

Protracted armed conflict and maternal health: a scoping review of literature and a retrospective analysis of primary data from northwest Syria

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ABSTRACT

Introduction Syria's protracted conflict has devastated the health system reversing progress made on maternal health preconflict. Our aim is to understand the state of maternal health in Syria focused on underage pregnancy and caesarean sections using a scoping review and quantitative analysis; the latter draws on data from the Syrian American Medical Society's (SAMS) maternal health facilities in northwest Syria.

Methods We performed a scoping review of academic and grey literature on the state of maternal health across Syria since the onset of conflict (taken as March 2011). Identified articles were screened using pre-established criteria and themes identified. We also performed a retrospective quantitative analysis of maternal health data from SAMS' facilities in a microcontext in north-west Syria between March 2017 and July 2020, analysing the trends in the proportion of births by caesarean section and age at pregnancy.

Results Scoping review: of 2824 articles, 21 remained after screening. Main themes related to maternal mortality rates, caesarean sections, maternal age and perinatal care. 12 studies reported caesarean section rates; these varied from 16% to 64% of all births: northern Syria (19%–45%), Damascus (16%–54%), Lattakia (64%) and Tartous (59%). Quantitative analysis: Of 77 746 births across 17 facilities, trend data for caesarean sections showed a decrease from 35% in March 2017 to 23% in July 2020 across SAMS facilities. Girls under 18 years accounted for 10% of births and had a lower proportion of caesarean section births. There was notable geographical and interfacility variation in the findings.

Conclusion The quality of available literature was poor with country-level generalisations. Research which explores microcontexts in Syria is important given the different effects of conflict across the country and the fragmented health system. Our quantitative analysis provides some evidence around the changes to caesarean section rates in northwest Syria. Despite limitations, this study adds to sparse literature on this important topic.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Armed conflict adversely affects maternal health through direct effects on women but also through its effects on healthcare access.
- ⇒ Syria's protracted conflict has caused widespread destruction to the healthcare system and adversely affected access to maternal health services.
- ⇒ During Syria's conflict, higher proportions of caesarean sections were reported than preconflict with a greater proportion of underage pregnancies (under 18 years of age)
- ⇒ Conflict adversely affects access to and quality of maternal health services.

WHAT THIS STUDY ADDS

- ⇒ From the scoping review, we report a dearth of literature, particularly that which is localised around important indicators of maternal health.
- ⇒ Our quantitative analysis of 77 746 pregnancies from 17 facilities in northwest Syria (March 2017–July 2020) showed a general downward trend of the proportion of births by caesarean section.
- ⇒ A spike in the proportion of births by caesarean section occurred in March 2020 to 33.2% after an escalation of violence between December 2019 and February 2020 caused widespread displacement.
- ⇒ Deliveries among girls under 18 years of age accounted for 7946 (10.2%) of births in Syrian American Medical Society's facilities and the proportion delivered by caesarean section was lower than in those aged 18 years and over.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Further research which examines the impact of conflict on maternal health and the proportion of births by caesarean section across geopolitical regions in Syria is required.
- ⇒ Maternal health programmes which address the causes of underage pregnancies and their impacts are required given the sociological impacts which have resulted from the conflict in Syria.

INTRODUCTION

Protracted conflict adversely affects health systems, with particular impacts on reproductive, maternal, newborn and child health (RMNCH) services and outcomes. Attacks on healthcare facilities and sociopolitical instability can reduce access and widen existing inequalities with long-term consequences for mother and child.¹ Subsequent social changes may contribute to early or forced marriage and the associated potential consequences, including gender-based violence, domestic abuse and birth complications, which may have lasting effects on women, children and their communities.²

The impact of conflict can be both direct and indirect³ with immediate and longer-term consequences to RMNCH. Direct consequences include attacks on healthcare services which can in turn affect healthcare utilisation.⁴ Indirect consequences include socioeconomic and sociopolitical effects of conflict, ranging from changing roles of women in the community, early or forced marriages, inadequate food or shelter and insecurity.^{1 3} Quality of services can also be affected by the forced displacement of trained healthcare workers⁵ and interruptions in supply chains and in the range of services required for RMNCH. Data from such settings may be incomplete or unavailable, but increasing reports from local surveys or surveillance provide evidence around the impacts of conflict with reported indicators on under 5 mortality, maternal mortality rates (MMR) and vaccination rates providing some indication of the state of RMNCH in armed conflict.⁶

In Syria, the protracted conflict began with peaceful uprisings in March 2011 but rapidly escalated to armed conflict by the middle of 2012 with devastating impacts, particularly on women and children. The conflict has displaced more than half its preconflict population of 22 million and resulted in at least 585 000 deaths.⁷ Syria has experienced among the worst impacts of attacks on healthcare globally⁸ with more than 600 attacks on health facilities, including those for maternal or child health, leaving more than 50% of facilities not functioning.⁹ Areas outside of the control of the Syrian government have been most affected; these include the northeast and northwest of the country where large numbers of internally displaced people shelter, most of whom are women and children.¹⁰ The recent COVID-19 pandemic and economic collapse in 2020 have exacerbated existing vulnerabilities, leaving more than 80% of the Syrian population living in poverty (less than US\$2 a day) and more than 9 million living with food insecurity.¹¹ Almost 6 million women and at least 2.5 million girls are in need of humanitarian aid with around one quarter of the population of reproductive age.¹² Despite the extensive impacts on RMNCH, there remains little data with which to inform activities supporting RMNCH both now and in the longer term.

The aim of our research is to explore the impact of conflict on maternal healthcare in Syria in general with a focus on understanding the reporting of underage

pregnancies and caesarean sections during the conflict. We do this by performing a scoping review of available academic and grey literature on maternal health across Syria, coupled with a quantitative analysis of available data on the utilisation of maternal services, age at pregnancy and caesarean section rates from the Syrian American Medical Society (SAMS) a humanitarian organisation which has provided healthcare in Syria since the onset of the conflict. The latter describes data from a microcontext in northwest Syria and provides an opportunity to compare findings in the scoping review from across the whole country.

METHODS

We performed (1) a scoping literature review of academic and grey literature sources on maternal health in Syria since the onset of the conflict (taken as March 2011) and (2) a quantitative analysis of routinely collected clinical data on maternal health from a humanitarian organisation operating in northwest Syria between March 2017 and July 2020.

Scoping literature review

To identify available peer-reviewed studies, we searched electronic bibliographic databases including Medline, Embase and Google Scholar for articles relating to maternal health inside Syria during the crisis. We used Medical Subject Heading terms and keywords including 'maternal health,' 'Syria,' 'maternal mortality,' 'maternal morbidity,' 'caesarean section,' 'conflict,' 'antenatal,' 'postnatal' and 'perinatal' in various combinations to keep the search as broad as possible. We excluded manuscripts published before 2011 and those describing issues related to Syrian refugees rather than the situation inside Syria.

For grey literature, we searched OpenAire as well as individual relevant websites such as Maternal Health Task Force, Department For International Development), SAMS, Medecins Sans Frontieres, Save the Children, United Nations Population Fund (UNFPA), US Agency for International Development, the WHO reports and UNICEF.

The full search strategy (online supplemental table 1 appendix) and details of included studies (online supplemental table 2 appendix) are included in online supplemental appendix. Results were imported into excel and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to document study inclusion based on the selection criteria shown in table 1. Title and abstract screening was conducted by two authors following full text analysis by three authors to agree the final included articles. Following this, all articles had references and citations screened for additional relevant articles.

Quantitative analysis

We performed a retrospective analysis of clinical data on maternal health from SAMS' facilities in northwest Syria

Table 1 This table shows the inclusion and exclusion criteria for the scoping literature review

Feature	Inclusion	Exclusion
Population of interest	Syrian women inside Syria who are pregnant or have given birth including internally displaced persons	Syrian women who are pregnant or have given birth outside Syria including refugees
Intervention	Maternal health services	Sexual and reproductive health services
Outcomes	Maternal health Maternal morbidity and mortality Obstetric care (Antenatal, perinatal and postnatal) Availability of health services Utilisation of health services Maternal variables (age of mother) Birth statistics (caesarean section compared with vaginal birth) Abortion statistics	Gender based violence Neonatal health
Study design	Review articles, epidemiological studies, retrospective analysis, cross-sectional studies	Case reports and newspaper articles.
Study period	Study period after the start of the conflict in March 2011.	Study period before the start of the conflict in March 2011.
Language	Full paper available in English or Arabic.	Full paper not available in English or Arabic.

using data obtained from March 2017 to June 2020. This included routinely collected data from healthcare facilities which were reported monthly to the country office of SAMS in Gaziantep in Turkey. This is inputted into SAMS' health information system (HIS) based on International Classification of Disease (ICD)-10 coding.

Setting

Northwest Syria is an area of almost 36 000 km² encompassing the governorates of Aleppo, Hama, Idlib and Latakia; it contains 4.17 million Syrians of whom more than 2 million are internally displaced.¹³ A further escalation of violence between December 2019 and March 2020 displaced one million people, mostly from southern to northern parts of Idlib governorate; 80% of these are women and children. Widespread displacement and attacks on and around health facilities have strained regional health and humanitarian services. 1.4 million displaced Syrians live in tented settlements, while others may reside in rented accommodation, unfinished buildings or communal shelters, for example, schools or mosques facing numerous obstacles to healthcare access and essential humanitarian support.¹³

SAMS

SAMS is a humanitarian organisation which, as of the end of 2020, is mainly operating in northwest Syria (with some projects in northeast Syria) though it had previously provided healthcare in Dara'a in Southern Syria and in Eastern Ghouta in Damascus' suburbs. Its programmes focus on populations with the highest needs which are currently in northwest and northeast Syria.

Data

Data from all 17 of SAMS' facilities which provided maternal healthcare in northwest Syria were included. Anonymised, aggregated data on consultations relating to maternal health and the total number of monthly

consultations were provided from SAMS' HIS. These are classified by local data collectors as per ICD-10 coding on electronic databases and then sent electronically to the SAMS HIS team based in Turkey; this is then aggregated and processed. Monthly aggregates, collected from March 2017 to July 2020, provided the dataset examined in this study; no patient identifiable data were provided to the research team. All data relevant to maternal health as per ICD-10 classification were included. We do not have this disaggregated by antenatal or postnatal visits. Variables included number of maternal consultations, total number of consultations, age of mother (under or over 18), provided as a total as well as by facility, number of vaginal births, number of caesarean sections and facility type.

Facilities

Data from facilities containing records of vaginal births, caesarean sections and assisted births during at least one of the months in question were extracted. Following extraction, facilities were either categorised as offering basic emergency obstetric care (BEmOC) or comprehensive obstetric care (CEmOC), and as being referral or non-referral facilities for maternal and obstetric care. For the purposes of this study, BEmOC facilities were defined according to UNFPA guidance¹⁴ as those expected to be capable of administering medications used in obstetric care, performing assisted vaginal births and basic neonatal resuscitation, and removing the placenta and/or other retained products of conception. In addition to these basic procedures, CEmOC facilities are equipped and expected to safely perform surgery and blood transfusions. In the SAMS' health system, BEmOC facilities are typically primary healthcare centres (PHCs) staffed and equipped with basic equipment including an emergency bag (contains supplies for obstetric and newborn

complications as well as newborn resuscitation), ultrasound, fetoscope, labour table and a hospital bed.

Statistical analysis

All available data were obtained; as such, size calculations were not made. The outcomes of interest are the trends in the proportion of births by caesarean sections and underage pregnancies over time. Data were analysed using the R statistical programming language. Relevant summary data frames were generated using the dplyr package from which trends in the proportion of caesarean sections and vaginal births over time were produced for each facility using a combination of base R graphical features and the ggplot2 package. Analysis was restricted to basic summary and descriptive statistics, with no statistical techniques employed to quantify any apparent relationships between variables due to limitations of the data. As such, inferences were primarily made based on a visual and contextual analysis of the graphics that were generated. Line graphs and scatterplots were used to draw conclusions on descriptive data.

Bias

Data were provided from SAMS' facilities only; this accounted for a varying proportion of the total number of facilities providing maternal healthcare in northwest Syria throughout the study period. Experiences may differ in other regional facilities supported by other organisations. These data were collected during active conflict; as such, there may be inaccuracy in recording, missing data or misdiagnosis due to inadequate resources or experienced staff. Also, the data do not include patients who may not have presented due to difficulties with access, checkpoints or conflict.

We included papers from the whole of Syria on maternal health to be comprehensive and to inform the findings from the microcontext in northwest Syria for which a quantitative analysis was performed. This allows comparison of caesarean section and underage pregnancies across Syria and the microcontext in northwest Syria.

PATIENT AND PUBLIC INVOLVEMENT

Patients were not involved in setting the research questions, deciding outcomes measured or in the design of this study. The study made use of routinely collected data and so there was no participation burden to patients at the facilities included. This work will directly impact SAMS' maternal health programmes in Syria. Relevant data will be shared with the public and with healthcare workers working in these areas as well as the health cluster in Gaziantep which is involved with planning of services in northwest Syria.

RESULTS

Of 2873 articles identified in the literature search, 2657 were excluded through title screening. The remaining texts were imported to excel and duplicates removed

leaving 201 papers for abstract analysis; excluding another 158 titles. The remaining 43 publications were analysed in full and a final 21 papers deemed appropriate for inclusion in the review.

Scoping literature review

Of the 21 included articles, 13 were peer-reviewed studies^{15–27} and 8 grey literature reports.^{28–35} Of the 13 peer-reviewed studies, 6 were secondary data analysis,^{15–19 27} 3 were cross-sectional studies,^{21 25 28} 1 clinical audit,²³ 1 literature review,²² 1 case study,²⁴ 1 prospective data registry study²⁶ and 1 mixed-method study that included a literature review and country-level data reporting.²⁰ From the grey literature reports, four were country-level data reporting,^{28–30 35} two were activity reports,^{33 34} one was secondary data analysis³² and one was a qualitative study.³¹ See figure 1 for the PRISMA flow chart. Included articles all reported results from inside Syria, however, the geographical areas described varied; 12 studies described results relating to Syria as a whole, 4 described results specific to Damascus and rural Damascus, 1 focused on northeast Syria (Hassaka, Ar-Raqqah) and 4 reported on northwest Syria (Aleppo, Idlib, Atmeh, Hama).

The main emerging areas from the literature can be grouped into those relating to (1) maternal mortality estimates; (2) caesarean sections; (3) underage pregnancies and (4) perinatal care (PNC).

Maternal mortality estimates

The MMR reports the number of maternal deaths per 100 000 live births and is a recognised indicator of maternal health globally, however, estimates can vary widely. Of the 21 articles identified, 7 described MMR in Syria.^{17–20 22 29 30} MMR estimates ranged from between 27 and 49 per 100 000 in 2010 to between 54.1 and 68 per 100 000 in 2015. All data were country-level estimates with results available between 1990 and 2017. The papers which mention MMR draw on similar data sources including the Global Burden of Disease^{17 19} or secondary analyses from the UN MMEIG (United Nations Maternal Mortality Estimation Inter-agency Group).^{18 30 36} Data reported by some authors as World Bank estimates use data from the UN MMEIG. All studies present a similar trend with an initial decline in MMR between 1990 and 2010, preconflict, followed by an overall increase in MMR during the years of the conflict until 2017. This is reported by UN MMEIG as increasing from 16 per 100 000 in 2000 to 27 per 100 000 in 2010 and 31 per 100 000 in 2017.³⁶

Types of birth

Twelve studies describe caesarean sections compared with vaginal births.^{15 21–23 25–27 31–35} Of these, 11^{15 21–23 25–27 31–33 35} reported facility level, caesarean section rates higher than the population-level WHO recommended 10%–15%, with the remaining study³⁴ reporting no births in its Syrian facilities during the included study period. These studies are summarised in table 2. In terms of geographical area,

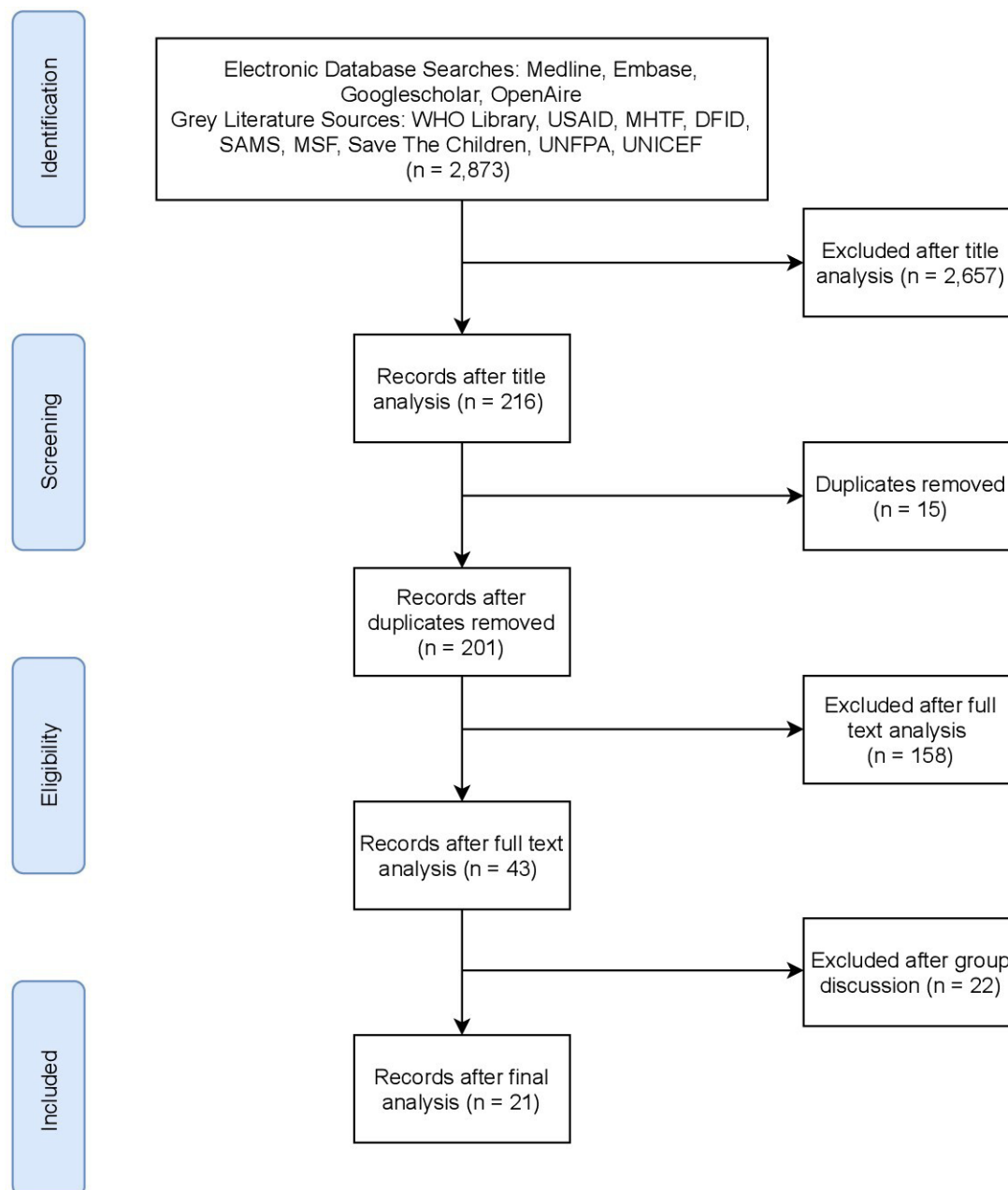


Figure 1 PRISMA flow chart for included and excluded academic and grey literature papers. DFID, Department For International Development; MHTF, Maternal Health Task Force; MSF, Medecins Sans Frontieres; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; SAMS, Syrian American Medical Society's; UNICEF, United Nations Population Fund; USAID, US Agency for International Development.

six studies^{26 31–35} reported caesarean section rates from northern Syria, including Hassakeh, Ar-Raqqa, Atmeh, Aleppo and Deir-ez-zour ranging between 0%³⁵ and 44.6%.³² Seven studies^{21–23 25 27 32 35} reported caesarean section rates from Southern Syria including Damascus, Hama, Homs, Dar'a, As-Sweida, Quneitra and East Ghouta, ranging between 16.3%²⁵ and 53.9%.²¹ One study reported very high caesarean section rates in facilities in Lattakia (63.7%) and Tartous (58.7%), which was attributed to cultural preferences rather than the effect of the conflict.³⁵

Underage pregnancies

From the articles reviewed, four^{22 31–33} commented on maternal age, three of which reported primary data^{31–33} and one secondary data.²² Human Appeal reported that 25% of patients seen at Al Imaan Hospital in Idlib were under 18 years old.³¹ SAMS reported that in one of their facilities in Southern Syria, 12.2% of pregnancies were in girls under the age of 18 between September 2017 and February 2018 and in another in East Ghouta the proportion was 12.7% in the same time period.³² UNFPA reported the number of pregnant women under 18 in

Table 2 This table summarises findings from studies which report caesarean section rates including location and date

Author	Study period	Location	No of facilities	Type of facilities	Vaginal births	Caesarean sections	Caesarean section rate (%)
Al-Hammami ²³	2011–2017	Damascus, Syria	1	University Hospital	45 649	32 466	41.6
	2011				Not stated	Not stated	32
	2012				Not stated	Not stated	33
	2013				Not stated	Not stated	43.5
	2017				Not stated	Not stated	51
WHO	December 2015	Ar-Raqqa	4	Public Hospitals	1702	386	18.5
		Hama	6		659	611	48.1
		Homs	6		240	217	47.5
		Dara'a	4		85	28	24.8
		Aleppo	13		226	180	44.3
		Deir-ez-zour	4		35	0	0
		Al Hassakeh	4		717	115	13.8
		As-Sweida	3		280	165	37.1
		Quneitra	1		70	40	36.4
		Damascus	15		958	572	37.4
		Rural Damascus	9		325	291	47.2
		Lattakia	8		272	478	63.7
Terkawi ²⁶	October–December 2017	Atmeh District, Syria	1	Women and Children's Health Centre	1440	617	30.0
Human Appeal ³¹	January–August 2019	Aleppo, Syria	1	NGO hospital	1367	385	22.0
UNFPA ³³	2016	North Syria	Not Specified	Not specified	1296	431	25.0
		Southern Syria			1096	574	34.4
MSF ³⁴	2015	Hassakeh, Syria	1	Maternity hospital	1166	393	25.2
Kabakian-Khasholian ²⁵	November 2014–April 2015	Damascus, Syria	1	Public teaching hospital	1009	197	16.3
Alsharif ²⁷	2018–2020	Damascus, Syria	Not Specified	Not specified	734	787	51.7
Roumieh ²¹	January–December 2017	Damascus, Syria	8	Largest primary care facilities	509	596	53.9
Cuesta ¹⁵	2008–2015	MSF Facilities, Syria	1	General hospital	0	0	0
DeJong ²²	2014	Damascus, Syria	1	Public maternity hospital	Not stated	Not stated	46
Syrian American Medical Society ⁴⁷	September 2017–February 2018	North Syria	3	Major reproductive health facilities	Not stated	Not stated	44.6
		Southern Syria	3		Not stated	Not stated	39.3
		East Ghouta, Syria	1		Not stated	Not stated	41.1

MSF, Medecins Sans Frontieres; NGO, Non-governmental organisation; UNFPA, United Nations Population Fund.

its northern facilities (129) and in its Southern facilities (506).³³ DeJong *et al* report secondary data from the 2006 UN Population Division estimates on the adolescent birth rate per 1000 adolescent women preconflict, in 2009, to be 69 per 1000 compared with 70 per 1000 in 2013.²² None of the four articles commented on the parity or gravidity of the women discussed. Not all reports gave the denominator of their studies or explored relevant indicators including birth outcomes.

Perinatal care

Of the included articles, seven discuss the provision of antenatal care (ANC) in Syria since 2011,^{21 22 25 26 28 33 34} three commented on PNC^{23 27 33} and three articles comment on the presence of skilled birth attendants during labour all of which report figures for Syria as a whole.^{22 28 31}

Two of the studies comment on ANC coverage in Syria generally^{17 23}; Abdelgawad *et al* report 88% ANC coverage between the years 2009 and 2013, DeJong *et al* report

the proportion of women attending at least one ANC visit preconflict was 87.7% compared with 62% during the conflict. Three studies reported the proportion of antenatal visits at specific hospitals, two in Damascus in 2015 and 2017^{22 26} and one in Atmeah in 2017.²⁷ Kabakian-Khasholian *et al* interviewed 1200 women using public services in a teaching hospital in Damascus between November 2014 and April 2015 and found that 32.5% attended less than four ANC visits while 67.5% attended four or more ANC visits. Roumieh *et al* interviewed 1105 women from the 8 largest primary care facilities in Damascus between January and December 2017 and found that 79% had 5 or more ANC visits. The Atmeah study²⁷ reviewed records of 730 women at the Syrian Expatriate Medical Association (SEMA) women's and children's health centre between October and December 2017. Of these women 39% received no ANC visits, 14% met the minimum requirements for the WHO four ANC visits (1 first trimester, 1s trimester, 2 third trimester) and only 4% met the minimum requirements for the WHO ideal 8 visits (1 first trimester, 2s trimester, 5 third trimester).

Quantitative analysis

Data were available for 24 facilities of which 7 were excluded leaving 17. Five were excluded because they did not routinely provide obstetric or newborn care but had performed one or two births under extenuating

circumstances. Two other facilities were excluded after examination revealed that births performed at larger nearby hospitals were misattributed to them.

Descriptive analysis

There were a total of 2007748 consultations (for all conditions) in SAMS' facilities during the study period with a median of 50 398 (IQR: 40 820–59 637) consultations per month. There were 77746 births with a median of 129 births per facility per month. **Figure 2A** shows the total consultations per month (for all presentations) of the study period and **figure 2B** shows the number of births by caesarean section and vaginal births.

In **figure 2A** and a steep drop in the number of consultations is apparent starting in late 2017, as is a decline in the number of total monthly consultations from the end of 2019 and the beginning of 2020. **Figure 2B** shows that, in both time periods noted in **figure 2A**, there is a decline in total overall births. In the first time period at the end of 2017, the fall in the number of vaginal and caesarean section births was similar, however, given the overall lower numbers of caesarean section births, this resulted in a proportionately greater decrease in caesarean sections compared with the total number of births (corresponding to the dip in caesarean section rate seen in **figure 2C**). In the second time period in early 2020, **figure 2B** shows a sharper decrease in the number of vaginal births relative to caesarean sections, which only decreased slightly in

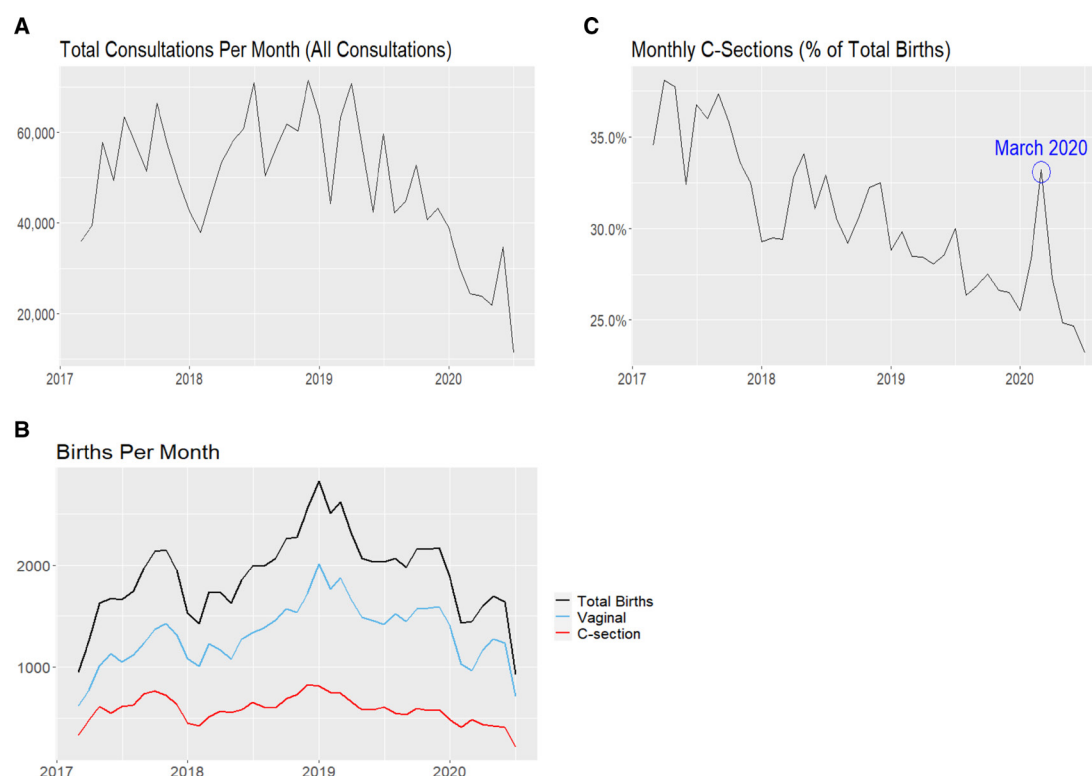


Figure 2 (A) This figure shows the total number of consultations (all presentations) per month between March 2017 and July 2020. (B) This figure shows the number of births per month delivered by caesarean sections or vaginal birth. In boxes are two time periods in which there are declines in the numbers of births. (C) This figure shows the caesarean section rates as a percentage of the total births across all SAMS' health facilities per month between March 2017 and July 2020. SAMS, Syrian American Medical Society's.

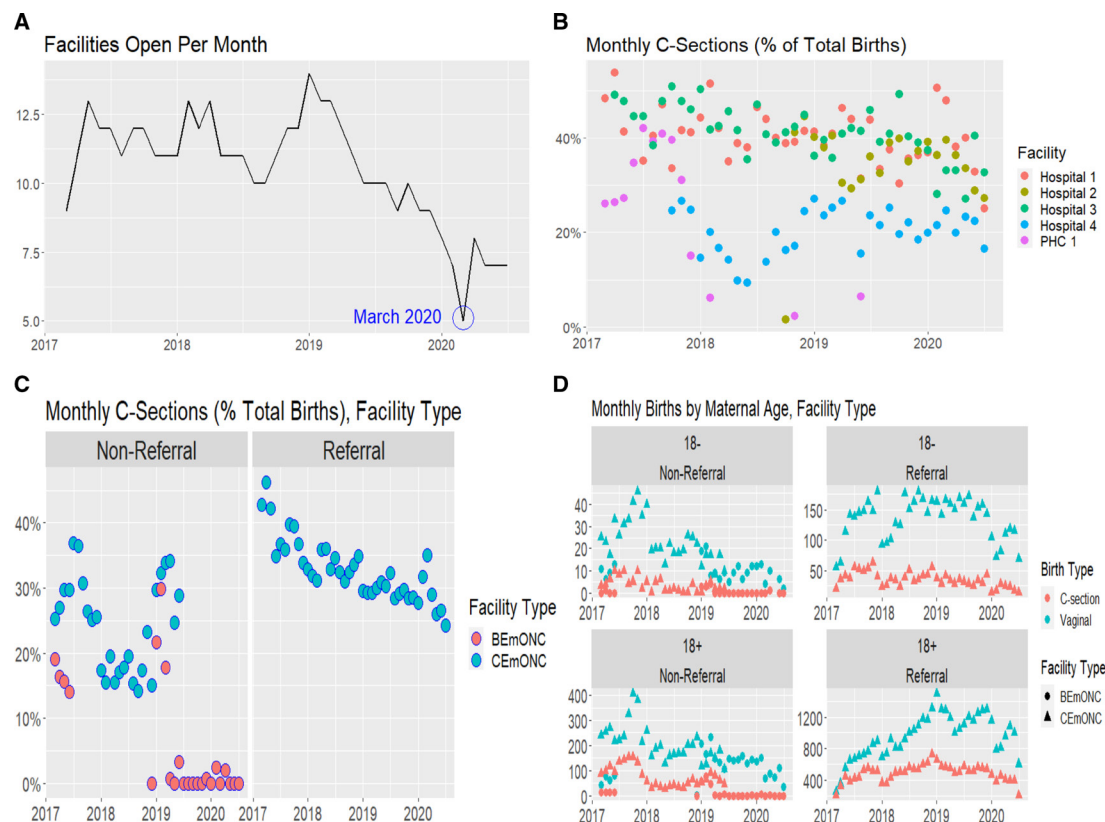


Figure 3 (A) This figure shows the number of facilities open each month from March 2017 to July 2020. (B) This figure shows the monthly caesarean section proportions as a percentage of total births, for each of the five facilities which remained open in March 2020 and were functioning between March 2017 and July 2020. (C) This figure shows the percentage of births by caesarean section on a monthly basis in referral and non-referral hospitals and in BemONC and CEmONC facilities. (D) This figure shows the number of vaginal and caesarean section births in referral and non-referral facilities divided by age group, under 18 and 18 years and over. BemONC, basic emergency obstetric care; CEmONC, comprehensive obstetric care; PHC, primary healthcare centre.

accordance with the established trend causing the spike in caesarean section rates in March 2020 in figure 2C.

Types of births

The percentage of births by caesarean section varied throughout the study period. Figure 2C shows a general decline in the percentage caesarean section rate from around 37% in early 2017 towards less than 25% in the middle of 2020; with a sharp drop in the percentage of caesarean sections in late 2017 and peak in March 2020.

To explore whether the changes to the number of births related to a change in the number of open facilities, we plotted the number of open facilities each month, shown in figure 3A. A decline throughout 2019 is noted from a peak of 14 facilities in January 2019 to a low of 5 facilities in March 2020. The decreases in consultations seen in figure 2A in late 2017 and early 2020 correspond to reductions in functioning facilities in the same periods in figure 3A.

To further investigate the peak in the proportion of caesarean sections in March 2020, we plotted the percentage of caesarean sections for the five facilities which remained open that month, see figure 3B. Hospital 1 and hospital 3 follow the same overall trend of all facilities with an overall decrease in caesarean section

rate. However, their proportions were consistently higher than average, starting at 48.3% in hospital 1 and 48.9% in hospital 3 in March 2017 and ending at 25% in Hospital 1 and 32.6% in hospital 3 in July 2020. Hospital 2 also had a generally higher than average caesarean section proportion, although not as high as the previously mentioned hospitals. Hospital 4 maintained a steady, although lower, proportion of caesarean sections relative to the other facilities, except for a notable drop in mid 2018. Online supplemental table 4 appendix shows the catchment, total births in the time-period and mean monthly births for these five facilities.

Figure 3C compared caesarean section rates in facilities that received external referrals and those that did not. Caesarean section rates in referral facilities follow the same trend generally seen across all facilities with a steady decrease during the study period except for a peak seen in March 2020. However, in non-referral facilities there is no linear trend in caesarean section rates throughout the study period, although an overall decrease is nonetheless present. In non-referral hospitals, the percentage of births by caesarean section fell to zero in BEmONC facilities.

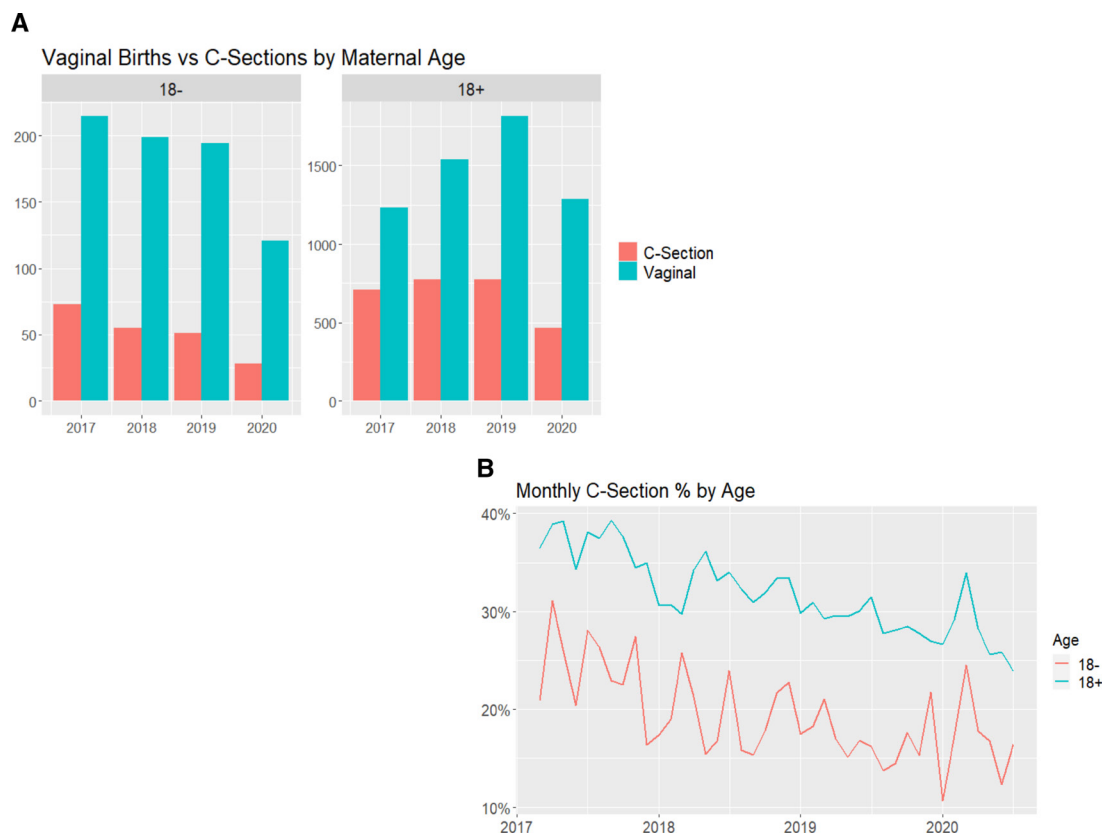


Figure 4 (A) This figure shows the number of births by caesarean section or vaginal birth divided into those aged under 18 years or 18 years and over. (B) This figure shows the percentage of caesarean section births each month in women under 18 compared with women aged 18 years of age or over.

Underage pregnancies

Of 77746 births, 7946 (10.2%) were in girls under 18 years of age.

Figure 3D shows caesarean section rates in referral and non-referral facilities divided into pregnancies in those under 18 and those 18 years and over. In these figures, we can note that the referral facilities follow the same trends as seen in figure 2B. Though the non-referral facilities have less uniform trends, overall we can see that the number of births decreased throughout the study period. Trends in births by caesarean section in referral and non-referral facilities were similar in both age groups.

Figure 4A shows the number of caesarean section and vaginal births by maternal age; there is a decline in the number of vaginal and caesarean section births over the time period in the under 18 age group that is not evident among those 18 and over. Figure 4B compares the proportions of caesarean section births by maternal age. Here, it is evident that the proportion of caesarean section births in women under the age of 18 were consistently lower than in those over 18. While the trend in the proportion of caesarean sections in girls under 18 is more volatile due to the smaller number of births vs those over 18, the previously noted dip in late 2017 and peak in March 2020 are both still visible.

DISCUSSION

The scoping literature review revealed limited information regarding maternal health in Syria after the onset of the conflict; of 21 including reports, most reported on single centres or made country-level generalisations with limited discussion of geographical disparities. Four main themes around maternal health in Syria were noted: maternal mortality, caesarean sections rates, underage pregnancies and PNC.

Key findings from the quantitative analysis of data of 77746 births between March 2017 and July 2020 from SAMS' facilities in northwest Syria show that the proportion of caesarean sections over time trended downward from 38% in April 2017 to 23% in July 2020. In addition, we highlight two prominent changes to the proportion of caesarean section births during the study period; one in late 2017 when the percentage of births by caesarean section dropped to 29.3% and the other in March 2020 when there was a steep peak in the percentage of caesarean section births from 26.5% to 33.2%. We also highlight of 77746 births in SAMS facilities that 7946 (10.2%) were in girls under 18 years of age and that the proportion of caesarean section births in this age group was lower than in those aged 18 years and over throughout the time period.

Maternal mortality

MMR estimates varied widely in the literature from between 27 and 49 per 100 000 in 2010 to between 54.1 and 68 per 100 000 in 2015. Only country-level estimates were available. Besides potential inaccuracies in the recording of maternal deaths during conflict, we also highlight the need for more decentralised reporting of MMR given that the conflict has disparate effects on the different regions in Syria. Government controlled areas throughout the conflict may have been less affected by attacks on healthcare³⁷ though services may have been degraded by insufficient resources, insufficient numbers of healthcare workers and now the impacts of the COVID-19 pandemic.³⁸ Discrepancies in reporting on MMR and other indicators are noted internationally even in countries not facing conflict.³⁹ However, given the weaknesses of international reporting systems on MMR, we call for improved reporting on maternal deaths, perhaps through MDSR (Maternal Death Surveillance and Response) systems; these did not exist robustly pre or post conflict onset⁴⁰ but are key to accurate reporting and action regarding maternal mortality.

Proportion of births by caesarean section

In the literature review, caesarean section rates varied greatly across Syria and were almost all higher than the population level, WHO recommended 10%–15%.⁴¹ It is important to note that this recommendation refers to population rather than facility level with recent WHO statements noting the importance of appropriate caesarean section rates at a facility level.⁴¹ Of note, preconflict, caesarean section rates of up to 15% were reported in Syria.⁴² The variation across geographical areas was wide but the average caesarean section rate in northern Syria was 25% compared with 39% in Southern Syria with the highest caesarean section rates found in Latakia (63.7%) and Tartous (58.7%), both government-controlled areas. This finding is notable considering that most areas in Southern Syria are under government control. There is little consensus on the effect of armed conflict on caesarean section rates; in some settings such as Columbia, caesarean section rates decreased in conflict-affected areas⁴³ due to disruption of services, whereas in the Democratic Republic of Congo, caesarean section rates were higher in areas of armed conflict compared with the national average.⁴⁴ In a review of obstetric care among refugees in sub-Saharan Africa and Asia, the overall caesarean section rate in the countries was low and it was even lower among those who had been forcibly displaced.⁴⁵

In cases of protracted conflict, the destruction of health infrastructure reduces rates of institutional births and subsequently reduces the number of caesarean sections performed.⁴⁶ However, it is possible that in Syria, although access to services has been compromised, the quality of healthcare provided for women who are able to deliver in healthcare facilities allows for higher rates of caesarean sections. One possible reason for this

is scheduled caesarean sections that allow women and healthcare staff to decide on when the birth happens. The desire to reduce the amount of time women must be in hospital is a consequence of the targeted attacks on healthcare facilities that have made them unsafe places to reside.^{31 32} There is an evidence gap regarding the quality of decision making around caesarean sections in conflict and their impact on mortality; an MDSR system would allow better tracking of this.

From the SAMS quantitative analysis, there was also a large variation in caesarean section rates with changing trends over time. In particular, there was a fall in caesarean section rates in late 2017 from 37.3% to 29.3% and peak in March 2020 to 33.2%. The first notable decline seen in [figure 2C](#) in late 2017 is matched by a fall in consultations in the same period, as seen in [figure 2A](#). In this time, both caesarean sections and vaginal births decreased by similar proportions; however, given the overall lower numbers of caesarean section births, this resulted in a relative decrease in the proportion of caesarean sections compared with the total number of births. In the same period in which the lowest proportion of caesarean sections were recorded, there was an escalation in violence in East Ghouta with aerial and chemical weapon attacks killing at least 2000 civilians and displacing a further 13 000.⁴⁷ There was also a large-scale attack on Idlib in northwest Syria between October 2017 and February 2018 destroying six healthcare facilities and five white helmet centres.⁴⁸ SAMS facilities were functioning in both of these areas during the period of attacks which may be the reason for the considerable drop in consultations and subsequently recorded births and caesarean section proportions during that time.

The peak in the proportion of caesarean sections in March 2020, from 26.5% to 33.2% in late 2019, occurred alongside a sharper decline in vaginal births (and total births) compared with caesarean sections. As such, though the proportion of caesarean sections increased, the total number of caesarean sections performed did not. This time period correlated with a steep reduction in the number of total monthly consultations, seen in [figure 2A](#). The importance of this finding relates to a significant escalation of violence with increasing attacks by the Syrian government and its allies, such as Russia, on northwest Syria where SAMS facilities were located.⁴⁹ Between December 2019 and February 2020, this escalation of violence forcibly displaced around one million people from their homes.^{50 51} Many were displaced away from facilities in which SAMS provided maternal healthcare and, as seen in [figure 3A](#), there was a decline in the number of open facilities. Of the five facilities that remained open during March 2020, the majority had historically tended to have above-average caesarean section rates, as seen in [figure 3B](#), contributing to the greater proportion of caesarean sections. Three of the five were larger CEmONC Referral Hospitals which would have received patients requiring caesarean sections sent from smaller facilities or presenting independently. Of

the two other facilities, one was a PHC that performed fewer caesarean sections and fewer births overall, and the other was a maternity hospital in a more remote area that consequently received fewer transfers from other facilities.

Throughout the first half of the study period both referral and non-referral facilities, some of which were BEmONC facilities, were carrying out caesarean sections. However, towards the middle of 2019, non-referral CEmONC facilities were either downgraded to BEmONC facilities (as in most cases) or ended all obstetric care (or closed entirely). All remaining BEmONC facilities stopped performing caesarean sections completely. As a result, the caesarean sections proportions fell among non-referral facilities from mid-2019 onwards as seen in figure 3D. This is explained in more detail in online supplemental appendix.

Underage pregnancies

Pregnancy under the age of 19 years is a risk factor for obstetric complications.^{52 53} There is limited information in the literature regarding underage pregnancies, and it shows heterogeneity in the rates across the different regions of Syria. Our literature review suggested that one quarter of pregnant patients seen in a hospital in Idlib were under the age of 18.³¹ Armed conflict can increase the risk of violence against women who suffer due to the breakdown of social norms, destruction of health services and increased economic pressures. This puts women and girls at risk of rape, known to be used as a weapon in war,⁵⁴ forced early marriage and sexual exploitation.⁵⁵

From SAMS data, we note that 7946 (10.2%) of 77 748 total births were in girls aged under 18 years. Of note, the proportion of births by caesarean sections in girls under 18 was lower than those aged 18 years and over, and the trends in the two age groups broadly mirrored each other. Reasons for this could be that older patients may have had prior caesarean sections increasing their risk of a subsequent caesarean section. These findings mirror some studies⁵⁶ but not others.⁵⁷ A study from Ghana noted a higher risk of caesarean section and complications in girls aged 19 years and under with longer-term consequences for both mother and child.⁵⁷

Perinatal care

Estimates of ANC visits and PNC coverage in Syria vary both before and during the conflict. Some sources suggest that the number of women attending at least one ANC visit was around 88% preconflict²⁸ but that PNC coverage was only 27%.²² In the period after the uprising, ANC and PNC coverage has only been documented in specific regions, calculated based on attendance to specific facilities, rather than nationally. The proportion of women attending an adequate number of ANC visits varies by study and location with one study in Damascus reporting that 67.5% of women were attending four or more ANC visits²⁵ and another reporting that 79% attended five or

more.²¹ However, a study in Atmeh found that only 14% of women received four or more ANC visits.²⁶

The estimates for the coverage by skilled health personnel at births also varies in the literature reportedly 96%^{22 28} prior to the conflict dropping to 72% in 2013²² and as low as 25% in 2020.³¹

Limitations

Data were provided from SAMS' facilities only; this accounted for a portion of the total number of facilities providing maternal healthcare in northwest Syria during the study period. We do not have accurate records as to the exact proportion, but it is estimated that 20% of health services in the northwest were by SAMS. We; therefore, do not have data for other agencies and different geographic areas in Syria. These data were collected during active conflict, therefore, there may be inaccuracy in recording, missing data or misdiagnosis due to inadequate resources or experienced staff. Furthermore, as is common in many humanitarian settings with restrictions to data collection^{58 59} it is not possible to analyse certain maternal health parameters, however, this work remains an important addition to the literature looking at underage pregnancies and caesarean sections in conflict settings. The changes to presentations to facilities as a result of episodes of increased conflict or other factors which influence healthcare access may also falsely skew the data.

CONCLUSION

We note a dearth of literature which explores maternal health in postconflict Syria. Identified literature, particularly around MMR, makes country-level generalisations when the variable effects of conflict across different regions require more granular investigation; this is particularly so given the fragmented nature of Syria's health system. As such, future research which explores variations in maternal care in micro-contexts across Syria is required. In addition, research which explores the drivers of caesarean sections during conflict and the relationship between conflict, modes of birth and outcomes is required both in Syria and in the context of conflicts elsewhere. Our quantitative analysis using SAMS' data (despite limitations) provides a useful addition to the literature around fluctuations in the proportion of caesarean section births and underage pregnancies during conflict in one of the largest available cohorts from the northwest of Syria.

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Patient consent for publication Not applicable.

Ethics approval Only anonymised data collected for routine clinical purposes and monitoring and evaluation were included; it was provided as aggregated monthly data. This was assessed and approved by SAMS' research committee. A formal ethics review was therefore not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data used in this study are anonymised, aggregated data on consultations relating to maternal health and the total number of monthly consultations from 17 of SAMS' (Syrian American Medical Society) health facilities in northwest Syria. Data requests can be made to the corresponding author.

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Appendix 1

Tables in the appendix:

Database	Search used	Number of results	Number after title screening	Number after abstract screening
USAID	syria * AND "maternal health" OR "pregnan *" OR "maternal morbidity" OR "maternal mortality" OR antenatal OR perinatal	371	30	0
	"syria*" AND "maternal health" OR pregnan * OR "maternal morbidity" OR "maternal mortality" OR antenatal OR postnatal	25	9	0
GoogleScholar	syria * "maternal health" abortion OR "pregnan *" OR "maternal morbidity" OR "maternal mortality" OR antenatal OR perinatal OR postnatal "syria *" -refugee -migrant	899	90	38 Results combined and duplicates removed.
Embase	(maternal care/ or perinatal care/ or maternal nutrition/ or maternal treatment/ or maternal welfare/) OR (("maternal mortality" or "maternal morbidity" or "antenatal" or "postnatal" or "abortion").mp) OR (pregnan*.mp) AND (Syria*.mp). Limit to (human and yr="2011-Current")	176	26	
Medline	(maternal care/ or perinatal care/ or maternal nutrition/ or maternal treatment/ or maternal welfare/) OR (("maternal mortality" or "maternal morbidity" or "antenatal" or "postnatal" or "abortion").mp) OR (pregnan*.mp) AND (Syria*.mp). Limit to (human and yr="2011-Current")	94	17	
WHO	Syria	44	1	0
OpenAire	Syria maternal health	57	2	1
Maternal Health Task Force (MHTF)	Syria maternal health	19	1	0
	Antenatal with Syria as filter	2	0	0
	Postnatal with Syria as filter	2	1	0
	Maternal with Syria as filter	8	1	0
	Perinatal with Syria as filter	0	0	0
	Pregnant with Syria as filter	5	3	0
DFID	"syria*" maternal antenatal postnatal perinatal pregnan*. Updated after 1/01/2011	260	7	0
	"syria*" "maternal" antenatal postnatal perinatal pregnan*	10	2	0
SAMS	Looked through the reports page	21	4	1
MSF	"syria" AND maternal health OR abortion OR pregnan * OR maternal morbidity OR maternal mortality OR antenatal OR perinatal OR postnatal	26	7	0
	Also looked through all published reports	10	4	1
Save the children	"syria *" "maternal health" abortion OR "pregnan *" OR "maternal morbidity" OR "maternal mortality" OR antenatal OR perinatal OR postnatal	806	3	0
UNFPA	syria*" AND "maternal health" OR abortion OR "pregnant *" OR "maternal mortality" OR "maternal morbidity" OR antenatal OR perinatal	9	3	0
UNICEF	Syria AND maternal health	14	1	0
	Looked through all publications under maternal health/mortality	15	4	2
Total		2,873	216	43

Table 1 appendix: This table shows the complete search strategy used for the scoping literature review.

Year	First Author	Study Title	Journal	Peer-reviewed/ Grey Literature	Study type	Study setting	Study period	Study objectives	Methods
2019	J. Gil Cuesta	Does the presence of conflict affect maternal and neonatal mortality during Caesarean sections?	Public Health Action	Peer-reviewed	Secondary data analysis of routinely collected maternal programme data.	MSF health facilities in 12 countries.	2008-2015	Is conflict associated with a difference in the rate of maternal and neonatal mortality during C-sections?	Data on the number of maternal deaths, neonatal deaths, number of total deliveries and the number of c-sections carried out in each MSF CEmONC facility in the 12 countries included between 2008 and 2015. Maternal mortality was defined as the total number of maternal deaths that occurred during the time in the theatre or in the recovery room, divided by the total number of C-sections conducted. Univariate analysis was used to describe the number of C-sections, the year, the type of facility and the presence and intensity of conflict. Bivariate analysis was used to describe the association between the maternal and neonatal mortality outcome variables and the conflict variables, with significance determined as $P < 0.05$. The data were analysed using Stata v14 (StataCorp LLC, College Station, TX, USA).
2015	Omar Hakeem	Adverse birth outcomes in women exposed to Syrian chemical attack	The Lancet	Peer-reviewed	Secondary data analysis of routinely collected maternal programme data.	Moadamyah, Syria	September - November 2014	To find the long-term consequences of chemical attack exposure on pregnant women and their offspring.	Review of medical notes of pregnant women visiting Al Ghouta hospital comparing outcomes of those exposed to chemical attacks to those who were not. The outcomes compared were number of miscarriages, premature births, still births and birth defects.
2014	Ahmed Mohamed Tammam Abdelgawad	The Association between Health Financing and Maternal and Child Health in Middle East and North Africa Countries	The American University in Cairo Digital Archive and Research Repository	Grey Literature	Cross-sectional study	21 countries from the MENA region	2009-2013	To investigate the relationship between the different health care financing options across the MENA region and maternal and child health outcomes.	Cross-sectional analysis of country level data from 21 countries in the MENA region. Control variables (total fertility rate, contraceptive prevalence, maternal mortality ratio, antenatal care coverage, births attended by skilled health personnel, availability of basic essential obstetric care and availability of comprehensive essential obstetric care, perinatal mortality rate, prevalence of low birth weight and prevalence of infertility in women) were compared across each country based on public spending on health per capita. Data source was the WHO Eastern Mediterranean Region Countries statistics summaries sheets from 2009 to 2013.
2014	Nicholas J Kassebaum	Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013	The Lancet	Peer-reviewed	Secondary analysis of country level reporting data	180 GBD countries	1990-2013	To measure levels and track trends in maternal mortality, the key causes contributing to maternal death, and the timing of maternal deaths.	Data was identified from 180 of 188 GBD countries, including 4877 site-years of vital registration data, 1213 site-years of sibling histories from Demographic and Health Surveys (DHS) and Reproductive Health Surveys (RHS) providing information about the pregnancy-related fraction of reproductive-age deaths, 73 site-years of censuses, 626 site-years of maternal mortality surveillance, and 267 site-years of verbal autopsy analyses covering women of reproductive age. We identified the above data sources through a systematic review, from GBD 2010 analyses, searches of Ministry of Health websites, and a search of the Global Health Data Exchange. The Cause of Death Ensemble model (CODEm) was used to model maternal mortality by age. 9 covariates for CODEm where used: age-specific fertility rate, total fertility rate, age-standardised HIV death rate for female individuals aged 15–49 years, neonatal death rate, lag- distributed gross domestic product (GDP) per person, proportion of deliveries occurring in facilities, proportion of deliveries overseen by skilled birth attendants, coverage of four visits of antenatal care, and malnutrition in children younger than 5 years. Maternal deaths were disaggregated into nine causes: maternal haemorrhage, maternal sepsis and other pregnancy-related infections, hypertensive disorders of pregnancy, obstructed labour, abortion, other direct maternal disorders, indirect maternal disorders, HIV, and late maternal deaths.

2019	Hussein H. Khachfe	Maternal mortality and health in the Arab World: A 25-year epidemiological study	The Journal of Obstetrics and Gynaecology Research	Peer-reviewed	Secondary analysis of country level reporting data	Arab countries	1990-2015	To assess the maternal health in terms of maternal mortality ratios and lifetime risk of maternal death in of women in the Arab World.	Data on maternal mortality ratios (MMR) and lifetime risk of maternal death (LTR) of countries from the Arab World were extracted from the UNICEF official data website from the years 1990 till 2015. Annual percent changes of MMR and LTR over the study period were calculated using the Joinpoint regression model. The One-way analysis of variance (ANOVA) test was used to determine if a significant difference existed between countries. In case of ANOVA significance, Tukey's Multiple Comparison test was done to tell whether significant difference exists among different groups. P<0.05 was considered statistically significant for all analyses.
2018	Ali H. Mokdad,	Maternal mortality and morbidity burden in the Eastern Mediterranean Region: findings from the Global Burden of Disease 2015 study	International Journal of Public Health	Peer-reviewed	Secondary analysis of country level reporting data	Eastern Mediterranean Region	1990-2015	To provide an overview of the burden of maternal mortality in the Eastern Mediterranean Region (EMR) by underlying cause and age from 1990 to 2015.	Overall maternal mortality was modelled using cause-of-death ensemble modelling (CODEm), where all combinations of covariates were tested and ranked based on out-of-sample predictive validity performance. Years of life lost (YLLs) were calculated by multiplying deaths by the residual expected individual lifespan at the age of death as derived from the GBD 2015 standard model life table. Years lived with disability (YLDs) were calculated by multiplying the number of prevalent cases of a certain health outcome by the disability weight assigned to this health outcome. Disability-adjusted life years (DALYs) were calculated by adding YLLs and YLDs. The associations between maternal mortality and socio-demographic status was evaluated using the socio-demographic index (SDI).
2017	Fatemeh Nahidi	Maternal Mortality Ratio in Eastern Mediterranean Region: A Priority of Reproductive Health	International Journal of Women's Health and Reproductive Sciences	Peer-reviewed	Literature review and country level reporting data	Eastern Mediterranean Countries	1990-2015	To evaluate the current situation and trends of MMR in the Eastern Mediterranean region between 1990 and 2015.	MMR was extracted from the World Bank and WHO websites for countries in the Eastern Mediterranean region between 1990 and 2015. A literature review was also conducted to corroborate or add to MMR values for each country. Percent change and average annual percent change in MMR for each country were calculated between 1990 and 2015. Countries were categorised to determine the progress they made in MMR reduction. The Fisher exact test was used to determine the significance of the trend of MMR, P<0.05 was taken as significant.
2019	Mayada Roumieh	Prevalence and risk factors for postpartum depression among women seen at Primary Health Care Centres in Damascus	BME Pregnancy and Childbirth	Peer-reviewed	Descriptive cross-sectional study	Eight largest primary health care centres in Damascus.	January to December 2017	To investigate the prevalence of postpartum depression among Syrian women seen at primary health care centres in Damascus and identify associated risk factors.	Sample size was determined based on an estimated prevalence of depressive symptoms amongst women in neighbouring countries at anywhere from 15% onwards and an estimated sample of 1200 women was aimed for. Women were recruited through various clinics and the Edinburgh Postnatal Depression Scale questionnaire was used to measure postpartum depression, with a cut-off score of 13 indicating probable depression. A further questionnaire was also designed to collect data on women's characteristics and other potential risk factors. Three trained nurses/midwives at each primary health centre collected the data. All variables were subjected to univariate and bivariate analysis to determine associations between postpartum depression and women's characteristics. To determine the main factors associated with postpartum depression and to allow for confounders, a multivariate analysis using logistic regression was used.
2017	Hisham Al-Hammami	Prevalence of Cesarean Section at ALTAWLID Hospital during the Syrian Crisis	Journal of Medical Pharmaceutical And Allied Sciences	Peer-reviewed	Retrospective Clinical Audit	Damascus, Syria at ALTAWLID university hospital.	1/1/2010 to 30/6/2017	To determine the prevalence of CS in Damascus, Syria at ALTAWLID University Hospital.	Number of vaginal and CS deliveries between 1/1/2010 and 30/6/2017 at AITawlid University Hospital were collected and proportion of CS was compared across the years.

2017	Jocelyn DeJong	Reproductive, maternal, neonatal and child health in conflict: a case study on Syria using Countdown indicators	BMJ Global Health	Peer-reviewed	Literature review	Syria, Jordan, Lebanon, Turkey	January 2011 until December 2015.	To provide an up-to-date review and critique of the best available data focusing on the conflict-affected Syrian population both within Syria (including non-displaced and IDPs) and those living as refugees in neighbouring countries	Searched: Medline, PubMed, Scopus, Popline, Index Medicus for WHO EMR (WHO Eastern Mediterranean Region), Google Scholar, Relief Web, UNHCR Syria Regional Refugee Response Portal, United Nations Development Programme, WHO Eastern Mediterranean Regional Office websites, specific relevant journals and hand searching of bibliographies of included articles Included original research studies that reported on Countdown indicators or proxy determinants on pre-conflict Syria, and during conflict among the Syrian population resident in Syria, the internally displaced or refugees in the neighbouring host countries (Jordan, Lebanon and Turkey) Data on Countdown indicators from identified literature based on the following geotemporal categories was extracted: Syria pre-conflict, Syria since 2011 and Syrian refugees in Lebanon, Jordan, and Turkey. Data were tabulated using the Countdown to 2015 framework of indicators. Results were reviewed and discussed with relevant key stakeholders.
2018	Rahma Aburas	The Brotherhood Medical Center: Collaborative Foundation of Maternity and Children's Healthcare Facility for Displaced Syrians	Frontiers in Public Health	Peer-reviewed	Case Study	Brotherhood Medical Centre, Atimah, Syria	August 2016 to January 2017	To provide an example of a health facility developed to address maternal and child health needs in response to the urgent needs in Syria.	Description of the development and the current estimated functioning of the health centre.
2017	Tamar Kabakian-Khasholian	Women's satisfaction and perception of control in childbirth in three Arab countries	Sexual and Reproductive Health Matters	Peer-reviewed	Cross-sectional study	3 University teaching hospitals in Mansoura, Egypt; Beirut, Lebanon; and Damascus, Syria.	November 2014 to April 2015 in Damascus,	To describe the levels of satisfaction with the childbirth experience and perceptions of control of women giving birth in public hospitals in three middle-income Arab countries, Egypt, Lebanon and Syria, and to determine the service delivery factors associated with their satisfaction.	Sample size was calculated based on an estimated reduction of 4% on the average C-section rates in the three countries (35%), the primary outcome of interest in the intervention study, considering a power of 85% and a significance level of 5%. Inclusion criteria: Women who gave birth and consented to participate in the study during the period November 2014 to July 2015 in Beirut and Mansoura, and November 2014 to April 2015 in Damascus Exclusion criteria: Women who were classified as high-risk by health care providers upon arrival to the hospital, those who suffered from intrauterine foetal death and those below 18 years of age Trained female field workers conducted interviews using a structured questionnaire with women who consented to participate. Information about type of birth, Apgar score and length of labour was obtained from the medical charts. The Mackey Childbirth Satisfaction Rating Scale was used to determine satisfaction. The Labor Agency Scale (LAS) was used to assess women's perception of control. Chi-squared statistics and one-way analysis of variance (ANOVA) test were used to compare socio-demographic and birth-related characteristics among the three country sites. Multiple regression analysis was performed to identify the determinants of the total satisfaction in this sample.

2019	Abdullah Sulieman Terkawi	Women's health in Northwestern Syria: findings from Healthy-Syria 2017 study	Avicenna Journal of Medicine	Peer-reviewed	Prospective data registry study and cross-sectional survey.	SEMA medical centre in Atmeh district	February 2017 - December 2017	To provide an updated account of women's health, including pregnancy, perinatal care, childbirth, and other conditions to identify obstacles and challenges to health-care delivery in Northwest Syria.	Women who visited the obstetrics and gynaecology department between February and December 2017 had routine data collected and recorded including date of birth, name, national ID number, gender, condition of living, date of visit, and diagnosis. A survey to examine reasons for poor ANC attendance was given to pregnant patients who were coming for their ANC visits. The survey included age, gestational age, living situation, educational level and a list of 15 potential barriers to ANC attendance. Frequency and percentage of each condition was calculated. Chi-square test was used to evaluate statistical significance when comparing categorical and frequency results. Binary logistic regression analysis was used to identify factors associated with low attendance rates at ANC visits. Potential confounders were included in the model (age, condition of living [refugee camp vs. resident in town], and parity). Models were evaluated based on their -2 Log likelihood (-2LL), Cox and Snell R-square, Nagelkerke R-square, overall predictive ability of the model, and the model-driven P-value by the Omnibus test. The model with the lowest -2LL, highest R-squares, and the best overall prediction accuracy was selected as the best model. A P-value of 0.05 was considered statistically significant.
2015	WHO	Trends in maternal mortality: 1990 to 2015	WHO publications	Grey Literature	Country level reporting data	Globally	1990-2015	To report global, regional and country-level estimates of trends in maternal mortality between 1990 and 2015.	Maternal mortality measures were obtained from country-specific data sources such as civil registration systems, population-based surveys, specialized studies, surveillance studies and censuses. Variables: number of maternal deaths; number of maternal deaths per 100 000 live births (MMR); and the proportion of deaths among women of reproductive age due to maternal causes. Limited data availability for many countries, and the limitations of the data that are available, mean that statistical models are needed for generating comparable estimates of maternal mortality across countries. In this study the Bayesian maternal mortality estimation (BMat) model was used.

2019	WHO	TRENDS IN MATERNAL MORTALITY 2000 to 2017		Grey Literature	Country level reporting data	Countries and territories included in the analyses are WHO Member States with populations over 100 000, plus two territories (Puerto Rico, and the West Bank and Gaza Strip). 185 countries.	2000 to 2017	To presents internationally comparable global, regional and country-level estimates and trends for maternal mortality between 2000 and 2017	The United Nations Maternal Mortality Estimation Inter-Agency Group (UN MMEIG) – comprising WHO, the United Nations Children’s Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank Group and the United Nations Population Division (UNPD) of the Department of Economic and Social Affairs – has collaborated with external academic teams and technical experts on a new round of estimates for 2000–2017. To provide increasingly accurate MMR estimates, the previous estimation methods have been refined to optimize use of country-level data. Consultations with countries were carried out during May and June 2019. This process generated additional data for inclusion in the maternal mortality estimation model. Data sources include: CRVS systems, population-based household surveys, reproductive-age mortality studies (RAMOS), confidential enquires into maternal deaths (CEMD), verbal autopsies, censuses and other specialized maternal mortality studies conducted at the national level. Statistical models: for countries with a CRVS system, a Bayesian CRVS adjustment model was used to account for error in reporting maternal death. For all countries, a Bayesian maternal mortality estimation model was used to estimate the MMR for each country- year of interest.
2020	Human Appeal	Risking Death to Give Birth: The consequences of conflict on the health needs of women and girls in Syria		Grey Literature	Literature review and qualitative interviews and surveys	Al Imaan Hospital in Aleppo which then moved to Idlib during the period of the study.	January 2019 - April 2020	1. To explore how the reproductive health needs of women and girls have been affected by the Syrian conflict. 2. To determine whether the right to health is being upheld for women and girls in Syria. 3. To identify reproductive health needs. 4. To establish women’s decision-making ability in processes related to matters of protection and health.	To assist with identifying the challenges in reproductive healthcare access and delivery in Syria, we corroborated 74 visitation reports totalling 740 medical staff interviews and 532 patient surveys undertaken by Human Appeal’s Monitoring and Evaluation team at Al Imaan Hospital for Women and Children in western rural Aleppo between January and August 2019. Semi-structured interviews with 3 female staff members, a senior nurse, 2 midwives and a female Syrian journalist were conducted remotely in Arabic between 2nd March and 6th April. A literature review was conducted looking at media reports, online databases, policy reports and peer-reviewed academic literature to supplement findings regarding women’s health in Syria.
2019	SAMS	Disrupted Health Care In Syria: The State of Reproductive Health		Grey Literature	Secondary data analysis and qualitative semi-structured interviews.	Dara’a, Idlib and East Ghouta.	September 2017 - March 2018	To document the impact of the Syrian conflict on the provision of reproductive healthcare.	This report relies on two primary sources of information: quantitative data from records collected by SAMS staff in 10 facilities in Dara’a, Idlib, and East Ghouta between September 2017 and March 2018 and 21 semi-structured interviews with reproductive healthcare providers at SAMS facilities in these three regions.
2017	UNFPA	REGIONAL SITUATION REPORT FOR SYRIA CRISIS		Grey Literature	Activity report	SYRIA, LEBANON, JORDAN, IRAQ, TURKEY, EGYPT.	2016	To document the work UNFPA conducted in Syria and for Syrian refugees throughout 2016 and up to February of 2017.	Documentation of routinely collected data.

2015	MSF	INTERNATIONAL ACTIVITY REPORT 2015		Grey Literature	Activity report	Globally.	2015	To document MSFs work throughout 2015.	Documentation of routinely collected data.
2015	WHO	HeRAMS Annual Report: January - December 2015 Public Hospitals in the Syrian Arab Republic		Grey Literature	Country level reporting data	99 Ministry of Health (MoH) hospitals and 14 Ministry of Higher Education (MoHE) hospitals in Syria.	January - December 2015	To report descriptive and trend analysis for the situation of public hospitals in all 14 governorates of Syria.	The completeness of reporting from public hospitals across Syria remained at 100%, where all the 99 Ministry of Health (MoH) Hospitals and the 14 Ministry of Higher Education (MoHE) hospitals continued to report to HeRAMS in December 2015. Domains reported through HeRAMS system: Accessibility of hospitals Infrastructure - damage, bed capacity, water sources, electrical power Human resources - number of doctors, nurses, midwives, type of doctor Utilisation of health services - outpatient consultations, inpatient stays, labs, blood bank and imaging services, emergency cases, mass casualties and surgeries, normal deliveries, CS, children with severe disease, children with severe acute malnutrition, NCD consultations, psychiatric cases. Availability of medical equipment Availability of medicines and medical supplies
2020	Mhd Nezar Alsharif	THE INCREASING RATIO OF CESAREAN SECTION DELIVERIES: CAUSES AND IMPLICATIONS	European Journal of Biomedical and Pharmaceutical Sciences	Peer-reviewed	Secondary data analysis of routinely collected maternal programme data.	Obstetric clinics, Damascus, Syria.	January 2013 to 30 June 2014 and 10 August 2018 to 31 January 2020	To record the rates of caesarean deliveries compared to natural births, and the reasons for the CS deliveries in Damascus Syria.	Obstetric files of all pregnant women between 1 January 2013 to 30 June 2014 and 10 August 2018 to 31 January 2020 were collected and reviewed. Statistical Analysis was done using SPSS 23.0

Table 2a appendix: This table shows the study characteristics of all included studies in the scoping literature review.

First Author	Population studied	Details of study population	Results / Outcomes
J. Gil Cuesta	The study population was defined as the women who underwent an emergency C-section conducted by MSF Operational Center Brussels and the neonates of these women, from January 2008 to December 2015, in selected facilities under the Emergency Obstetric Care programme.		Maternal mortality (MM) was 0.15% (46 maternal deaths) related to C-sections. MM = 0% in Syria, 0 deliveries per year The MM decreased from 0.25% (four maternal deaths) in 2008 to 0.07% (three maternal deaths) in 2015 ($P < 0.02$). C-sections performed in non-conflict countries showed a MM of 0.11%, which was not statistically different from that in conflict settings (0.18%). In conflict settings, the MM was not statistically different (0.1% vs. 0.2%) between minor and war-intensity conflicts. C-sections in general hospitals reported a higher MM (0.18%) compared to maternities (0.09%), with a borderline statistically significant difference ($P = 0.05$). Syria: MMR 2015: 68, C-section rate 2002 15%
Omar Hakeem	211 pregnant women who visited at Al Ghouta hospital.	110 women had a history of self-reported exposure to the chemical attack and 101 women were not exposed.	There were 49 miscarriages (45%) in the exposed group compared with 14 (14%) in the non-exposed women. There were four premature births (<37 weeks' gestation; two of them died shortly after birth) and three stillbirths (≥ 28 weeks' gestation) in the group of women with a history of exposure to gases, compared with none in the unexposed group. Seven women exposed to the attack delivered neonates with malformations, of whom five died after a few hours to a few days and the other two survived—one with cardiac abnormalities and the other with cerebral oedema.

Ahmed Mohamed Tammam Abdelgawad	Data from the following countries analysed: Bahrain, Egypt, Afghanistan, Kuwait, Iraq, Djibouti, Oman, Jordan, Somalia, Qatar, Lebanon, S. Sudan, Saudi Arabia, Libya, Sudan, UAE, Morocco, Yemen, OPT, Syria, Tunisia.		Syria: Total expenditure on health as % of GDP: 3.7 Gov. Health Expenditure as % of total health Expenditure: 49 Gov health expenditure as % of total gov. expenditure: 5.6 Out of pocket expenditure as of % total health expenditure: 51 Ministry of Health budget as % of gov. budget: 5 Physicians / 10000 of population: 6.5 Nurses / 10000 of population: 15 Hospital beds / 10000 of population: 15.3 Primary health care units / 10000 of population: 1 Antenatal care coverage (%): 88 Birth attended by skilled health personnel (%): 96 New birth with low birth weight (%): 10.3 Neonatal mortality (per 1000 live births): 8.5
Nicholas J Kassebaum	Women who died as a result of pregnancy.		Syria: Maternal mortality ratio (per 100,000 livebirths) 1990: 120.5 (86.0 to 158.8) 2003: 64.8 (49.1 to 80.9) 2013: 44.1 (31.1 to 60.3) Number of maternal deaths 1990: 513 (367 to 676) 2003: 309 (235 to 386) 2013: 229 (161 to 313)
Hussein H. Khachfe	Women who died whilst pregnant in the 22 included countries between 1990 and 2015.		MMR in all countries in the Arab World significantly decreased between 1990 and 2015, with an average decreased of around 45%. Syrian Arab Republic MMR per 100,000: 1990: 123 1995: 89 2000: 73 2005: 58 2010: 49 2015: 68 Syria lifetime risk of maternal death: 1990: 1:150 1995: 1:230 2000: 1:330 2005: 1:450 2010: 1:650 2015: 1:440
Ali H. Mokdad,	Women who died as a result of a maternal disorder in the Eastern Mediterranean Region between 1990 and 2015.		Syria: Maternal Deaths: 1990: 560 (421–719) 2000: 365 (276–480) 2015: 237 (181–309) Maternal Mortality Ratio per 100,000: 1990: 125.7(94.6–161.6) 2000: 73.6 (55.6–96.7) 2015: 54.1 (41.3–70.5)
Fatemeh Nahidi	Women who died whilst pregnant between 1990-2015 in the Eastern Mediterranean countries. Following the definition proposed by the WHO, maternal mortality was considered as the death of a woman during pregnancy or up to 42 days after delivery irrespective of the site and duration of the pregnancy. The definition includes deaths from any cause related to or aggravated by pregnancy and its management, but not those from accidental or incidental causes.		Maternal mortality ratio per 100,000 live births: 1990: 130 2013: 49 2015: 68
Mayada Roumieh	All women who recently gave birth (30–45 days postnatal) seen at the selected primary health care centres during the study period.	Mean age 27.7 years, high education 18.6%, work outside the house 17.7%, did not live in a separate house 48%, shared the house with three families or more 11.8%, internally displaced 46.5%.	28.2% (312 women) of women had a score of 13 or more on the EPDS (probable depression), while 20.7% (229 women) of women scored 10–12 on the EPDS (possible depression). 7 women had the thought of harming themselves with suicidal idiations. Bivariate analysis indicated that postpartum depression was significantly associated with demographic factors (younger age at marriage), socio-economic factors (women and husbands’ lower level of education), pregnancy-related factors (poor antenatal care; delivery at public hospital), conflict-related factors (displacement; multiple families at house; perceived exposure to a lot of life stressors/pressure), and health-related factors (a reported health problem during pregnancy; reported a mental health problem; and having a newborn with health problems). Logistic regression analysis revealed that postpartum depression was significantly associated with a reported health problem during last pregnancy; displacement; perceived exposure to a lot of life stressors; while antenatal care had a protective effect.

Hisham Al-Hammami	Women who gave birth at Al Tawlid university hospital from the begining of January 2010 to end of June 2017.	90054 deliveries; 54,105 normal deliveries and 35949 CS.	78,115 births during the period of the Syrian crisis; 45,649 vaginal deliveries (58.4%), 32,466 CS (41.6%). In 2010, the percentage of caesarean births was 29%, and this percentage increased gradually until reaching its peak in the first half of 2017 at 51%.												
Jocelyn DeJong	Conflict-affected Syrian population both within Syria (including non-displaced and IDPs) and those living as refugees in neighbouring countries.		Coverage of at least one ANC visit with a skilled professional declined from 87.7% to 62%. Rates of skilled birth attendance at delivery dropped from 96.2% to 72%. Data from the largest public maternity hospital in Damascus show C-section rates increasing from 29% in 2010 to 46% in 2014. Syria pre-conflict: 548,000 births (2010), 12.4 stillbirth rate per 100,000, 52 MMR Syria in conflict: 460,000 births (2015), 62.7 MMR												
Rahma Aburas	All women and children presenting to the brotherhood medical clinic between August 2016 and January 2017, around 300 per day.	Women who were given postnatal care had to live 250 km from the clinic.	Number of deliveries in August 2016 = 80, January 2017 = 175. <table><tr><td>Function</td><td>Est. No. of cases</td></tr><tr><td>OB/GYN emergency room visits</td><td>100/day</td></tr><tr><td>Normal deliveries</td><td>25/day</td></tr><tr><td>Outpatient cases</td><td>300/day</td></tr><tr><td>Operative cases</td><td>10/day</td></tr><tr><td>Inpatient cases</td><td>25/day</td></tr></table>	Function	Est. No. of cases	OB/GYN emergency room visits	100/day	Normal deliveries	25/day	Outpatient cases	300/day	Operative cases	10/day	Inpatient cases	25/day
Function	Est. No. of cases														
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Normal deliveries	25/day														
Outpatient cases	300/day														
Operative cases	10/day														
Inpatient cases	25/day														
Tamar Kabakian-Khasholian	Women who gave birth and consented to participate in the study during the period November 2014 to July 2015 in Beirut and Mansoura, and November 2014 to April 2015 in Damascus.	Average age = 26 years, majority didn’t work outside the home, more women in the Syrian hospital had low levels of education, average number of children 3.53 in Syria.	60.6% of obstetricians were female in Syria. Type of birth: Normal: 1010 (83.7%) C-section: 196 (16.3%) Antenatal visits: Less than 4 visits: 390 (32.5%) 4 or more visits: 810 (67.5%)												
Abdullah Sulieman Terkawi	All women who visited the obstetric and gynaecology department during the study period.	Patients’ age range was 11–75 years, with a median [IQR] age of 25 (20–31) years. Among the pregnant women, 2955 (60%) were living in the refugee camp, whereas 1981 (40%) were residents in the town.	A total of 4936 pregnant women were seen in the center during the study period, many of whom came for multiple visits. Among the 730 women who delivered between October and December 2017, 39% did not have any antenatal visits, 4% satisfied the minimal WHO requirements for ideal ANC visits and 14% satisfied the minimal WHO requirement for FANC visits. Patients living in the refugee camps are 2.7 times less likely to meet the WHO FANC visits compared to those who are town residents. Of 2057 delivery, 70% delivered vaginally and 30% CS. There were 216 (3% of all patient population) cases of miscarriage; 120 (56%) were in women living in refugee camps and 96 (44%) in patients who were resident in town. How convinced with ANC visits? - 43% very convinced, 48% convinced, 7% I do not know, 2% not fully convinced, and only 1% answered not convinced at all. How many ANCI visits are needed? - 52% did not know, 48% did know. What are the recommended timing for ANC visits? - 53% do not know, 47% did know.												
WHO	Pregnant women globally between 1990 and 2015.		Syrian Arab Republic Maternal mortality rate per 100,000 live births 2015: 68 Number of maternal deaths 2015: 300 Lifetime risk of maternal death 2015: 1 in 440 Proportion of deaths among women of reproductive age that are due to maternal causes 2015: 6.7 MMR: 1990: 123 1995: 89 2000: 73 2005: 58 2010: 49 2015: 68												

WHO	Pregnant women globally between 2000 and 2017.		Maternal mortality ratio per 100,000 live births Syria: 2000: 26 2005: 25 2010: 27 2015: 30 2017: 31 (Lower uncertainty interval - 20, Upper uncertainty interval - 50), number of deaths 130, lifetime risk of maternal death 1 in 1,000 Adult lifetime risk of maternal death for women in the population, defined as the probability that a 15-year-old girl (in the year of the estimate) will eventually die from a maternal cause.
Human Appeal	Women of reproductive age in Syria between 2010 and 2020.		In northwest Syria, 20% of mothers are able to feed their babies properly, and at least one in three children in the region is stunted. Prior to the conflict, 96% of births were attended by medical professionals, now, just 25% are. Al Imaan Hospital in Aleppo, of 1,752 deliveries, 88% were natural births and 22% caesarean sections. This is due to the fear for safety with long waiting times in natural births due to the threat of aerial bombings. 43 percent of Syrians would only go to hospital if their lives depended on it. Out of the estimated 120 women visiting Al Imaan hospital each day in Idlib, around 25 percent of these were thought to be pregnant girls under the age of 18.
SAMS	Quantitative - women in Dara'a, Idlib and East Ghouta between September 2017 and March 2018. Qualitative - 8 midwives, 6 obstetricians-gynecologists (OBGYN), 6 physicians serving as OBGYNs and 1 nurse.		In 2017, 12 SAMS facilities, 6 of which provided RH services, were forced to close either temporarily or permanently as a result of targeted attacks. Most hospitals surveyed in this report didn't meet Sphere Standards, either due to lack of funding or lack of medical personnel. In northern Syria, because The data provided by SAMS medical facilities for a 6-month time period spanning September 2017 through February 2018 has indicated a high percentage of C-sections, much higher than the pre-conflict C-section rate of 26.4% in Syria. In three major RH facilities in northern Syria, C-sections reached 44.63% of total deliveries, and the rate of C-sections reached 39.3% in three facilities in southern Syria and 41.1% in one East Ghouta center.⁵⁹
UNFPA	Women and girls in Syria and female Syrian refugees in neighbouring countries.		UNFPA RESPONSE IN SYRIA: • 8,573 normal deliveries • 5,476 C-section deliveries • 11,569 ante-natal care services • 1,225 pregnancies under 18 26,587 clients received services in the northern part of Syria: • 1,296 normal deliveries • 431 C-section deliveries • 129 pregnancies under 18 • 5,372 ante-natal care services • 173 post-natal care services 12,452 beneficiaries received services in the southern part of Syria: • 1,096 normal deliveries • 574 C-sections • 506 pregnancies under 18 • 4,288 ante-natal care services • 688 post-natal care services

MSF	Individuals supported by MSF globally throughout 2015.		Aleppo governorate: MSF-run hospital in Azaz district: saw 6,000 patients for antenatal, postnatal and family planning consultations and delivered 409 babies. Hassakeh governorate: MSF worked in a maternity hospital in the area, where 1,559 births were assisted, including 393 caesarean sections. Dara'a governorate: MSF provided medical donations, relief items and technical support to six hospitals and health posts across Dara'a governorate, assisting with more than 2,000 deliveries.
WHO	All people making use of hospitals in Syria in 2015.		Normal deliveries vs CS: Ar-Raqqa: 1,702 normal deliveries 386(19.1%) CS Hama: 659 normal deliveries 611(48.1%) CS Homs: 240 normal deliveries, 217(47.5%) CS Dara'a: 85 normal deliveries, 28(24.8%) CS Aleppo: 226 normal deliveries, 180(44.3%) CS Deir-ez-zour: 35 normal deliveries, 0 CS Al Hassakeh: 717 normal deliveries, 115(13.8%) CS As-Sweida: 280 normal deliveries, 165(37.1%) CS Quneitra : 70 normal deliveries, 40(36.4%) CS Damascus, Syria: 958 normal deliveries, 571(37.3%) CS Lattakia, Syria: 272 normal deliveries, 478 (63.7%) CS Tartous, Syria: 311 normal deliveries, 442(58.7%) CS
Mhd Nezar Alsharif	All pregnant cases who reviewed the clinics between 10 August 2018 to 31 January 2020 for delivery.		10 August 2018 to 31 January 2020: 787 cases (52%) had CS deliveries. Of the CS, 57% of them had a caesarean section delivery per their request (no indications), while 43% of them had an indication for caesarean section delivery. 1 January 2013 to 30 June 2014: 523 cases (33%) had CS deliveries, 44% of them per patients request and 56% had it with medical indications.

Table 2b appendix: This table shows the results of all included studies in the scoping literature review.

First Author	Author's conclusions	Limitations
J. Gil Cuesta	The study found no differences in maternal or neonatal mortality in emergency C-sections between conflict and non-conflict periods, however other factors not assessed could influence mortality. These could be related to the accessibility of healthcare, clinical presentation or type of procedure. They suggest that the lack of a difference in mortality rates with or without conflict could be related to the MSF's use of standardised procedures, adequate equipment and proper staff in all their supported surgical facilities. To continue health-care provision during conflict and non-conflict, homogenous minimal quality standards should therefore continue to be implemented and monitored.	The study included only those women who had reached health facilities and had one specific operation. Further studies that include other forms of delivery, number of stillborn, more complex pathology or patients with delayed access to care during conflict would be required to assess other reasons. Looking at country level context rather than local facility level context is a limitation of this study. To minimise this, the conflict category was validated with staff at each of the facilities.
Omar Hakeem	The data suggest an increased incidence of spontaneous abortion, stillbirth, and birth defects in women exposed to chemical attacks compared with women who were not exposed, and to the previously available statistics on Syria.	Very small sample size and only in one hospital, may not be representative of all pregnant women exposed to chemical weapons.
Ahmed Mohamed Tammam Abdelgawad	Spending on health is significantly associated with improved maternal and child health outcomes and reduces infant and child mortality. Furthermore, improvements in government effectiveness enhances the effect of government health spending which reduces infant and under-five child mortality. Thus, increasing government expenditures is likely to lead to better improvements of health outcomes if it is accompanied by the right policies and institutions. There was significant negative correlation between out of pocket (OOP) and the maternal and child health indicators. This can give a recommendation to policy makers to minimize this OOP portion, as minimising this portion improves maternal and child health outcomes.	Generalised country level reporting with no context specific data or discussion.
Nicholas J Kassebaum	Ambitious calls for progress in maternal mortality in the next 15–20 years and reductions in MMRs to less than 30 in all countries have been deemed financially and technically feasible. Our finding that rates of change in maternal mortality in some developing countries have exceeded 8% in the past decade (eg, in China) lends support to ambitious aspirational goals.	Method of estimating the detailed causes of maternal death used all available data, but such specific data are not available for many countries, or, if they are available, are coarse with respect to age. Therefore, the true extent of the interplay between cause and age in maternal mortality and differences between countries in the same region may have been underestimated. Estimates of maternal mortality are affected by estimates in each age group of other causes of death developed for the GBD 2013 because of the requirement that cause-specific mortality must sum to all-cause mortality. Errors in the estimates for other causes of death could bias upwards or downwards the assessments of maternal mortality.
Hussein H. Khachfe	The overall trend of maternal mortality and lifetime risk of maternal death showed a significant decrease throughout the years of our study due to the increased efforts put in by a number of countries to achieve goal 5a of the 2015 Millennium Development Goals. Although the Arab world did not achieve the goal of decreasing maternal mortality by 75% by 2015, it did decrease by around 45%. Some possible reasons that this was not possible could include high prevalence of child marriage, unsafe abortions and political instability. Improved economic development, increased resources allocated to the obstetrics sector and improving women's knowledge and education were key factors to the decrease in MMR and LTR across many countries in the Arab world.	Reliability of data rests of the validity of the UNICEF database. Lack of proper registration and lack of proper reporting present in many Arab countries may contribute to mistakes and under representation of the true burden of maternal deaths in these countries.
Ali H. Mokdad,	Progress in reducing maternal mortality in the EMR has accelerated in the past 15 years, but there is still much to do to reduce preventable deaths. Extending basic maternal health services, improving quality of care, and eliminating unmet need for contraception are all crucial, proven steps effective at reducing MMR. This study demonstrates the importance of empowering women: increased women's rights are needed to improve their health. Coordinated and rigorous efforts are needed to make sure that every woman in need receives these interventions in a timely fashion at each stage of her reproductive life.	Many countries in the region have poor health data and vital statistics, GBD methodology was used to account for quality and lack of data. Also, little information is available on unsafe abortion in the region due to religion and culture, limiting the ability to assess the impact of this practice on MMR.
Fatemeh Nahidi	The WHO reported an average annual change of 2.56% for MMR in Syria between 1990 and 2015. A Syrian study indicated that there is an urgent need for developing national protocols to regulate practices during the third stage of labor and the postpartum period. It was reported that the causes of maternal mortality and their contributing factors in Syria reflect serious defects in the quality of maternal care that need to be rectified urgently. This research showed that Syria has made progress toward improved maternal mortality.	The number of related studies was low. In addition, the authors did not find any article about maternal mortality in Iraq, Libya, Djibouti, and the United Arab Emirates.
Mayada Roumich	The findings of this study should alert Syrian health professionals that postpartum depression needs to be screened for in the usual antenatal and postnatal care of Syrian women. This study indicated that nearly one of three women have postpartum depression, a concerning finding considering that the promotion of mental health and wellbeing is among health priorities of the global development agenda.	The main limitations of this study include the issue of design which was not prospective and further that the recruitment was only from women who are using the primary health care centers.
Hisham Al-Hammami	In 2014, caesarean delivery was 43% in South America. It was the highest percentage of global Caesareans in that period compared to 43.5% in the ALTAWLID University Hospital in Damascus, Syria in the same year. Given the increasing rate of CS in the crisis and globally it is very important to focus our attention on the causes of this incidence in order to reduce it.	Data collected in only 1 hospital.

Jocelyn DeJong	Increase in c-section rates could be explained by the need for women and their physicians to schedule delivery around the security situation. The available mortality data in Syria during conflict showed an increase in maternal mortality ratio, although it was not possible to provide accurate data on conflict-related casualties among women. In Syria, available data show a decline in coverage of ANC, skilled birth attendance and child immunisation. A partial explanation for these observed trends may be differential access to healthcare across Syria.	Definitions may differ between included studies and countdown indicators limiting the ability of this review to draw conclusions.
Rahma Aburas	The BMC represents a unique example of cooperation between local and regional stakeholders with the aim of filling a critical gap in provisioning of medical humanitarian aid for women and children.	This is a descriptive study that uses estimated number of cases limiting the accuracy of its figures.
Tamar Kabakian-Khasholian	Perceived control during labour was a significant predictor of improved satisfaction levels among women in the three sites of the study. In addition, having few children in the sample from Egypt and Lebanon and receiving care by a team including both male and female physicians in the Syrian hospital decreased satisfaction. Although the mean satisfaction score was high, there were slight variations in the levels between the three sites. Differences might be explained by the context of conflict and displacement that affect Syria and Lebanon. The hospitals from these two countries included in the study provide services to refugees and to internally displaced populations, therefore it is expected that these women will be reluctant to express criticism about the care they received while feeling “grateful” for accessing a hospital and giving birth to a healthy infant. Perceived control during labour was found to be at an average level in the overall sample with slightly higher scores in Lebanon and Syria than in Egypt. Women’s satisfaction with childbirth improved with an increased number of children, specifically in the samples from Egypt and Lebanon. These women would have prior experience with the system of care and therefore have already shaped their expectations according to the routines followed at these facilities. The lack of this relationship in the sample from Syria could be attributed to the lack of previous experience with birthing in a hospital for women displaced from rural to urban areas due to the prevailing conflict. It is to be noted that women in the hospitals in this study are not entitled to choose their health care providers. The hospitals in Lebanon and Syria were found to have teams of both male and female obstetricians, residents, medical and nursing students attending the birth. This was a factor inducing dissatisfaction among women in the Syrian hospital compared to being offered care by either a male or a female physician. The presence of a male provider in the team together with female providers is considered disrespectful in this context and influences their satisfaction with care.	Women were interviewed in the very early postpartum hours or days which probably shifted satisfaction levels towards more favorable ones.
Abdullah Sulieman Terkawi	The study identified a considerable deficiency in the ANC and PNC visits, high adolescent birth rate, and higher caesarean delivery ratio than recommended by the WHO. There was a severe shortage in the number of obstetrician-gynaecologists per 1000 population. The study found that challenges are much greater amongst those living in camps than in the city. The major challenges facing patients trying to visit the centre, especially for their ANC visits, are related to poor transportation services and deficient staffing.	This study data are derived from a single center in the Northwestern part of Syria. Thus, it may not perfectly represent other affected areas in Syria nor the across-the-border communities in neighboring countries. The recent deployment of Healthy Syria program made accessible data limited to 2017 only, making extrapolation to a longer period difficult.
WHO	Syria has made insufficient progress to achieving the Millennium Development Goal 5.	Household surveys: This approach has the following limitations. • It identifies pregnancy-related deaths, rather than maternal deaths. • It produces estimates with wide confidence intervals, thereby diminishing opportunities for trend analysis. • It provides a retrospective rather than a current maternal mortality estimate (referring to a period approximately five years prior to the survey); the analysis is more complicated. The data available on all countries was limited and so there are limitations to the calculations used to find the estimates for each country.

WHO	In 2017, according to the Fragile States Index, 15 countries were considered to be “very high alert” or “high alert” (from highest to lowest: South Sudan, Somalia, Central African Republic, Yemen, Syrian Arab Republic, Sudan, the Democratic Republic of the Congo, Chad, Afghanistan, Iraq, Haiti, Guinea, Nigeria, Zimbabwe and Ethiopia), and these 15 countries had MMRs in 2017 ranging from 31(Syrian Arab Republic) to 1150 (South Sudan).	This study is limited by the accuracy of the data sources it relies on. Limitations of verbal autopsy: Misclassification of causes of deaths in women of reproductive age Difficulty identifying direct and indirect maternal deaths The accuracy of the estimates depends on the extent of family members’ knowledge of the events leading to the death, the skill of the interviewers, and the competence of physicians who do the diagnosis and coding. • Detailed verbal autopsy for research purposes that aims to identify the cause of death of an individual requires physician assessment and long interviews. Such systems are expensive to maintain, and the findings cannot be extrapolated to obtain national MMRs.
Human Appeal	Whilst the world is on the whole experiencing positive developments in maternal health, more Syrian women are currently dying in childbirth or from pregnancy-related complications than they were twenty years ago. It is estimated that maternal mortality in Syria has risen by as much as 40 percent since the conflict began. International factors have a part to play as conflict affected countries typically receive 60 percent less official development assistance for reproductive health than non-conflict affected countries. Maternal mortality, risk of miscarriage, premature labour and undernourishment have all been exacerbated by the Syrian conflict. This by and large due to the fact that close to a decade of war has corroded Syria’s healthcare system leaving vast shortages of medical supplies, qualified staff and functioning facilities.	Most data are based on one site and so may not be representative of maternal health in Syria generally.
SAMS	The conflict has exacted a heavy toll on the provision of reproductive healthcare in particular. While the conflict has affected populations across gender, age, political and religious affiliation, for women especially, the challenges are tremendous. In the Syrian context, expectant women struggle to maintain healthy pregnancies and to give birth safely amidst the war’s persistently corrosive effects on reproductive healthcare, which largely impede access to adequate services and family planning.	Many obstacles, including the systematic attacks on healthcare, and the severe shortage in medical personnel limit the ability to collect adequate and reliable data across Syria.
UNFPA	UNFPA believes that every Syrian woman and girl has the right to have access to affordable reproductive health care and be effectively protected from gender-based violence. UNFPA and partners are scaling up efforts to empower and improve the lives of Syrian women and youth and impacted communities inside Syria and in host countries, including by advocating for human rights and gender equality, to better cope with and recover from the crisis.	This is a descriptive study with no clear explanation of the methodology used to collect reported data, this limits the reliability of these results.
MSF	In 2015, MSF continued to operate six medical facilities in different locations across northern Syria and saw an increase in the number of people with medical complications caused by delayed medical care, and in infections and deaths due to shortages of antibiotics.	This is a descriptive study with no clear explanation of the methodology used to collect reported data, this limits the reliability of these results.
WHO	The global norm for the percentage of CS to normal deliveries is 5% to 15%, all 12 governorates are above this threshold. The highest CS figures are reported in Latakia and Tartous, which are due to cultural preferences, where the pregnant women opt for CS for several reasons such as reducing pain and choosing a fixed date for delivery, in relation to other social occasions. In Homs, Rural Damascus, and Aleppo the high numbers of CSs are due to the fact that majority of the pregnant women prefer CS because of the security situation. Across all reported functional hospitals in December 2015, 37% (3,524) of deliveries are CSs while 63% (5,880) are normal deliveries.	The HeRAMS tool relies on effective and proper recording of data at each facility and so there may be issues with accuracy considering the context and number of facilities included.

Mhd Nezar Alsharif	The percentage of caesarean delivery globally has increased during the years and this includes caesarean delivery by mother request as an important factor among other reasons. The average global caesarean section is 18.6%, the highest rates are found in South America at 42.9%compared to 33% in our study in Damascus, Syria in the same year. Furthermore, given the increasing rate of CS in our country and globally, it is very important to focus our attention on the causes of this incidence in order to reduce it.	Methodology is very limited; this limits the reliability of these results.
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Table 2c appendix: This table shows the conclusions of all included studies in the scoping literature review.

Feature	Inclusion	Exclusion
Population of interest	Syrian women inside Syria who are pregnant or have given birth including internally displaced persons	Syrian women who are pregnant or have given birth outside Syria including refugees
Intervention	Maternal health services	Sexual and reproductive health services
Outcomes	Maternal health Maternal morbidity and mortality Obstetric care (Antenatal, perinatal and postnatal) Availability of health services Utilisation of health services Maternal variables (age of mother) Delivery statistics (cesarean section compared or vaginal delivery) Abortion statistics	Gender based violence Neonatal health
Study design	Review articles, epidemiological studies, retrospective analysis, cross-sectional studies	Case reports and newspaper articles.
Study period	Study period after the start of the conflict in March 2011.	Study period before the start of the conflict in March 2011.
Language	Full paper available in English or Arabic.	Full paper not available in English or Arabic.

Table 3 appendix: This table shows the inclusion and exclusion criteria for the scoping literature review

Facility Name (Alias)	Catchment (from SAMS dashboard)	Total Deliveries from March 2017 to July 202	Mean Monthly Deliveries (Median)
General Hospital (Hospital 1)	41,836/44,304 (94.4%)	5,115	125 (124)
General Hospital (Hospital 2)	99,062/151,005 (65.6%)	6,924	315 (319)
Maternity Specialized Hospital (Hospital 3)	125,054/351,914 (35.5%)	16,966	424 (427)
Maternity Hospital	61,116/62,747 (97.4%)	7,914	247 (266)

(Hospital 4)			
PHC (PHC 1)	20,992/28,248 (74.3%)	1,230	95 (95)

Table 4 appendix: This table shows the anonymised name of the hospital or primary healthcare (PHC) facility with the estimated catchment area, total deliveries in the time period and the mean monthly deliveries.

Figures in the appendix:

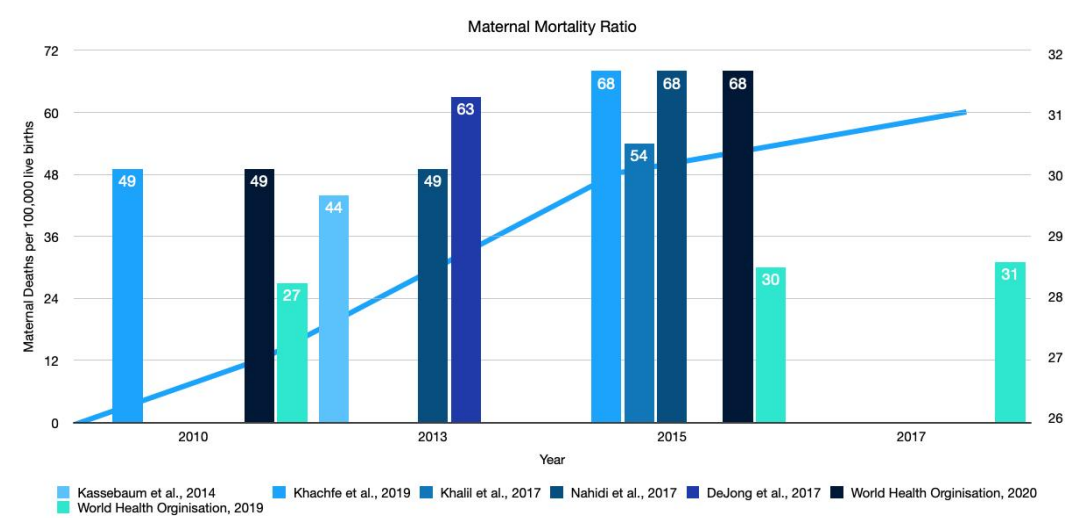


Figure 1 appendix: Bar chart of maternal mortality rates (MMR) reported by each reviewed study compared to a line graph of the UN MMEIG MMR estimates during the same periods.