth and access to antenatal (prenatal) care, to attempt to identify possible contributing factors to the U.S. MMR and possible areas for improvement.

"Women in the U.S. are the most likely to die from complications related to pregnancy or childbirth. In 2018, there were 17 maternal deaths for every 100,000 live births in the U.S. – a ratio more than double that of most other high-income countries." (Roosa Tikkanen, 2020)

Background

According to commonwealthfund.org, the U.S. has the highest maternal mortality rate among developed countries, an overrepresentation of Obstetrician-gynecologists (ob-gyns) in its maternity care workforce relative to midwives, and has an overall shortage of maternity care providers (ob-gyns and midwives) relative to births; where in comparison to other countries, primary care is central in healthcare system and ob-gyns are outnumbered significantly by midwives. Additionally, the U.S. does not guarantee access to provider home visits or paid parental leave in the postpartum period even though studies show that most maternal deaths take place post-birth (Lancet, 2016).

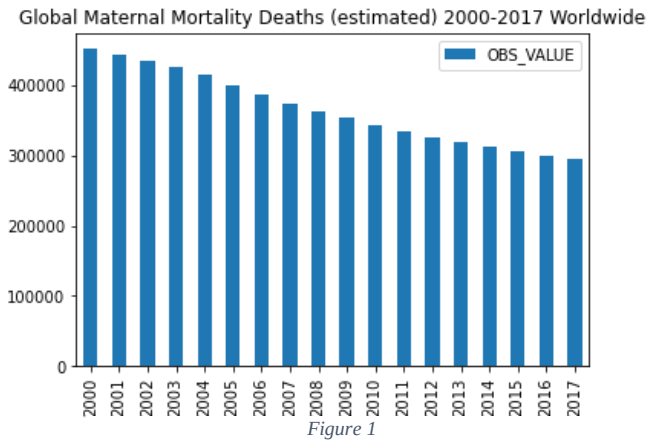

Figure 1

Global Mortality Rates

To get a baseline, it's important to note that global maternal mortality rates have decreased

[1] See **Appendix B: Key Terms** - for definition of maternal mortality.

roughly 44% since 1990 (Trayler-Smith, 2022), and UNICEF data[i] for the years between 2000-2017 confirm that estimated global maternal-related deaths have seen a steady decrease since 2000 (Figure 1). Data[ii] shows that when organized by geographic region, Sub-Saharan Africa and South Asia hold the two highest rates of maternal-related deaths per 100,000 live births (MMR) (Figure 2). In order to compare how the U.S. was doing in comparison to the rest of the world, I looked at data[iii] for the years between 2013-2018[2], specifically the five countries with the lowest and highest MMR. For this specific timeframe the U.S. MMR was **14.8**, in comparison the lowest (Italy) was **2.38**, and highest (Sierra Leone) was **1571.1** (Figure 3).

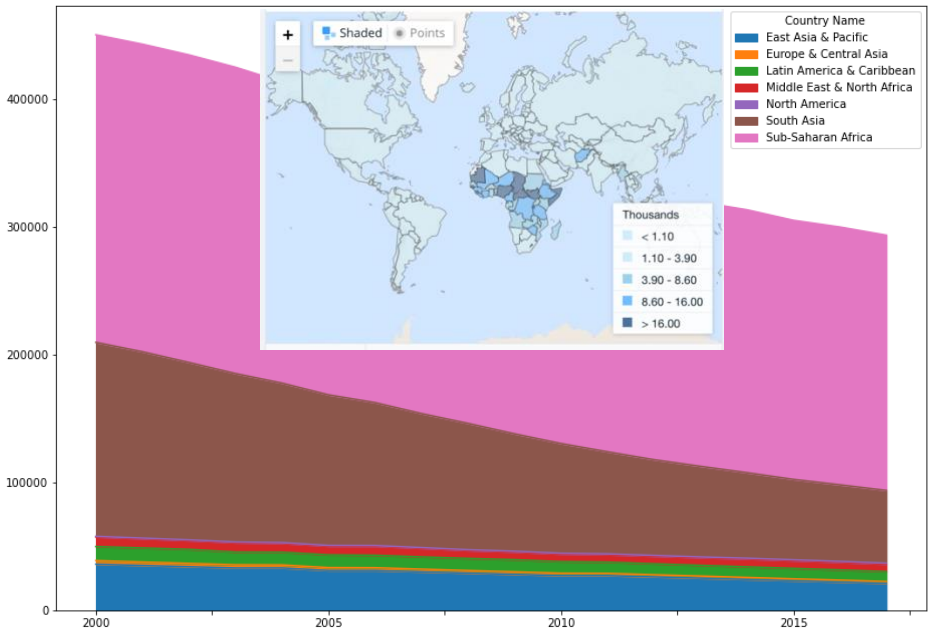

Figure 2

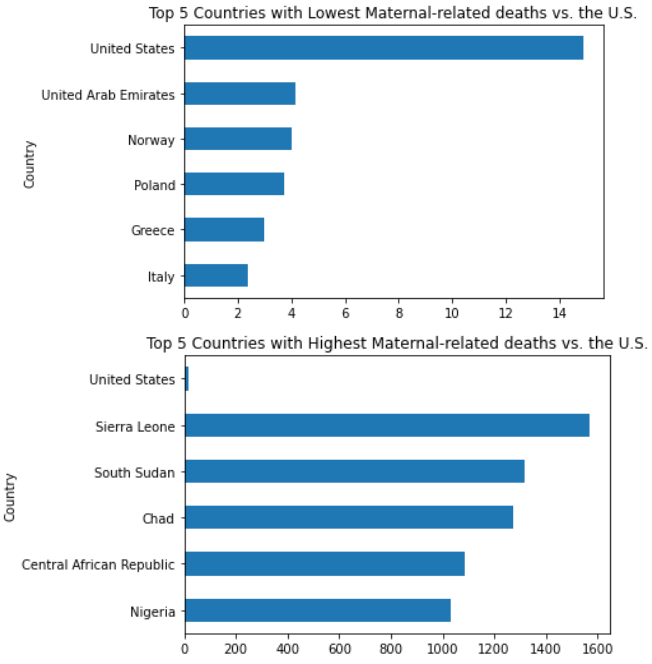

Figure 3

For the same timeframe, I looked at the countries closest in MMR to the U.S. in order to identify if those countries

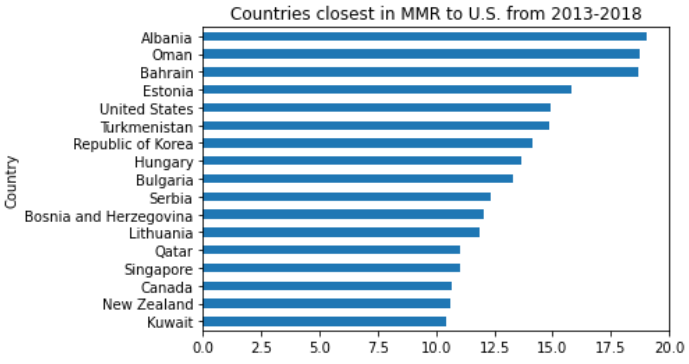

Figure 4

[2] Note that I wanted to look at country rates on a granular level (5-year time-frame) and this was the most recent years available in my datasets.

were generally developed countries[3] (Figured 4)[4]; of which only one (Canada) is considered to be a developed country.

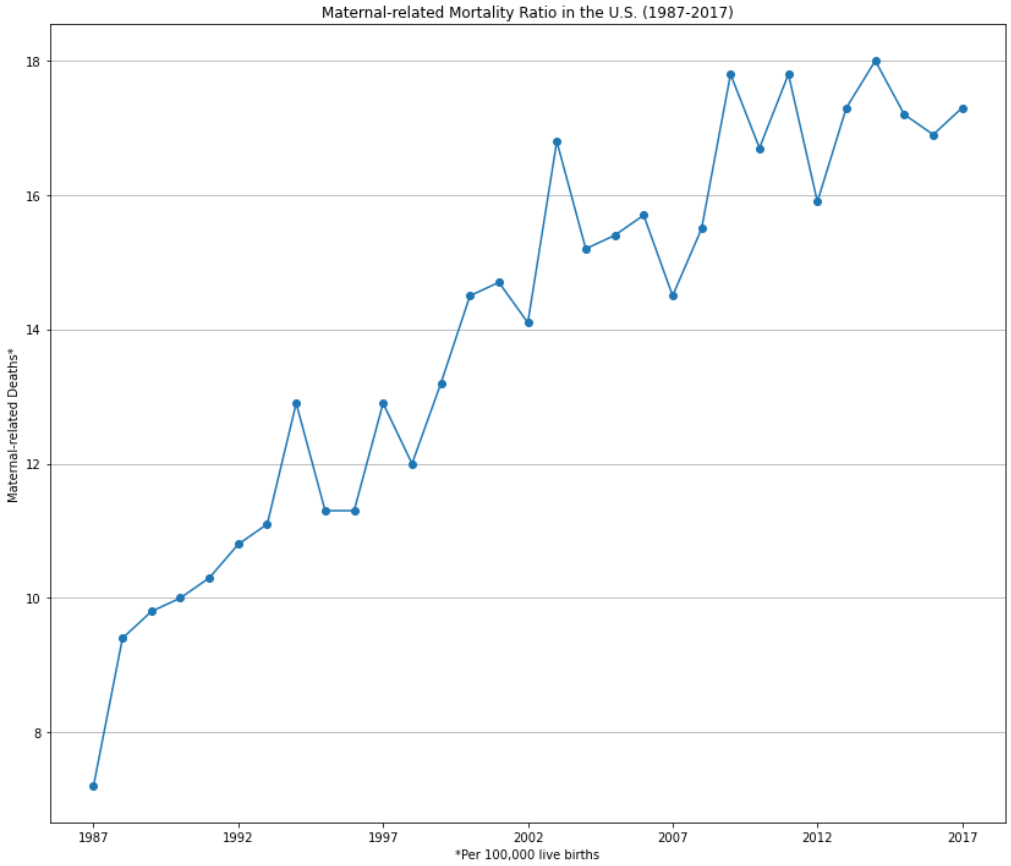

Figure 5

U.S. Maternal Mortality Ratio

When looking at the U.S. individually, we observe that the number of reported[5] maternal-related deaths in the U.S. has increased from **7.2** deaths per 100,000 live births in 1987 to **17.3** in 2017 (Figure 5)[iv]. The Center for Disease Control and Prevention (CDC) notes that although identification and reporting of maternal-related deaths has improved, reasons for this steady increase are unclear; it should be noted that one possible explanation is that there have been reports of errors in pregnancy status reported on death records potentially skewing the actual number of maternal-related deaths in the U.S.[v]

[3] See Appendix B: Key Terms, for definition on developed countries.

[4] For this comparison I am looking at countries closest in MMR to the U.S. +/- 5.

[5] It's important to note that this data only reflects reported pregnancy-related deaths and may not be completely accurate by not accounting for those deaths not reported.

Attendance by Skilled Birth Attendant

Data shows us that of the top 5 countries between the years of 2013-2018 with the lowest and highest MMR, the countries with the lowest rates had a high rate of attendance by skilled birth professionals at the delivery, where in contrast the top 5 countries with the highest MMR had a low attendance rate at the deliveries[6] (Figures 6 and 7)[7]. According to a study published by the CommonWealthFund.org, the WHO recommends midwives as an evidence-based approach to reducing maternal mortality. Midwives are trained providers that can manage normal pregnancies, assist with childbirth, and provide care postpartum. Ob-gyns on the other hand, are physicians who are trained to identify and intervene in abnormal conditions that may arise before, during, and after pregnancy; care by Ob-gyns is typically provided in only in hospital-based setting. The U.S. along with Canada, held the lowest rates of midwives and ob-gyns available, about 12 and 15 providers

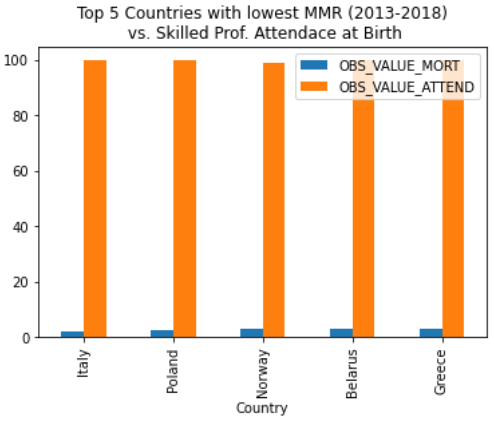

Figure 6

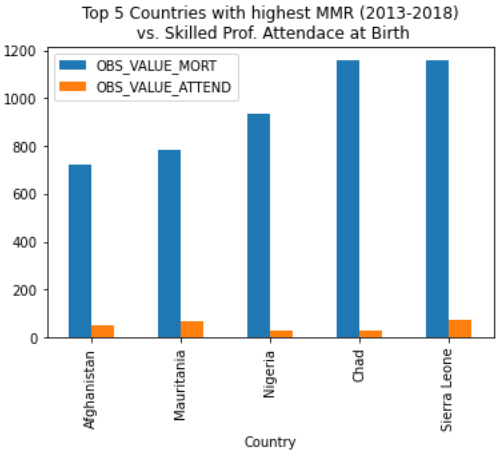

Figure 7

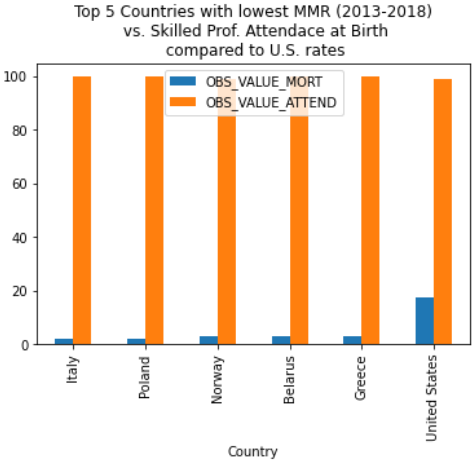

Figure 8

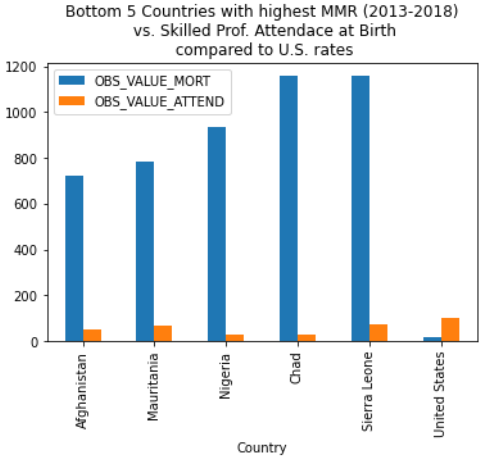

Figure 9

[6] See **Appendix B: Key Terms** - for definition of Skilled birth attendant

[7] It should be noted that the scales for comparison are not exactly the same because mortality rates are being measured by 1 in 100,000 whereas attendance by skilled birth professional is measured by 1 in 100.

per 1,000 live births, respectively whereas all other countries have a ratio that is roughly between two and six times higher.[vi] When looking at how the U.S. compares to the data displayed in Figure 6 and 8, despite having similar attendance by skilled professional at birth to the top 5 countries with the lowest MMR(2013-2018), the U.S. still had a significantly higher rate of maternal mortality.

Maternal Deaths by Cause

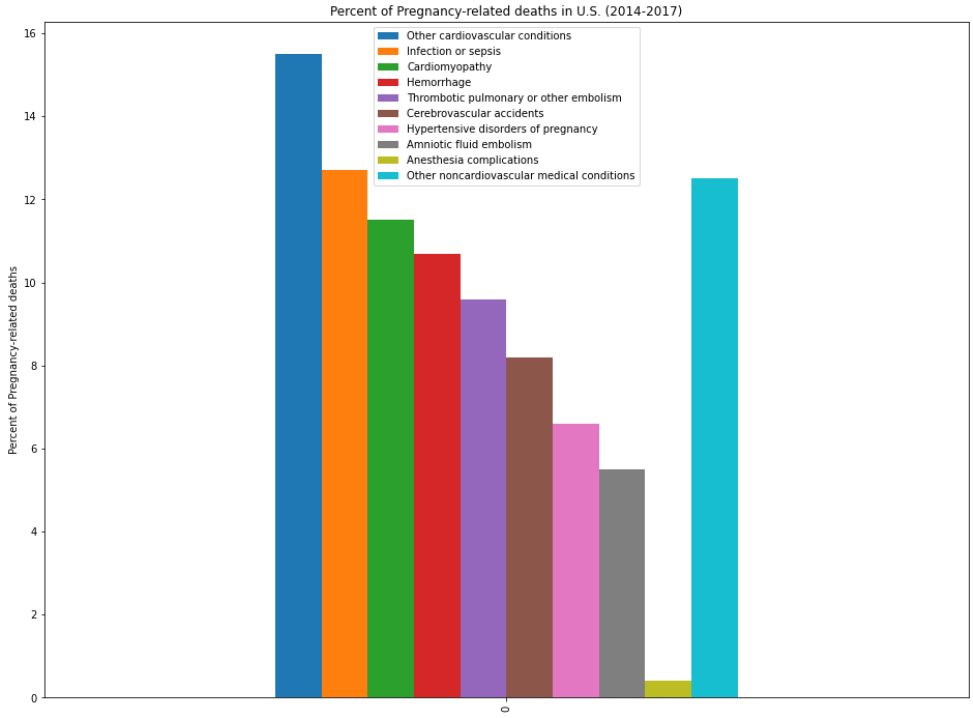

Figure 10

Data obtained from the CDC (Figure 10) show that for pregnancy-related deaths[8] in the U.S. from 2014-2017, that biggest contributing factor was cardiovascular conditions at 15.5%. According to the CDC, studies have shown that "an increasing number of women in the U.S. have chronic health conditions such as hypertension, diabetes, and chronic heart disease. These conditions may put a woman at higher risk of complications during pregnancy or the postpartum year." (CDC, n.d.) It should also be noted that the CDC is unable to account the cause of death for 6.7% of all pregnancy related deaths for this timeframe.

[8] See **Appendix B: Key Terms** - Maternal Mortality, for definition of "pregnancy-related death".

Additionally, data provided by the commonwealthfund.org, reports that in the U.S. about 17% of deaths occur on the day of delivery, 52% occur after delivery or postpartum, see below Figure 11:

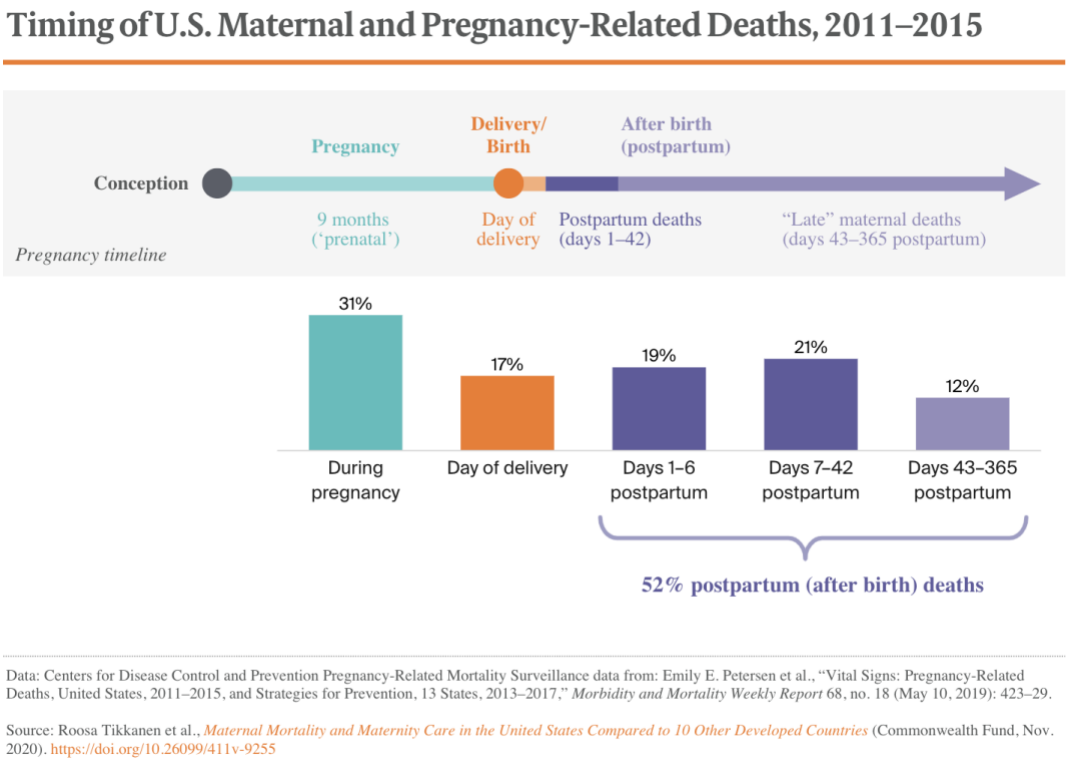

Figure 11

Race as factor

It's often been argued that racial and ethnic disparities in healthcare exist in the U.S. and that those disparities carry over into the U.S. maternal mortality rates. When examining race as factor for U.S. MMR to determine if there are certain groups with higher maternal mortality rates, we observe that in the two groups with the highest MMR appear to be the "Non- Hispanic Black" and "Non-Hispanic American Indian or Alaskan Native"

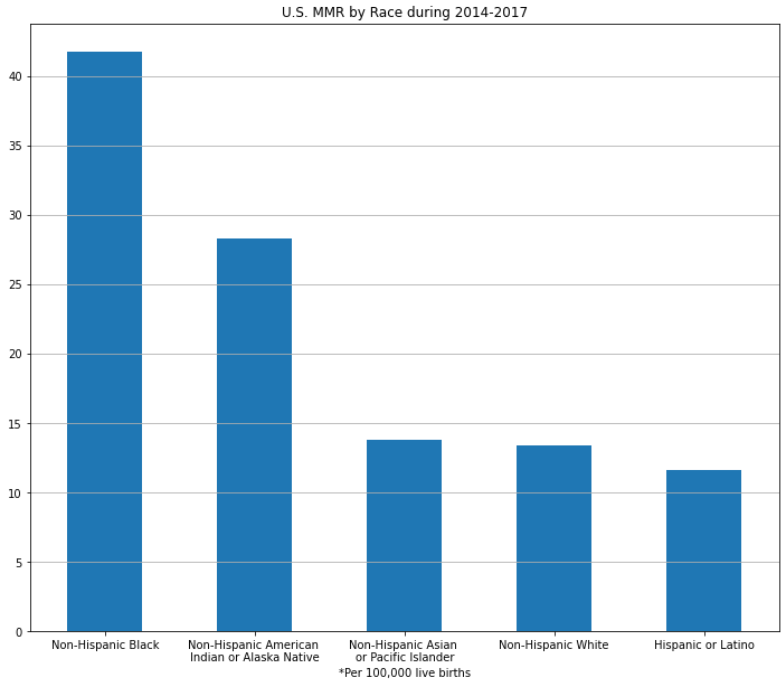

Figure 12

groups, confirming those disparities exist. Figure 12 shows that during 2014-2017 the highest leading group (Non-Hispanic Black) of women had 41.7 deaths per 100,000 live births, whereas in contrast the lowest group of women (Hispanic or Latina) had 11.6 deaths per 100,000 live births. The CDC notes the "Variability in the risk of death by race/ethnicity may be due to several factors including access to care, quality of care, prevalence of chronic diseases, structural racism, and implicit biases" (CDC, n.d.).

Does income play a factor?

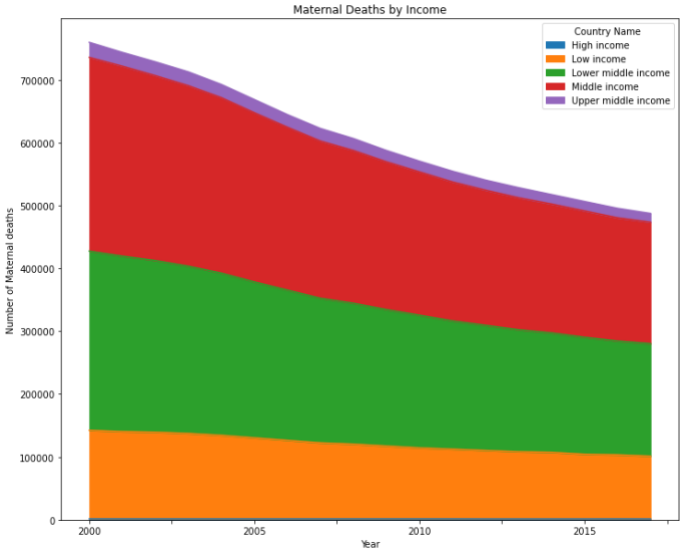

Figure 13

On the topic of disparities, if we evaluate MMR against income status data provided through The World Bank, the numbers of maternal deaths globally regardless of income group have all seen a decline since 2000 (Figure 13), with the exception of the low income group (orange*) which has seen a steady rate of maternal deaths since 2000.

If we look at the U.S. individually (Figure 14), that same data shows Low Income and Lower middle income groups have seen a steady decline in number of maternal deaths whereas Middle income and Upper middle income have remained fairly consistent.

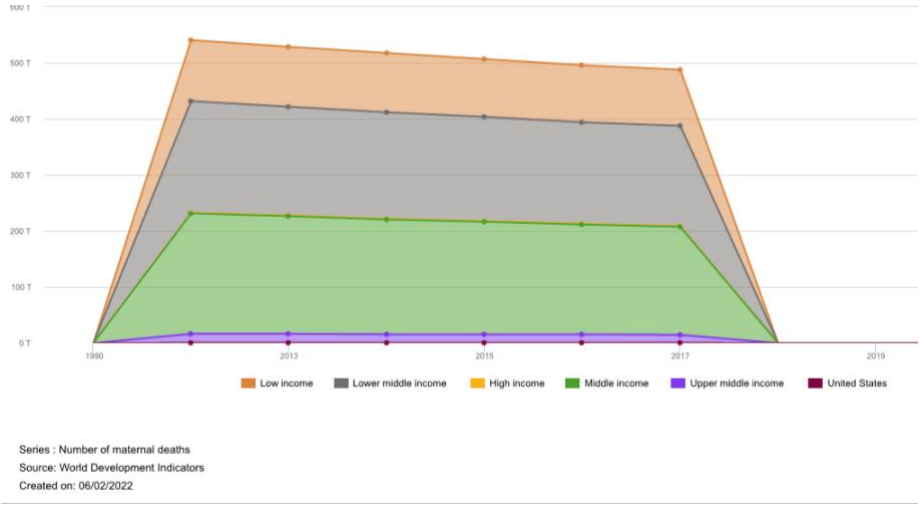

Figure 14

Conclusion

This analysis leads me to believe that the U.S. does in fact have poor maternal mortality rates when compared globally, particularly with other developed countries, however, it's difficult to say with

certainty what is the leading cause of the high maternal-mortality rates. I believe, that it's largely due to a combination of contributing factors such as disparities among racial and economic groups when it comes to access to healthcare services. Additionally, it could be argued that a different approach and view on what standard pre and post-natal care should look like in the U.S. compared to what it's like in other developed countries is a big contributing factor. My recommendation would be for the U.S. to conduct analysis on what the standard model of care is for pregnant women in countries that have lower MMR to identify opportunities for growth and improvement.

Limitations, Challenges, and Ethical Considerations

One limitation and challenge that I need to note is related to the topic of access to antenatal (maternal or prenatal care) in the U.S. I originally wanted to compare the rates of access to antenatal care such as number of visits during and post pregnancy in the U.S., to other developed and developing countries. However, although this data was available for other countries, I was unable to locate this data for the U.S., thus I was not able to make this comparison and complete this portion of my analysis.

Additionally, it should also be taken into consideration that there have been concerns that accurate causes of death related to maternal mortality have not always been reported, possibly skewing the data.

When attempting to determine potential ethical considerations I believe we should consider how certain identifying factors are used in attempting to predict a woman's likelihood of mortality such as race; we should ensure that the use of Race for example, is not based on a prejudicial bias but rather on a fact, if considered at all. Similarly on the topic of race, data has shown that there are in fact disparities in MMR among different racial/ethnic groups, because of this when considering recommendations, we should consider solutions that help to bridge the gap in access to pre and post natal care for all women regardless of race or economic status.

Methods

This review was largely conducted by reviewing Maternal Mortality Rate (MMR) data published by various organizations such as the CDC Wonder, UNICEF, and The World Bank to identify current and past MMR contributing factors and determine how the U.S. compares to the rest of the world.

Appendix A: Data Sources/ Data Dictionary

Section	Data Sources
Background	The data used for this section was obtained by The Commonwealth Fund – a private foundation established in 1918 whose mission is to promote a high-performing health care system that achieves better access, improved quality, among other things, for society's most vulnerable, including low-income people, the uninsured, and people of color. ▪ https://www.commonwealthfund.org/publications/issue-briefs/2020/nov/maternal-mortality-maternity-care-us-compared-10-countries#1
Global Mortality Rates	The data used for this section was obtained from the UNICEF Data Warehouse: ▪ https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=.MNCH_MATERNAL_DEATHS+MNCH_LTR_MATERNAL_DEATH+MNCH_MMR+COD_MATERNAL_CONDITIONS+MNCH_ANC1+MNCH_ANC4+MNCH_SAB.F.&startPeriod=1970&endPeriod=2022 ▪ GLOBAL_DATAFLOW_1970-2022.xlsx Additional data sources were obtained from The World Bank Data: ▪ https://data.worldbank.org/indicator/SH.MMR.DTHS ▪ API_SH.MMR.DTHS_DS2_en_excel_v2_4024797.xls
U.S. Maternal Mortality Ratio	The data used for this section was obtained from the CDC Pregnancy Mortality Surveillance System ▪ https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm ▪ trends_in_pregnancy_related_mortality_in_the_united_states__1987_2017.csv
Attendance by Skilled Birth Attendant	The data used for this section was obtained from the UNICEF Data Warehouse: ▪ https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=.MNCH_MATERNAL_DEATHS+MNCH_LTR_MATERNAL_DEATH+MNCH_MMR+COD_MATERNAL_CONDITIONS+MNCH_ANC1+MNCH_ANC4+MNCH_SAB.F.&startPeriod=1970&endPeriod=2022 ▪ GLOBAL_DATAFLOW_1970-2022.xlsx
Maternal Deaths by Cause	The data used for this section was obtained from the CDC Pregnancy Mortality Surveillance System ▪ https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm

	▪ causes_of_pregnancy_related_death_in_the_united_states__2014_2017.csv
Race as a factor	The data used for this section was obtained from the CDC Pregnancy Mortality Surveillance System ▪ https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm ▪ pregnancy_related_mortality_ratio_by_race_ethnicity__2014_2017.csv
Does income play a factor?	The data used for this section was obtained from The World Bank Data: ▪ https://data.worldbank.org/indicator/SH.MMR.DTHS API_SH.MMR.DTHS_DS2_en_excel_v2_4024797.xls

Appendix B: Key Terms

Term	**Definition**
Maternal Mortality	It should be noted that during this analysis various terms were identified as being used in the U.S. to measure maternal deaths, which vary slightly in definition (Roosa Tikkanen, 2020): **Maternal Mortality or a Maternal Death** refers to the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. ***This is the term is used by the WHO in international comparisons****, this measure is reported as a ratio per 100,000 births.* **Pregnancy-associated death** refers to death while pregnant or within one year of the end of the pregnancy, irrespective of cause. **Pregnancy-related death** refers to death during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy or the aggravation of an unrelated condition by the physiologic effects of pregnancy. ***Used in the U.S. only,*** *this CDC measure is typically reported as a ratio per 100,000 births.*
THE MATERNAL MORTALITY RATIO (MMR), EXPLAINED	The numbers can get a bit confusing here, so a quick explanation on the WHO's Maternal Mortality Ratio may be useful. The WHO calculates maternal mortality risk for a country relative to the number of live births it experiences. Since those numbers are different for most countries, an accurate way of comparing maternal mortality rates around the world is to look at the number of maternal deaths per every 100,000 live births. By honing in on "live births," the WHO also rules out stillbirths for a greater sense of accuracy. (Trayler-Smith, 2022)
Skilled Birth Attendant/Professional	Skilled health personnel (generally doctors, nurses or midwives). According to the revised definition these are competent maternal and newborn health (MNH) professionals educated, trained and regulated to national and international standards. They are competent to: 1. Provide and promote

	evidence-based, human-rights based, quality, socio-culturally sensitive and dignified care to women and newborns; 2. Facilitate physiological processes during labour and delivery to ensure a clean and positive childbirth experience; and 3. Identify and manage or refer women and/or newborns with complications. Traditional birth attendants, even if they receive a short training course, are not included.
Developed Country	• Countries may be classified as either developed or developing based on the gross domestic product (GDP) or gross national income (GNI) per capita, the level of industrialization, the general standard of living, and the amount of technological infrastructure, among several other potential factors. • According to the United Nations (UN), a nation's development status is a reflection of its "basic economic country conditions." • The human development index (HDI) is a metric developed by the United Nations that's used to assess the social and economic development levels of countries based on life expectancy, educational attainment, and income, which serves as an alternate means of assessing a nation's development status. • The United States was the richest developed country on Earth in 2020, with a total GDP of $20.95 trillion. • China was the richest developing country on Earth in 2020, with a total GDP of $14.72 trillion.

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[i] Data obtained from UNICEF Data Warehouse: Global Mortality Rates. https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=.MNCH_MATERNAL_DEATHS+MNCH_LTR_MATERNAL_DEATH+MNCH_MMR+COD_MATERNAL_CONDITIONS+MNCH_ANC1+MNCH_ANC4+MNCH_SAB.F.&startPeriod=1970&endPeriod=2022

[ii] Data obtained from The World Bank “Number of maternal deaths”: WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division. Trends in Maternal Mortality: 2000 to 2017. Geneva, World Health Organization, 2019: https://data.worldbank.org/indicator/SH.STA.MMRT?end=2017&start=2017&view=map

[iii] Data obtained from UNICEF Data Warehouse: Global Mortality Rates. https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=.MNCH_MATERNAL_DEATHS+MNCH_LTR_MATERNAL_DEATH+MNCH_MMR+COD_MATERNAL_CONDITIONS+MNCH_ANC1+MNCH_ANC4+MNCH_SAB.F.&startPeriod=1970&endPeriod=2022

[iv] Data obtained from CDC: Pregnancy Mortality Surveillance System (PMSS). https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm

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[v] CDC. (n.d.). *Pregnancy Mortatlity Surveillance System*. Retrieved from Reproductive Health: Maternal Mortality: https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm

[vi] Roosa Tikkanen, M. Z. (2020, Nov 18). *Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries*. Retrieved from TheCommonwealthFund.org: https://www.commonwealthfund.org/publications/issue-briefs/2020/nov/maternal-mortality-maternity-care-us-compared-10-countries#1